In [ ]:

In [ ]:
```
!pip install tensorflow-gpu==2.0.0
%matplotlib inline
```

```
Requirement already satisfied: tensorflow-gpu==2.0.0 in /usr/local/lib/python3.6/dist-packages (2.0.0)
Requirement already satisfied: keras-preprocessing>=1.0.5 in /usr/local/lib/python3.6/dist-packages (from ten
sorflow-gpu==2.0.0) (1.1.0)
Requirement already satisfied: six>=1.10.0 in /usr/local/lib/python3.6/dist-packages (from tensorflow-gpu==2.
0.0) (1.12.0)
Requirement already satisfied: wrapt>=1.11.1 in /usr/local/lib/python3.6/dist-packages (from tensorflow-gpu==
2.0.0) (1.12.1)
Requirement already satisfied: wheel>=0.26 in /usr/local/lib/python3.6/dist-packages (from tensorflow-gpu==2.
0.0) (0.34.2)
Requirement already satisfied: protobuf>=3.6.1 in /usr/local/lib/python3.6/dist-packages (from tensorflow-gpu
==2.0.0) (3.10.0)
Requirement already satisfied: tensorboard<2.1.0,>=2.0.0 in /usr/local/lib/python3.6/dist-packages (from tens
orflow-gpu==2.0.0) (2.0.2)
Requirement already satisfied: gast==0.2.2 in /usr/local/lib/python3.6/dist-packages (from tensorflow-gpu==2.
0.0) (0.2.2)
Requirement already satisfied: termcolor>=1.1.0 in /usr/local/lib/python3.6/dist-packages (from tensorflow-gp
u==2.0.0) (1.1.0)
Requirement already satisfied: absl-py>=0.7.0 in /usr/local/lib/python3.6/dist-packages (from tensorflow-gpu=
=2.0.0) (0.9.0)
Requirement already satisfied: tensorflow-estimator<2.1.0,>=2.0.0 in /usr/local/lib/python3.6/dist-packages
(from tensorflow-gpu==2.0.0) (2.0.1)
Requirement already satisfied: google-pasta>=0.1.6 in /usr/local/lib/python3.6/dist-packages (from tensorflow
-gpu==2.0.0) (0.2.0)
Requirement already satisfied: opt-einsum>=2.3.2 in /usr/local/lib/python3.6/dist-packages (from tensorflow-g
pu==2.0.0) (3.2.1)
Requirement already satisfied: numpy<2.0,>=1.16.0 in /usr/local/lib/python3.6/dist-packages (from tensorflow-
gpu==2.0.0) (1.18.4)
Requirement already satisfied: keras-applications>=1.0.8 in /usr/local/lib/python3.6/dist-packages (from tens
orflow-gpu==2.0.0) (1.0.8)
Requirement already satisfied: grpcio>=1.8.6 in /usr/local/lib/python3.6/dist-packages (from tensorflow-gpu==
2.0.0) (1.28.1)
Requirement already satisfied: astor>=0.6.0 in /usr/local/lib/python3.6/dist-packages (from tensorflow-gpu==
2.0.0) (0.8.1)
Requirement already satisfied: setuptools in /usr/local/lib/python3.6/dist-packages (from protobuf>=3.6.1->te
nsorflow-gpu==2.0.0) (46.1.3)
Requirement already satisfied: google-auth<2,>=1.6.3 in /usr/local/lib/python3.6/dist-packages (from tensorbo
ard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (1.7.2)
Requirement already satisfied: requests<3,>=2.21.0 in /usr/local/lib/python3.6/dist-packages (from tensorboar
d<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (2.23.0)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.6/dist-packages (from tensorboard<2.
1.0,>=2.0.0->tensorflow-gpu==2.0.0) (3.2.1)
Requirement already satisfied: werkzeug>=0.11.15 in /usr/local/lib/python3.6/dist-packages (from tensorboard<
2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (1.0.1)
```

```
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in /usr/local/lib/python3.6/dist-packages (fr
om tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (0.4.1)
Requirement already satisfied: h5py in /usr/local/lib/python3.6/dist-packages (from keras-applications>=1.0.8
->tensorflow-gpu==2.0.0) (2.10.0)
Requirement already satisfied: rsa<4.1,>=3.1.4 in /usr/local/lib/python3.6/dist-packages (from google-auth<2,
>=1.6.3->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (4.0)
Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.6/dist-packages (from google-a
uth<2,>=1.6.3->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (0.2.8)
Requirement already satisfied: cachetools<3.2,>=2.0.0 in /usr/local/lib/python3.6/dist-packages (from google-
auth<2,>=1.6.3->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (3.1.1)
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.6/dist-packages (from requests<3,>=2.2
1.0->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (2.9)
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.6/dist-packages (from requests<3,>
=2.21.0->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (3.0.4)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/local/lib/python3.6/dist-packa
ges (from requests<3,>=2.21.0->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (1.24.3)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.6/dist-packages (from requests<3,
>=2.21.0->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (2020.4.5.1)
Requirement already satisfied: requests-oauthlib>=0.7.0 in /usr/local/lib/python3.6/dist-packages (from googl
e-auth-oauthlib<0.5,>=0.4.1->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (1.3.0)
Requirement already satisfied: pyasn1>=0.1.3 in /usr/local/lib/python3.6/dist-packages (from rsa<4.1,>=3.1.4-
>google-auth<2,>=1.6.3->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (0.4.8)
Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.6/dist-packages (from requests-oauth
lib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard<2.1.0,>=2.0.0->tensorflow-gpu==2.0.0) (3.1.0)
```

In [ ]:

```python
import pickle

import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt


tf.__version__
tf.test.gpu_device_name()
```

Out[ ]:

```
'/device:GPU:0'
```

In [ ]:
```
!pip install keras==2.2.4
```

```
Requirement already satisfied: keras==2.2.4 in /usr/local/lib/python3.6/dist-packages (2.2.4)
Requirement already satisfied: pyyaml in /usr/local/lib/python3.6/dist-packages (from keras==2.2.4) (3.13)
Requirement already satisfied: h5py in /usr/local/lib/python3.6/dist-packages (from keras==2.2.4) (2.10.0)
Requirement already satisfied: keras-applications>=1.0.6 in /usr/local/lib/python3.6/dist-packages (from kera
s==2.2.4) (1.0.8)
Requirement already satisfied: keras-preprocessing>=1.0.5 in /usr/local/lib/python3.6/dist-packages (from ker
as==2.2.4) (1.1.0)
Requirement already satisfied: scipy>=0.14 in /usr/local/lib/python3.6/dist-packages (from keras==2.2.4) (1.
4.1)
Requirement already satisfied: six>=1.9.0 in /usr/local/lib/python3.6/dist-packages (from keras==2.2.4) (1.1
2.0)
Requirement already satisfied: numpy>=1.9.1 in /usr/local/lib/python3.6/dist-packages (from keras==2.2.4) (1.
18.4)
```

In [ ]:

In [ ]:
```
# It is GNU radio generated datset which accounts for practical aspect of wieless channels such as ...
# It 220,000 samples. Each sample is 2*128 matrix containing the IQ (2) of a received signal sampled 128 time
s.
# It contains sample points for 11 diifferent modulation schemes (BPSK,QAM,8PSK,...) at 20 different SNR leve
ls, which adds up to 220 tuples of ('modulation',SNR) where for each tuple we have 1000 samples of dimenssion
2*128.

def to_onehot(yin):
    yy = list(yin) # This is a workaround as the map output for python3 is not a list
    yy1 = np.zeros([len(list(yy)), max(yy)+1])
    yy1[np.arange(len(list(yy))),yy] = 1
    return yy1


def ModCls_loaddata(path_to_dataset):
    # There is a Pickle incompatibility of numpy arrays between Python 2 and 3
    # which generates ascii encoding error, to work around that we use the following instead of
    # Xd = cPickle.load(open("RML2016.10a_dict.dat",'rb'))
    with open(path_to_dataset, 'rb') as open_file:
        u = pickle._Unpickler( open_file )
        u.encoding = 'latin1'
        Xd = u.load()

    snrs,mods = map(lambda j: sorted(list(set(map(lambda x: x[j], Xd.keys())))), [1,0])
    X = []
    lbl = []
    for mod in mods:
        for snr in snrs:
            X.append(Xd[(mod,snr)])
            for i in range(Xd[(mod,snr)].shape[0]):  lbl.append((mod,snr))
    X = np.vstack(X)

    # Partition the data
    #  into training and test sets of the form we can train/test on
    #  while keeping SNR and Mod labels handy for each
    np.random.seed(2016)
    n_examples = X.shape[0]
    n_train = int(n_examples * 0.5)
    train_idx = np.random.choice(range(0,n_examples), size=n_train, replace=False)
    test_idx = list(set(range(0,n_examples))-set(train_idx))
    X_train = X[train_idx]
    X_test =  X[test_idx]
```

```
    Y_train = to_onehot(map(lambda x: mods.index(lbl[x][0]), train_idx))
    Y_test = to_onehot(map(lambda x: mods.index(lbl[x][0]), test_idx))

    in_shp = list(X_train.shape[1:])
    classes = mods
    return X,lbl,X_train,X_test,classes,snrs,mods,Y_train,Y_test,train_idx,test_idx
```

In [ ]:
```
from google.colab import drive
drive.mount('/gdrive')
%cd /gdrive
```

```
Drive already mounted at /gdrive; to attempt to forcibly remount, call drive.mount("/gdrive", force_remount=T
rue).
/gdrive
```

In [ ]:
```
!ls 'My Drive/Colab Notebooks/Notebooks/'
```

```
 215_FP_2.ipynb     'Mini-project 3'      Untitled0.ipynb   Untitled5.ipynb
'homework=1.ipynb'   model.h5             Untitled1.ipynb   Untitled6.ipynb
 homework-1.ipynb    MOD.pkl              Untitled2.ipynb
 hw1-275-.ipynb      Pre-training.ipynb   Untitled3.ipynb
 LICENSE.TXT         Untitled             Untitled4.ipynb
```

In [ ]:
```
X,lbl,X_train,X_test,classes,snrs,mods,Y_train,Y_test,train_idx,test_idx = ModCls_loaddata(
    'My Drive/Colab Notebooks/Notebooks/MOD.pkl')


print('X_train.shape:', X_train.shape)
print('Y_train.shape:', Y_train.shape)
print(X.shape)
print(len(lbl))



print('Y_train[4:9]: \n', Y_train[4:9])
print('train_idx.shape:', train_idx.shape)
print('train_idx[4:9]:', train_idx[4:9])
print(lbl[train_idx[4]], lbl[train_idx[5]], lbl[train_idx[6]], lbl[train_idx[7]], lbl[train_idx[8]], lbl[trai
n_idx[9]])

print('classes:', classes)
```

```
X_train.shape: (110000, 2, 128)
Y_train.shape: (110000, 11)
(220000, 2, 128)
220000
Y_train[4:9]:
 [[0. 0. 0. 0. 0. 0. 0. 0. 0. 1. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0. 0. 1. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0. 1. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0. 1. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 1. 0. 0. 0.]]
train_idx.shape: (110000,)
train_idx[4:9]: [184829 192624 169402 179790 145554]
('QPSK', -12) ('QPSK', 4) ('QAM64', -2) ('QAM64', 18) ('QAM16', -10) ('BPSK', -2)
classes: ['8PSK', 'AM-DSB', 'AM-SSB', 'BPSK', 'CPFSK', 'GFSK', 'PAM4', 'QAM16', 'QAM64', 'QPSK', 'WBFM']
```

In [ ]:
```
X_train.shape
```

Out[ ]:
```
(110000, 2, 128)
```

In [ ]:

In [ ]:
```
from keras.preprocessing.image import ImageDataGenerator
from keras.preprocessing.image import img_to_array
from keras.preprocessing.image import load_img
import numpy as np
import argparse
import cv2
import os
from imutils import paths
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.applications import VGG16
from tensorflow.keras.applications.resnet_v2 import ResNet152V2
from tensorflow.keras.layers import AveragePooling2D
from tensorflow.keras.layers import Dropout
from tensorflow.keras.layers import Flatten
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Input
from tensorflow.keras.models import Model
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.utils import to_categorical
from sklearn.preprocessing import LabelBinarizer
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix
from imutils import paths
import matplotlib.pyplot as plt
import numpy as np
import argparse
import cv2
import os
```

```
Using TensorFlow backend.
```

In [ ]:

In [ ]:

Out[ ]:
```
[2, 128]
```

In [ ]:
```
# The CNN Network
list(X_train.shape[1:])

in_shp = list(X_train.shape[1:])
dr = 0.5 # dropout rate (%)
in_shp
```

In [ ]:
```
tf.keras.layers.Reshape([1]+in_shp, input_shape=in_shp)
```

Out[ ]:
```
<tensorflow.python.keras.layers.core.Reshape at 0x7ffa22180cf8>
```

In [ ]:
```
x2 = np.reshape(X_train, (-1, 2,128,1))
```

In [ ]:
```
x2.shape
```

Out[ ]:
```
(110000, 2, 128, 1)
```

In [ ]:
```
x3 = np.reshape(X_test, (-1, 2,128,1))
```

In [ ]:
```
x3.shape
```

Out[ ]:
```
(110000, 2, 128, 1)
```

In [ ]:
```
x_train=x2
y_train=Y_train
x_valid=x3
y_valid=Y_test
```

In [ ]:
```
x_train = x_train.astype('float32')
x_valid = x_valid.astype('float32')
x_train /= 255
x_valid /= 255
```

In [ ]:
```
from tensorflow.keras import utils
y_train = utils.to_categorical(y_train, 11)
y_valid = utils.to_categorical(y_valid, 11)
```

In [ ]:
```
x3[1]
```

In [ ]:
```
y_train.shape
```

Out[ ]:
```
(110000, 11)
```

In [ ]:
```
o = np.zeros((224, 224, 3))
```

In [ ]:
```
y_train.shape
```

Out[ ]:
```
(110000, 11)
```

In [ ]:
```
X_train[1].shape
```

Out[ ]:
```
(2, 128)
```

In [ ]:

In [ ]:
```
class_weights = {0: 1-np.count_nonzero(y_train2==0)/len(y_train2),
                 1: 1-np.count_nonzero(y_train2==1)/len(y_train2),
                 2: 1-np.count_nonzero(y_train2==2)/len(y_train2),
                 3: 1-np.count_nonzero(y_train2==3)/len(y_train2),
                 4: 1-np.count_nonzero(y_train2==4)/len(y_train2),
                 5: 1-np.count_nonzero(y_train2==5)/len(y_train2),
                 6: 1-np.count_nonzero(y_train2==6)/len(y_train2),
                 7: 1-np.count_nonzero(y_train2==7)/len(y_train2),
                 8: 1-np.count_nonzero(y_train2==8)/len(y_train2),
                 9: 1-np.count_nonzero(y_train2==9)/len(y_train2),
                 10: 1-np.count_nonzero(y_train2==10)/len(y_train2)}
```

In [ ]:
```
#==============================================================================
# Build VT-CNN2 Neural Net model using Keras
#  - Reshape [N,2,128] to [N,1,2,128] on input
#  - Pass through 2 2DConv/ReLu layers
#  - Pass through 2 Dense layers (ReLu and Softmax)
#  - Perform categorical cross entropy optimization
```

Out[ ]:
```
<tf.Tensor 'input_1:0' shape=(None, None, None, 1) dtype=float32>
```

In [ ]:
```
from __future__ import print_function
from tensorflow.keras import backend as K
from tensorflow.keras.layers import Layer
from tensorflow.keras import activations
from tensorflow.keras import utils
from tensorflow.keras.models import Model
from tensorflow.keras.layers import *
from tensorflow.keras.preprocessing.image import ImageDataGenerator
import numpy as np
import keras
from tensorflow.keras.callbacks import ModelCheckpoint
from tensorflow.keras import optimizers

K.set_image_data_format('channels_last')

def squash(x, axis=-1):
    s_squared_norm = K.sum(K.square(x), axis, keepdims=True) + K.epsilon()
    scale = K.sqrt(s_squared_norm) / (1 + s_squared_norm)
    return scale * x


def softmax(x, axis=-1):

    ex = K.exp(x - K.max(x, axis=axis, keepdims=True))
    return ex / K.sum(ex, axis=axis, keepdims=True)


def margin_loss(y_true, y_pred):

    lamb, margin = 0.5, 0.1
    return K.sum((y_true * K.square(K.relu(1 - margin - y_pred)) + lamb * (
        1 - y_true) * K.square(K.relu(y_pred - margin))), axis=-1)


class Capsule(Layer):


    def __init__(self,
                 num_capsule,
                 dim_capsule,
                 routings=3,
                 share_weights=True,
```

```
                 activation='squash',
                 **kwargs):
        super(Capsule, self).__init__(**kwargs)
        self.num_capsule = num_capsule
        self.dim_capsule = dim_capsule
        self.routings = routings
        self.share_weights = share_weights
        if activation == 'squash':
            self.activation = squash
        else:
            self.activation = activations.get(activation)

    def get_config(self):
        config = super().get_config().copy()
        config.update({
        'num_capsule':  self.num_capsule,
        'dim_capsule' : self.dim_capsule,
        'routings':  self.routings,
        'share_weight':self.share_weights,



        })
        return config

    def build(self, input_shape):
        input_dim_capsule = input_shape[-1]
        if self.share_weights:
            self.kernel = self.add_weight(
                name='capsule_kernel',
                shape=(1, input_dim_capsule,
                       self.num_capsule * self.dim_capsule),
                initializer='glorot_uniform',
                trainable=True)
        else:
            input_num_capsule = input_shape[-2]
            self.kernel = self.add_weight(
                name='capsule_kernel',
                shape=(input_num_capsule, input_dim_capsule,
                       self.num_capsule * self.dim_capsule),
                initializer='glorot_uniform',
                trainable=True)
```

```
    def call(self, inputs):


        if self.share_weights:
            hat_inputs = K.conv1d(inputs, self.kernel)
        else:
            hat_inputs = K.local_conv1d(inputs, self.kernel, [1], [1])

        batch_size = K.shape(inputs)[0]
        input_num_capsule = K.shape(inputs)[1]
        hat_inputs = K.reshape(hat_inputs,
                               (batch_size, input_num_capsule,
                                self.num_capsule, self.dim_capsule))
        hat_inputs = K.permute_dimensions(hat_inputs, (0, 2, 1, 3))

        b = K.zeros_like(hat_inputs[:, :, :, 0])
        for i in range(self.routings):
            c = softmax(b, 1)
            o = self.activation(keras.backend.batch_dot(c, hat_inputs, [2, 2]))
            if i < self.routings - 1:
                b = keras.backend.batch_dot(o, hat_inputs, [2, 3])
                if K.backend() == 'theano':
                    o = K.sum(o, axis=1)

        return o

    def compute_output_shape(self, input_shape):
        return (None, self.num_capsule, self.dim_capsule)




batch_size = 16
num_classes = 11
epochs = 100
```

```
input_image = Input(shape=(None, None, 1))
x = Conv2D(64, (3, 3), activation='relu')(input_image)
x=BatchNormalization(axis=-1, momentum=0.99, epsilon=0.001, center=True, scale=True, beta_initializer='zeros'
, gamma_initializer='ones', moving_mean_initializer='zeros', moving_variance_initializer='ones', beta_regular
izer=None, gamma_regularizer=None, beta_constraint=None, gamma_constraint=None)(x)
x = Conv2D(64, (3, 3), activation='relu')(x)
x = AveragePooling2D((2, 2))(x)
x = Conv2D(128, (3, 3), activation='relu')(x)
x = Conv2D(128, (3, 3), activation='relu')(x)




x = Reshape((-1, 128))(x)
x = Capsule(32, 8, 3, True)(x)
x = Capsule(32, 8, 3, True)(x)
capsule = Capsule(11, 16, 3, True)(x)
output = Lambda(lambda z: K.sqrt(K.sum(K.square(z), 2)))(capsule)




model = Model(inputs=[input_image], outputs=[output])

adam = optimizers.Adam(lr=0.001)

model.compile(loss=margin_loss, optimizer=adam, metrics=['accuracy'])
model.summary()

data_augmentation = False

# The best model is selected based on the loss value on the validation set


filepath='My Drive/Colab Notebooks/notebooks/weights.h5'
checkpoint = ModelCheckpoint(filepath, monitor='val_loss', verbose=1, save_best_only=True, mode='min')
callbacks_list = [checkpoint]




if not data_augmentation:
```

```
    print('Not using data augmentation.')
    model.fit(
        [x_train], [y_train],
        batch_size=batch_size,
        epochs=epochs,
        validation_data=[[x_valid], [y_valid]],
        shuffle=True,callbacks=callbacks_list)

else:
    print('Using real-time data augmentation.')
    # This will do preprocessing and realtime data augmentation:
    datagen = ImageDataGenerator(
        featurewise_center=False,  # set input mean to 0 over the dataset
        samplewise_center=False,  # set each sample mean to 0
        featurewise_std_normalization=False,  # divide inputs by dataset std
        samplewise_std_normalization=False,  # divide each input by its std
        zca_whitening=False,  # apply ZCA whitening
        zca_epsilon=1e-06,  # epsilon for ZCA whitening
        rotation_range=0.1,  # randomly rotate images in 0 to 180 degrees
        width_shift_range=0.1,  # randomly shift images horizontally
        height_shift_range=0.1,  # randomly shift images vertically
        brightness_range=[0.5,1.5],
        shear_range=0.1,  # set range for random shear
        zoom_range=0.1,  # set range for random zoom
        channel_shift_range=0.,  # set range for random chann el shifts
        # set mode for filling points outside the input boundaries
        fill_mode='nearest',
        cval=0.,  # value used for fill_mode = "constant"
        horizontal_flip=True,  # randomly flip images
        vertical_flip=True,  # randomly flip images
        # set rescaling factor (applied before any other transformation)
        rescale=None,
        # set function that will be applied on each input
        preprocessing_function=None,
        # image data format, either "channels_first" or "channels_last"
        data_format=None,
        # fraction of images reserved for validation (strictly between 0 and 1)
        validation_split=0.0)

    # Compute quantities required for feature-wise normalization
    # (std, mean, and principal components if ZCA whitening is applied).
    datagen.fit(x_train)
```

```
# Fit the model on the batches generated by datagen.flow().
model.fit_generator(
    datagen.flow(x_train, y_train, batch_size=batch_size),
    epochs=epochs,
    validation_data=(x_valid, y_valid),shuffle=True)
```

```
Model: "model_3"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_4 (InputLayer)         [(None, None, None, 1)]   0
_________________________________________________________________
conv2d_12 (Conv2D)           (None, None, None, 64)    640
_________________________________________________________________
batch_normalization_3 (Batch (None, None, None, 64)    256
_________________________________________________________________
conv2d_13 (Conv2D)           (None, None, None, 64)    36928
_________________________________________________________________
average_pooling2d_3 (Average (None, None, None, 64)    0
_________________________________________________________________
conv2d_14 (Conv2D)           (None, None, None, 128)   73856
_________________________________________________________________
conv2d_15 (Conv2D)           (None, None, None, 128)   147584
_________________________________________________________________
reshape_3 (Reshape)          (None, None, 128)         0
_________________________________________________________________
capsule_3 (Capsule)          (None, 11, 16)            22528
_________________________________________________________________
lambda_3 (Lambda)            (None, 11)                0
=================================================================
Total params: 281,792
Trainable params: 281,664
Non-trainable params: 128
_________________________________________________________________
Not using data augmentation.
Train on 110000 samples, validate on 110000 samples
Epoch 1/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.3612 - accuracy: 0.4583
Epoch 00001: val_loss improved from inf to 0.32234, saving model to My Drive/Colab Notebooks/notebooks/weight
s.h5
110000/110000 [==============================] - 71s 646us/sample - loss: 0.3612 - accuracy: 0.4584 - val_los
s: 0.3223 - val_accuracy: 0.5156
Epoch 2/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.3051 - accuracy: 0.5419
Epoch 00002: val_loss did not improve from 0.32234
110000/110000 [==============================] - 69s 631us/sample - loss: 0.3051 - accuracy: 0.5419 - val_los
s: 0.5189 - val_accuracy: 0.2370
Epoch 3/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2930 - accuracy: 0.5618
```

```
Epoch 00003: val_loss did not improve from 0.32234
110000/110000 [==============================] - 67s 607us/sample - loss: 0.2930 - accuracy: 0.5617 - val_los
s: 0.3841 - val_accuracy: 0.4386
Epoch 4/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2868 - accuracy: 0.5717
Epoch 00004: val_loss improved from 0.32234 to 0.29664, saving model to My Drive/Colab Notebooks/notebooks/we
ights.h5
110000/110000 [==============================] - 66s 602us/sample - loss: 0.2868 - accuracy: 0.5717 - val_los
s: 0.2966 - val_accuracy: 0.5596
Epoch 5/100
109856/110000 [============================>.] - ETA: 0s - loss: 0.2830 - accuracy: 0.5774
Epoch 00005: val_loss did not improve from 0.29664
110000/110000 [==============================] - 67s 610us/sample - loss: 0.2830 - accuracy: 0.5774 - val_los
s: 0.5493 - val_accuracy: 0.2694
Epoch 6/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2798 - accuracy: 0.5835
Epoch 00006: val_loss did not improve from 0.29664
110000/110000 [==============================] - 67s 606us/sample - loss: 0.2798 - accuracy: 0.5835 - val_los
s: 0.5092 - val_accuracy: 0.3597
Epoch 7/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2777 - accuracy: 0.5858
Epoch 00007: val_loss did not improve from 0.29664
110000/110000 [==============================] - 68s 621us/sample - loss: 0.2777 - accuracy: 0.5858 - val_los
s: 0.3677 - val_accuracy: 0.5118
Epoch 8/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2754 - accuracy: 0.5895
Epoch 00008: val_loss improved from 0.29664 to 0.28932, saving model to My Drive/Colab Notebooks/notebooks/we
ights.h5
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2754 - accuracy: 0.5895 - val_los
s: 0.2893 - val_accuracy: 0.5663
Epoch 9/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2733 - accuracy: 0.5942
Epoch 00009: val_loss did not improve from 0.28932
110000/110000 [==============================] - 67s 611us/sample - loss: 0.2733 - accuracy: 0.5942 - val_los
s: 0.5693 - val_accuracy: 0.2629
Epoch 10/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2711 - accuracy: 0.5979
Epoch 00010: val_loss did not improve from 0.28932
110000/110000 [==============================] - 67s 607us/sample - loss: 0.2711 - accuracy: 0.5979 - val_los
s: 0.3720 - val_accuracy: 0.4754
Epoch 11/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2694 - accuracy: 0.6006
Epoch 00011: val_loss improved from 0.28932 to 0.28810, saving model to My Drive/Colab Notebooks/notebooks/we
```

```
ights.h5
110000/110000 [==============================] - 68s 619us/sample - loss: 0.2695 - accuracy: 0.6006 - val_los
s: 0.2881 - val_accuracy: 0.5686
Epoch 12/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2674 - accuracy: 0.6044
Epoch 00012: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 618us/sample - loss: 0.2674 - accuracy: 0.6045 - val_los
s: 0.8765 - val_accuracy: 0.1132
Epoch 13/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2658 - accuracy: 0.6066
Epoch 00013: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 612us/sample - loss: 0.2658 - accuracy: 0.6065 - val_los
s: 0.5241 - val_accuracy: 0.2833
Epoch 14/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2639 - accuracy: 0.6101
Epoch 00014: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2639 - accuracy: 0.6101 - val_los
s: 0.3602 - val_accuracy: 0.5024
Epoch 15/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2622 - accuracy: 0.6143
Epoch 00015: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2622 - accuracy: 0.6143 - val_los
s: 0.3046 - val_accuracy: 0.5626
Epoch 16/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2604 - accuracy: 0.6175
Epoch 00016: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 619us/sample - loss: 0.2604 - accuracy: 0.6175 - val_los
s: 0.5198 - val_accuracy: 0.3299
Epoch 17/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2588 - accuracy: 0.6205
Epoch 00017: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 610us/sample - loss: 0.2589 - accuracy: 0.6204 - val_los
s: 0.3133 - val_accuracy: 0.5475
Epoch 18/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2571 - accuracy: 0.6240
Epoch 00018: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 608us/sample - loss: 0.2571 - accuracy: 0.6240 - val_los
s: 0.3015 - val_accuracy: 0.5551
Epoch 19/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2552 - accuracy: 0.6276
Epoch 00019: val_loss did not improve from 0.28810
110000/110000 [==============================] - 66s 603us/sample - loss: 0.2552 - accuracy: 0.6275 - val_los
s: 0.3349 - val_accuracy: 0.5157
```

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Epoch 20/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2537 - accuracy: 0.6302
Epoch 00020: val_loss did not improve from 0.28810
110000/110000 [==============================] - 66s 601us/sample - loss: 0.2538 - accuracy: 0.6301 - val_los
s: 0.3201 - val_accuracy: 0.5402
Epoch 21/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2519 - accuracy: 0.6345
Epoch 00021: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 620us/sample - loss: 0.2519 - accuracy: 0.6345 - val_los
s: 0.2907 - val_accuracy: 0.5663
Epoch 22/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2501 - accuracy: 0.6380
Epoch 00022: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 606us/sample - loss: 0.2501 - accuracy: 0.6379 - val_los
s: 0.4322 - val_accuracy: 0.4418
Epoch 23/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2489 - accuracy: 0.6398
Epoch 00023: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 608us/sample - loss: 0.2489 - accuracy: 0.6398 - val_los
s: 0.6978 - val_accuracy: 0.1962
Epoch 24/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2474 - accuracy: 0.6420
Epoch 00024: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 606us/sample - loss: 0.2474 - accuracy: 0.6420 - val_los
s: 0.3115 - val_accuracy: 0.5479
Epoch 25/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2461 - accuracy: 0.6448
Epoch 00025: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 620us/sample - loss: 0.2461 - accuracy: 0.6448 - val_los
s: 0.5641 - val_accuracy: 0.3132
Epoch 26/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2445 - accuracy: 0.6481
Epoch 00026: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2445 - accuracy: 0.6482 - val_los
s: 0.3018 - val_accuracy: 0.5593
Epoch 27/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2433 - accuracy: 0.6501
Epoch 00027: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 608us/sample - loss: 0.2433 - accuracy: 0.6501 - val_los
s: 0.2985 - val_accuracy: 0.5583
Epoch 28/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2420 - accuracy: 0.6532
Epoch 00028: val_loss did not improve from 0.28810
```

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110000/110000 [==============================] - 67s 607us/sample - loss: 0.2420 - accuracy: 0.6532 - val_los
s: 0.7623 - val_accuracy: 0.1917
Epoch 29/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2405 - accuracy: 0.6565
Epoch 00029: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2405 - accuracy: 0.6565 - val_los
s: 0.6262 - val_accuracy: 0.2833
Epoch 30/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2397 - accuracy: 0.6578
Epoch 00030: val_loss did not improve from 0.28810
110000/110000 [==============================] - 69s 623us/sample - loss: 0.2397 - accuracy: 0.6578 - val_los
s: 0.3043 - val_accuracy: 0.5585
Epoch 31/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2383 - accuracy: 0.6606
Epoch 00031: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 616us/sample - loss: 0.2383 - accuracy: 0.6606 - val_los
s: 0.4771 - val_accuracy: 0.3867
Epoch 32/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2371 - accuracy: 0.6618
Epoch 00032: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 615us/sample - loss: 0.2371 - accuracy: 0.6618 - val_los
s: 1.4809 - val_accuracy: 0.1151
Epoch 33/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2364 - accuracy: 0.6658
Epoch 00033: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2364 - accuracy: 0.6658 - val_los
s: 0.3968 - val_accuracy: 0.4505
Epoch 34/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2352 - accuracy: 0.6659
Epoch 00034: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 615us/sample - loss: 0.2352 - accuracy: 0.6659 - val_los
s: 0.9285 - val_accuracy: 0.1261
Epoch 35/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2339 - accuracy: 0.6699
Epoch 00035: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 618us/sample - loss: 0.2339 - accuracy: 0.6699 - val_los
s: 1.1857 - val_accuracy: 0.1171
Epoch 36/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2326 - accuracy: 0.6735
Epoch 00036: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 615us/sample - loss: 0.2326 - accuracy: 0.6736 - val_los
s: 0.3880 - val_accuracy: 0.4837
Epoch 37/100
```

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109984/110000 [============================>.] - ETA: 0s - loss: 0.2316 - accuracy: 0.6752
Epoch 00037: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 608us/sample - loss: 0.2316 - accuracy: 0.6752 - val_los
s: 0.5248 - val_accuracy: 0.3577
Epoch 38/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2314 - accuracy: 0.6754
Epoch 00038: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 609us/sample - loss: 0.2314 - accuracy: 0.6754 - val_los
s: 0.4025 - val_accuracy: 0.4605
Epoch 39/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2302 - accuracy: 0.6775
Epoch 00039: val_loss did not improve from 0.28810
110000/110000 [==============================] - 69s 625us/sample - loss: 0.2302 - accuracy: 0.6776 - val_los
s: 0.3444 - val_accuracy: 0.5215
Epoch 40/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2294 - accuracy: 0.6784
Epoch 00040: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 611us/sample - loss: 0.2294 - accuracy: 0.6784 - val_los
s: 0.3332 - val_accuracy: 0.5266
Epoch 41/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2286 - accuracy: 0.6807
Epoch 00041: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2286 - accuracy: 0.6807 - val_los
s: 0.3708 - val_accuracy: 0.5033
Epoch 42/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2279 - accuracy: 0.6816
Epoch 00042: val_loss did not improve from 0.28810
110000/110000 [==============================] - 66s 604us/sample - loss: 0.2279 - accuracy: 0.6816 - val_los
s: 0.3451 - val_accuracy: 0.5263
Epoch 43/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2269 - accuracy: 0.6844
Epoch 00043: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2269 - accuracy: 0.6844 - val_los
s: 0.3263 - val_accuracy: 0.5321
Epoch 44/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2265 - accuracy: 0.6840
Epoch 00044: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 617us/sample - loss: 0.2265 - accuracy: 0.6840 - val_los
s: 1.3052 - val_accuracy: 0.1096
Epoch 45/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2252 - accuracy: 0.6875
Epoch 00045: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 605us/sample - loss: 0.2252 - accuracy: 0.6875 - val_los
```

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s: 0.4514 - val_accuracy: 0.4342
Epoch 46/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2246 - accuracy: 0.6890
Epoch 00046: val_loss did not improve from 0.28810
110000/110000 [==============================] - 66s 604us/sample - loss: 0.2246 - accuracy: 0.6890 - val_los
s: 1.1322 - val_accuracy: 0.1623
Epoch 47/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2239 - accuracy: 0.6897
Epoch 00047: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 610us/sample - loss: 0.2239 - accuracy: 0.6898 - val_los
s: 0.3128 - val_accuracy: 0.5506
Epoch 48/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2231 - accuracy: 0.6906
Epoch 00048: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 617us/sample - loss: 0.2231 - accuracy: 0.6907 - val_los
s: 0.9263 - val_accuracy: 0.1621
Epoch 49/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2222 - accuracy: 0.6935
Epoch 00049: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 617us/sample - loss: 0.2222 - accuracy: 0.6936 - val_los
s: 0.3223 - val_accuracy: 0.5423
Epoch 50/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2219 - accuracy: 0.6932
Epoch 00050: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 612us/sample - loss: 0.2219 - accuracy: 0.6932 - val_los
s: 0.4768 - val_accuracy: 0.4147
Epoch 51/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2212 - accuracy: 0.6954
Epoch 00051: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 606us/sample - loss: 0.2212 - accuracy: 0.6954 - val_los
s: 0.3206 - val_accuracy: 0.5492
Epoch 52/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2208 - accuracy: 0.6957
Epoch 00052: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2209 - accuracy: 0.6956 - val_los
s: 0.3231 - val_accuracy: 0.5496
Epoch 53/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2199 - accuracy: 0.6993
Epoch 00053: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 615us/sample - loss: 0.2199 - accuracy: 0.6993 - val_los
s: 0.9579 - val_accuracy: 0.1680
Epoch 54/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2196 - accuracy: 0.6987
```

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Epoch 00054: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 608us/sample - loss: 0.2196 - accuracy: 0.6987 - val_los
s: 0.3456 - val_accuracy: 0.5166
Epoch 55/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2186 - accuracy: 0.6997
Epoch 00055: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 605us/sample - loss: 0.2186 - accuracy: 0.6997 - val_los
s: 0.3200 - val_accuracy: 0.5455
Epoch 56/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2181 - accuracy: 0.7022
Epoch 00056: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 606us/sample - loss: 0.2181 - accuracy: 0.7021 - val_los
s: 0.3275 - val_accuracy: 0.5326
Epoch 57/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2181 - accuracy: 0.7013
Epoch 00057: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 611us/sample - loss: 0.2181 - accuracy: 0.7012 - val_los
s: 0.3751 - val_accuracy: 0.5057
Epoch 58/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2174 - accuracy: 0.7030
Epoch 00058: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 609us/sample - loss: 0.2174 - accuracy: 0.7030 - val_los
s: 0.4464 - val_accuracy: 0.4289
Epoch 59/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2169 - accuracy: 0.7033
Epoch 00059: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 608us/sample - loss: 0.2169 - accuracy: 0.7033 - val_los
s: 0.3248 - val_accuracy: 0.5391
Epoch 60/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2161 - accuracy: 0.7040
Epoch 00060: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 610us/sample - loss: 0.2161 - accuracy: 0.7040 - val_los
s: 0.3184 - val_accuracy: 0.5464
Epoch 61/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2161 - accuracy: 0.7058
Epoch 00061: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 620us/sample - loss: 0.2161 - accuracy: 0.7058 - val_los
s: 0.3488 - val_accuracy: 0.5260
Epoch 62/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2156 - accuracy: 0.7065
Epoch 00062: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 619us/sample - loss: 0.2156 - accuracy: 0.7065 - val_los
s: 0.3788 - val_accuracy: 0.5017
```

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Epoch 63/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2150 - accuracy: 0.7076
Epoch 00063: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 612us/sample - loss: 0.2150 - accuracy: 0.7076 - val_los
s: 0.3742 - val_accuracy: 0.4974
Epoch 64/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2144 - accuracy: 0.7097
Epoch 00064: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2144 - accuracy: 0.7097 - val_los
s: 0.3312 - val_accuracy: 0.5443
Epoch 65/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2142 - accuracy: 0.7103
Epoch 00065: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 610us/sample - loss: 0.2141 - accuracy: 0.7103 - val_los
s: 0.5515 - val_accuracy: 0.3124
Epoch 66/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2134 - accuracy: 0.7109
Epoch 00066: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 615us/sample - loss: 0.2134 - accuracy: 0.7109 - val_los
s: 0.3238 - val_accuracy: 0.5452
Epoch 67/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2132 - accuracy: 0.7115
Epoch 00067: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 619us/sample - loss: 0.2132 - accuracy: 0.7115 - val_los
s: 0.3215 - val_accuracy: 0.5441
Epoch 68/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2129 - accuracy: 0.7124
Epoch 00068: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 617us/sample - loss: 0.2129 - accuracy: 0.7124 - val_los
s: 0.3329 - val_accuracy: 0.5360
Epoch 69/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2122 - accuracy: 0.7132
Epoch 00069: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2121 - accuracy: 0.7132 - val_los
s: 0.3350 - val_accuracy: 0.5329
Epoch 70/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2121 - accuracy: 0.7134
Epoch 00070: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 619us/sample - loss: 0.2121 - accuracy: 0.7134 - val_los
s: 0.3228 - val_accuracy: 0.5442
Epoch 71/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2116 - accuracy: 0.7143
Epoch 00071: val_loss did not improve from 0.28810
```

```
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2116 - accuracy: 0.7143 - val_los
s: 0.4082 - val_accuracy: 0.4626
Epoch 72/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2113 - accuracy: 0.7148
Epoch 00072: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 610us/sample - loss: 0.2113 - accuracy: 0.7148 - val_los
s: 0.4592 - val_accuracy: 0.4096
Epoch 73/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2108 - accuracy: 0.7159
Epoch 00073: val_loss did not improve from 0.28810
110000/110000 [==============================] - 66s 604us/sample - loss: 0.2108 - accuracy: 0.7158 - val_los
s: 0.3254 - val_accuracy: 0.5444
Epoch 74/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2102 - accuracy: 0.7164
Epoch 00074: val_loss did not improve from 0.28810
110000/110000 [==============================] - 66s 603us/sample - loss: 0.2102 - accuracy: 0.7164 - val_los
s: 0.3545 - val_accuracy: 0.5205
Epoch 75/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2101 - accuracy: 0.7163
Epoch 00075: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 610us/sample - loss: 0.2101 - accuracy: 0.7162 - val_los
s: 0.4389 - val_accuracy: 0.4397
Epoch 76/100
109984/110000 [============================>.] - ETA: 0s - loss: 0.2097 - accuracy: 0.7189
Epoch 00076: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 614us/sample - loss: 0.2097 - accuracy: 0.7189 - val_los
s: 0.3245 - val_accuracy: 0.5423
Epoch 77/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2096 - accuracy: 0.7180
Epoch 00077: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 608us/sample - loss: 0.2096 - accuracy: 0.7180 - val_los
s: 0.3254 - val_accuracy: 0.5412
Epoch 78/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2092 - accuracy: 0.7194
Epoch 00078: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 605us/sample - loss: 0.2092 - accuracy: 0.7194 - val_los
s: 0.3262 - val_accuracy: 0.5378
Epoch 79/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2087 - accuracy: 0.7195
Epoch 00079: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 609us/sample - loss: 0.2087 - accuracy: 0.7195 - val_los
s: 0.3314 - val_accuracy: 0.5357
Epoch 80/100
```

```
109968/110000 [============================>.] - ETA: 0s - loss: 0.2087 - accuracy: 0.7210
Epoch 00080: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 612us/sample - loss: 0.2087 - accuracy: 0.7210 - val_los
s: 0.3524 - val_accuracy: 0.5279
Epoch 81/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2084 - accuracy: 0.7216
Epoch 00081: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 616us/sample - loss: 0.2084 - accuracy: 0.7215 - val_los
s: 0.3975 - val_accuracy: 0.4945
Epoch 82/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2081 - accuracy: 0.7212
Epoch 00082: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 615us/sample - loss: 0.2080 - accuracy: 0.7212 - val_los
s: 0.3274 - val_accuracy: 0.5470
Epoch 83/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2079 - accuracy: 0.7229
Epoch 00083: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 614us/sample - loss: 0.2079 - accuracy: 0.7230 - val_los
s: 0.3858 - val_accuracy: 0.5074
Epoch 84/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2074 - accuracy: 0.7235
Epoch 00084: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 614us/sample - loss: 0.2074 - accuracy: 0.7235 - val_los
s: 0.3287 - val_accuracy: 0.5459
Epoch 85/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2070 - accuracy: 0.7239
Epoch 00085: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 609us/sample - loss: 0.2071 - accuracy: 0.7238 - val_los
s: 0.3319 - val_accuracy: 0.5369
Epoch 86/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2068 - accuracy: 0.7237
Epoch 00086: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2068 - accuracy: 0.7237 - val_los
s: 0.3731 - val_accuracy: 0.5146
Epoch 87/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2065 - accuracy: 0.7257
Epoch 00087: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 608us/sample - loss: 0.2064 - accuracy: 0.7257 - val_los
s: 0.3974 - val_accuracy: 0.4846
Epoch 88/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2065 - accuracy: 0.7244
Epoch 00088: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 607us/sample - loss: 0.2065 - accuracy: 0.7243 - val_los
```

```
s: 0.5414 - val_accuracy: 0.3713
Epoch 89/100
109968/110000 [============================>.] - ETA: 0s - loss: 0.2061 - accuracy: 0.7253
Epoch 00089: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 611us/sample - loss: 0.2062 - accuracy: 0.7252 - val_los
s: 0.5357 - val_accuracy: 0.3715
Epoch 90/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2058 - accuracy: 0.7264
Epoch 00090: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 613us/sample - loss: 0.2058 - accuracy: 0.7264 - val_los
s: 0.3451 - val_accuracy: 0.5281
Epoch 91/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2055 - accuracy: 0.7272
Epoch 00091: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 608us/sample - loss: 0.2055 - accuracy: 0.7272 - val_los
s: 0.3799 - val_accuracy: 0.5010
Epoch 92/100
109904/110000 [============================>.] - ETA: 0s - loss: 0.2053 - accuracy: 0.7268
Epoch 00092: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 606us/sample - loss: 0.2053 - accuracy: 0.7268 - val_los
s: 0.3698 - val_accuracy: 0.5104
Epoch 93/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2051 - accuracy: 0.7268
Epoch 00093: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 615us/sample - loss: 0.2051 - accuracy: 0.7268 - val_los
s: 0.6736 - val_accuracy: 0.2578
Epoch 94/100
109920/110000 [============================>.] - ETA: 0s - loss: 0.2046 - accuracy: 0.7297
Epoch 00094: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 609us/sample - loss: 0.2046 - accuracy: 0.7297 - val_los
s: 0.9135 - val_accuracy: 0.1835
Epoch 95/100
109888/110000 [============================>.] - ETA: 0s - loss: 0.2047 - accuracy: 0.7300
Epoch 00095: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 616us/sample - loss: 0.2047 - accuracy: 0.7300 - val_los
s: 0.3280 - val_accuracy: 0.5457
Epoch 96/100
109872/110000 [============================>.] - ETA: 0s - loss: 0.2047 - accuracy: 0.7279
Epoch 00096: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 616us/sample - loss: 0.2047 - accuracy: 0.7278 - val_los
s: 0.4594 - val_accuracy: 0.4403
Epoch 97/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2040 - accuracy: 0.7296
```

```
Epoch 00097: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 615us/sample - loss: 0.2040 - accuracy: 0.7296 - val_los
s: 0.3425 - val_accuracy: 0.5283
Epoch 98/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2040 - accuracy: 0.7282
Epoch 00098: val_loss did not improve from 0.28810
110000/110000 [==============================] - 68s 618us/sample - loss: 0.2040 - accuracy: 0.7282 - val_los
s: 0.3294 - val_accuracy: 0.5476
Epoch 99/100
109952/110000 [============================>.] - ETA: 0s - loss: 0.2034 - accuracy: 0.7309
Epoch 00099: val_loss did not improve from 0.28810
110000/110000 [==============================] - 69s 623us/sample - loss: 0.2034 - accuracy: 0.7309 - val_los
s: 0.3448 - val_accuracy: 0.5253
Epoch 100/100
109936/110000 [============================>.] - ETA: 0s - loss: 0.2037 - accuracy: 0.7293
Epoch 00100: val_loss did not improve from 0.28810
110000/110000 [==============================] - 67s 610us/sample - loss: 0.2037 - accuracy: 0.7293 - val_los
s: 0.3486 - val_accuracy: 0.5252
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

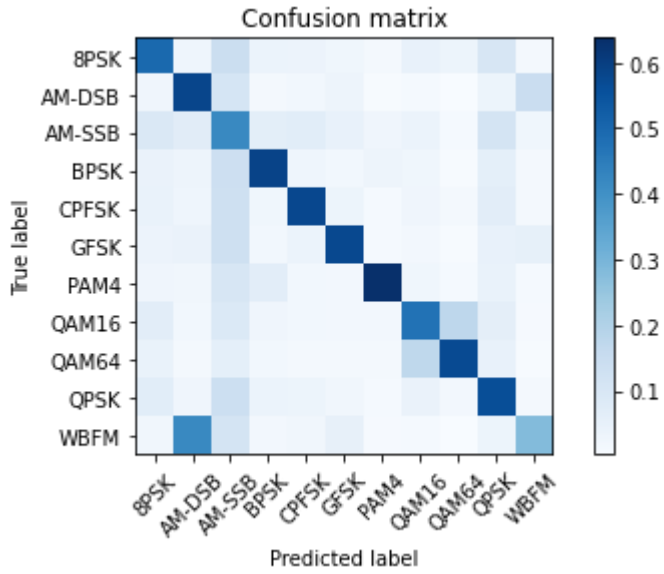
```
bs=1024
```

In [ ]:
```
score = model.evaluate(x_valid, y_valid, verbose=1, batch_size=bs)
print(score)
```

```
IOPub data rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_data_rate_limit`.

Current values:
NotebookApp.iopub_data_rate_limit=1000000.0 (bytes/sec)
NotebookApp.rate_limit_window=3.0 (secs)


[0.3486373400558125, 0.5252454]
```

In [ ]:
```
def plot_confusion_matrix(cm, title='Confusion matrix', cmap=plt.cm.Blues, labels=[]):
    plt.imshow(cm, interpolation='nearest', cmap=cmap)
    plt.title(title)
    plt.colorbar()
    tick_marks = np.arange(len(labels))
    plt.xticks(tick_marks, labels, rotation=45)
    plt.yticks(tick_marks, labels)
    plt.tight_layout()
    plt.ylabel('True label')
    plt.xlabel('Predicted label')
```

In [ ]:
```
test_Y_hat = model.predict(x_valid, batch_size=batch_size)
conf = np.zeros([len(classes),len(classes)])
confnorm = np.zeros([len(classes),len(classes)])
for i in range(0,X_test.shape[0]):
    j = list(Y_test[i,:]).index(1)
    k = int(np.argmax(test_Y_hat[i,:]))
    conf[j,k] = conf[j,k] + 1
for i in range(0,len(classes)):
    confnorm[i,:] = conf[i,:] / np.sum(conf[i,:])
plot_confusion_matrix(confnorm, labels=classes)
```



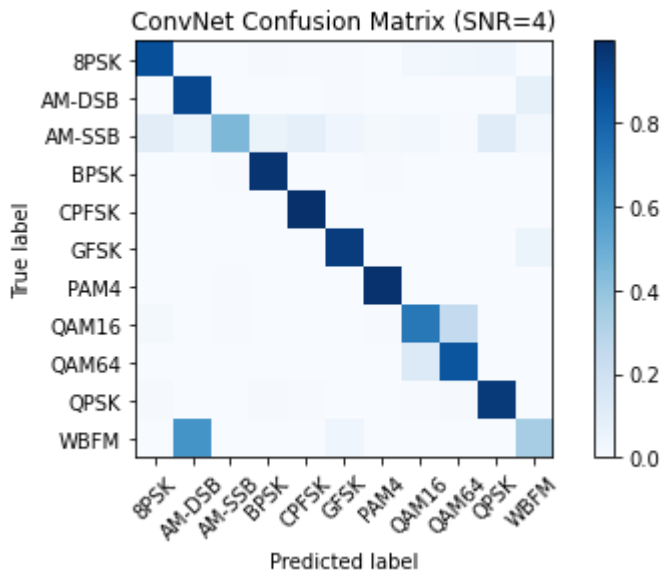
In [ ]:
```
x4 = np.reshape(test_X_i, (-1, 2,128,1))
```

In [ ]:
```
x4.shape
```

Out[ ]: (5465, 2, 128, 1)

In [ ]:
```
# Plot confusion matrix
acc = {}
for snr in snrs:

    # extract classes @ SNR
    test_SNRs = list(map(lambda x: lbl[x][1], test_idx))
    test_X_i = x_valid[np.where(np.array(test_SNRs)==snr)]
    test_Y_i = y_valid[np.where(np.array(test_SNRs)==snr)]

    # estimate classes
    test_Y_i_hat = model.predict(test_X_i)
    conf = np.zeros([len(classes),len(classes)])
    confnorm = np.zeros([len(classes),len(classes)])
    for i in range(0,test_X_i.shape[0]):
        j = list(test_Y_i[i,:]).index(1)
        k = int(np.argmax(test_Y_i_hat[i,:]))
        conf[j,k] = conf[j,k] + 1
    for i in range(0,len(classes)):
        confnorm[i,:] = conf[i,:] / np.sum(conf[i,:])

    if snr==4:
      plt.figure()
      plot_confusion_matrix(confnorm, labels=classes, title="ConvNet Confusion Matrix (SNR=%d)"%(snr))

    cor = np.sum(np.diag(conf))
    ncor = np.sum(conf) - cor
    print("Overall Accuracy: ", cor / (cor+ncor))
    acc[snr] = 1.0*cor/(cor+ncor)
```

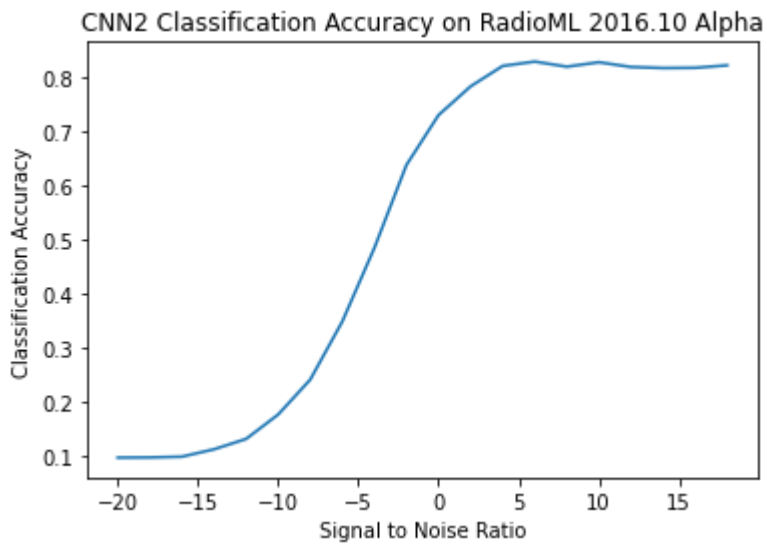
```
Overall Accuracy:  0.09551692589204025
Overall Accuracy:  0.09591280653950954
Overall Accuracy:  0.09732272069464544
Overall Accuracy:  0.11097076867556839
Overall Accuracy:  0.1301731996353692
Overall Accuracy:  0.1754043006930869
Overall Accuracy:  0.2401249311041705
Overall Accuracy:  0.34787390029325516
Overall Accuracy:  0.48428835489833644
Overall Accuracy:  0.6380624092888244
Overall Accuracy:  0.7304744525547445
Overall Accuracy:  0.7837150127226463
Overall Accuracy:  0.8215859030837004
Overall Accuracy:  0.8296028880866426
Overall Accuracy:  0.8201983769161406
Overall Accuracy:  0.8284153005464481
Overall Accuracy:  0.8196632265073329
Overall Accuracy:  0.8176785384757336
Overall Accuracy:  0.8180995475113122
Overall Accuracy:  0.8226822682268227
```



In [ ]:
```
# Show loss curves
plt.figure()
plt.title('Training performance')
plt.plot(history.epoch, history.history['loss'], label='train loss+error')
plt.plot(history.epoch, history.history['val_loss'], label='val_error')
plt.legend()
```

In [ ]:
```
# Plot accuracy curve
plt.plot(snrs, list(map(lambda x: acc[x], snrs)))
plt.xlabel("Signal to Noise Ratio")
plt.ylabel("Classification Accuracy")
plt.title("CNN2 Classification Accuracy on RadioML 2016.10 Alpha")
```

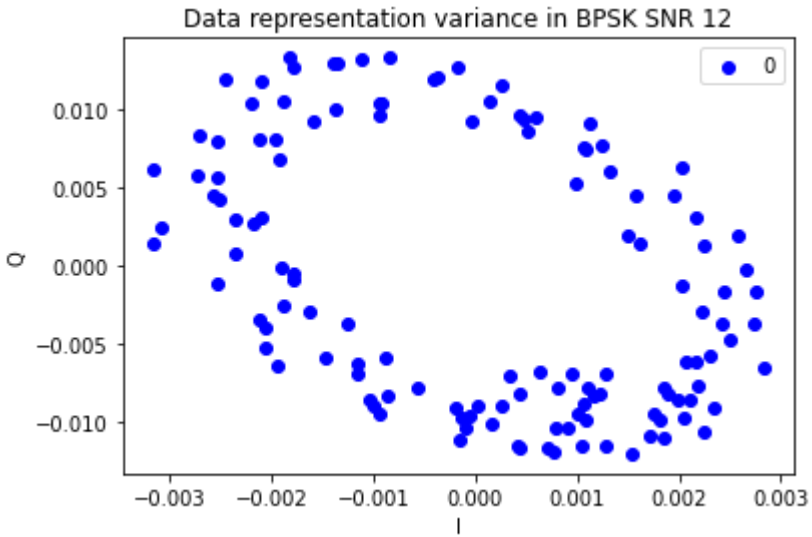
Out[ ]:
```
Text(0.5, 1.0, 'CNN2 Classification Accuracy on RadioML 2016.10 Alpha')
```

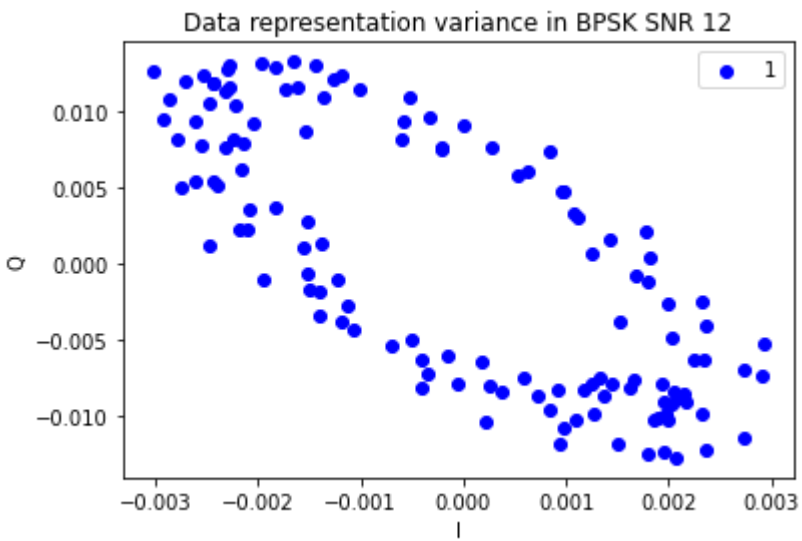


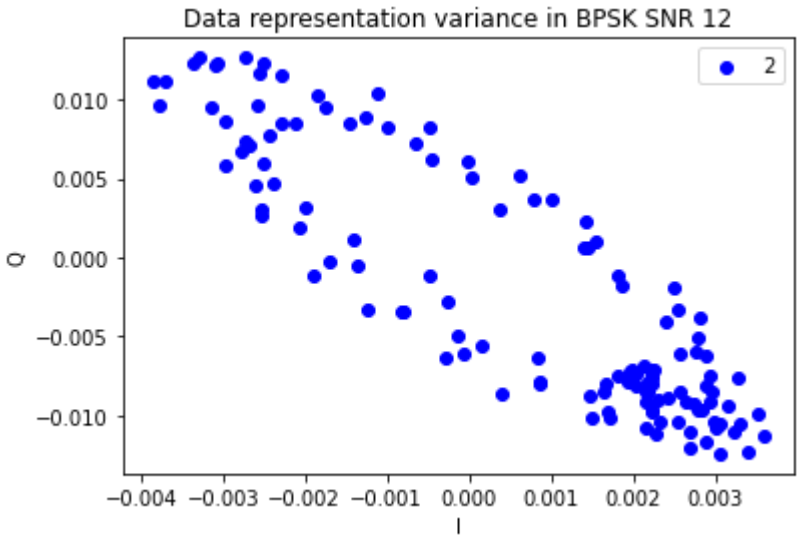
In [ ]:

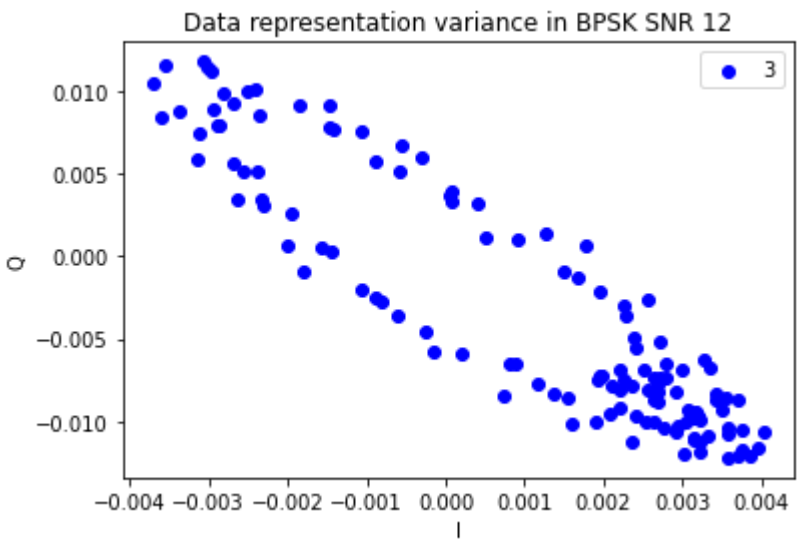
In [ ]:
```
import pickle
import random, sys, keras
import pandas as pd
import numpy as np

with open('My Drive/Colab Notebooks/MOD.pkl', 'rb') as open_file:
        u = pickle._Unpickler( open_file )
        u.encoding = 'latin1'
        Xd = u.load()
snrs,mods = map(lambda j: sorted(list(set(map(lambda x: x[j], Xd.keys())))), [1,0])
X = []
Y=[]
lbl = []
for mod in mods:
  for snr in snrs:
    if(mod=='BPSK'and snr==12):
      test = Xd[(mod,snr)]
      #print(test)
      X.append(Xd[(mod,snr)])
      for i in range(Xd[(mod,snr)].shape[0]):
        lbl.append((mod,snr))
        Y.append([test[0]+1j*test[1]])
X = np.vstack(X)
Y= np.vstack(Y)

df= pd.DataFrame(lbl,columns=["mod","snr"])
df['snr'].value_counts()
ind = []
for i in range(0,df.shape[0]):
  if(df['snr'][i]==16):
    ind.append(i)

import matplotlib.pyplot as plt
for i in range(0,1000,1):
    x = X[i][0]
    y= X[i][1]
    fig = plt.figure()
    plt.scatter(x,y,c='blue',label=i)
    plt.xlabel("I")
    plt.ylabel("Q")
    plt.title("Data representation variance in BPSK SNR 12")
    plt.legend()
```

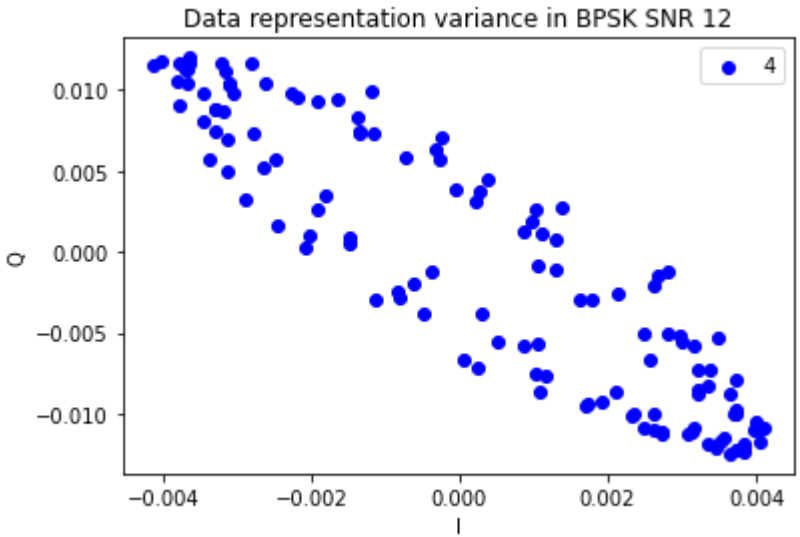
```
    plt.show()
#fig.savefig(path+"/IQ trained images/snr/%d.png"  % i)
```

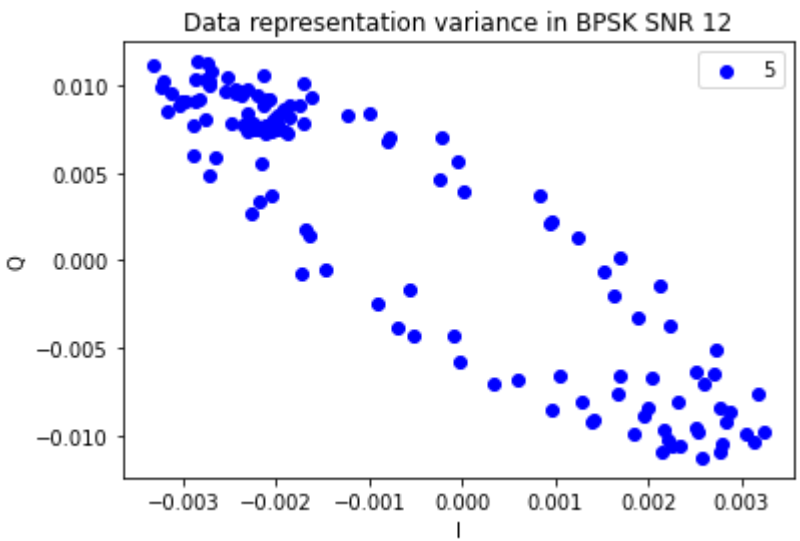

Data representation variance in BPSK SNR 12
0
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

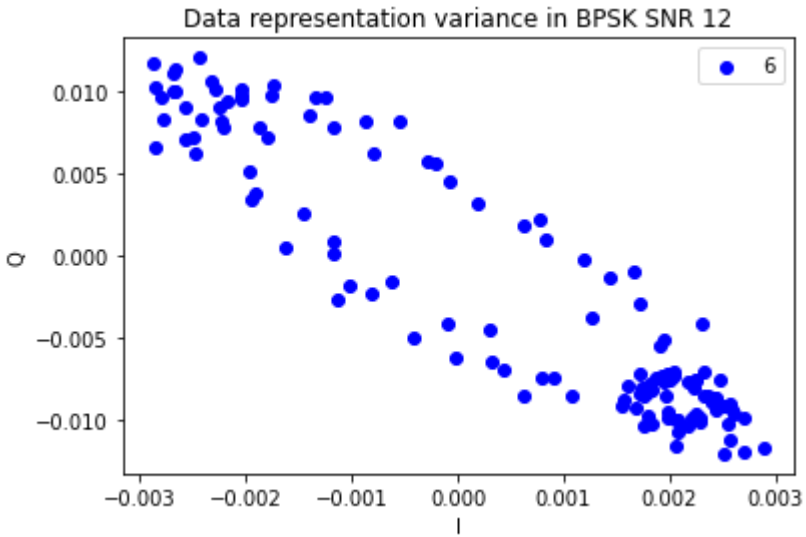

Data representation variance in BPSK SNR 12
1
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

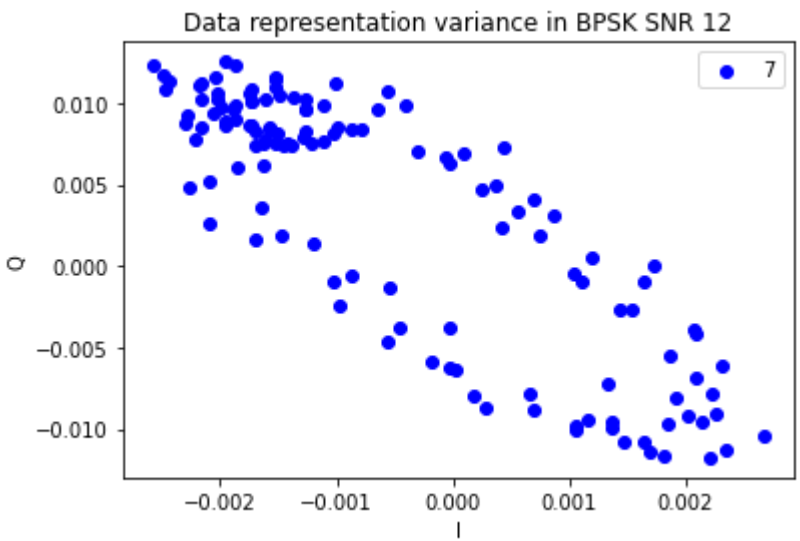

Data representation variance in BPSK SNR 12
2
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003
I

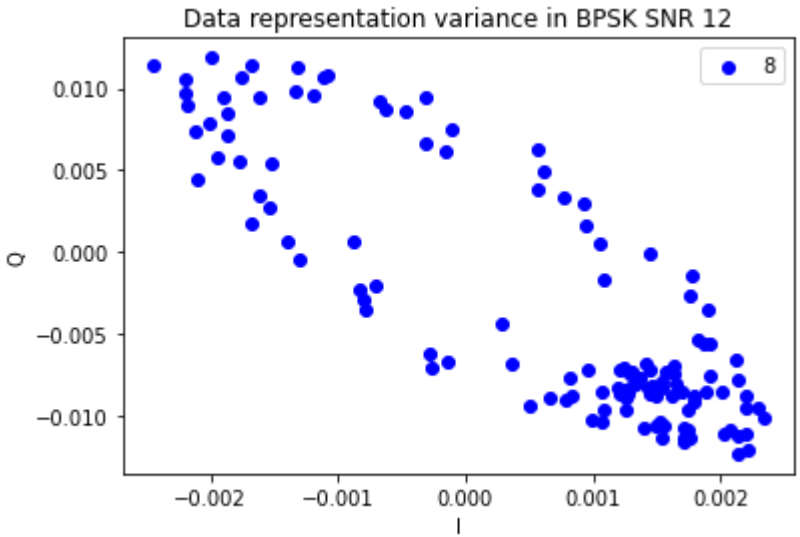

Data representation variance in BPSK SNR 12
3
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

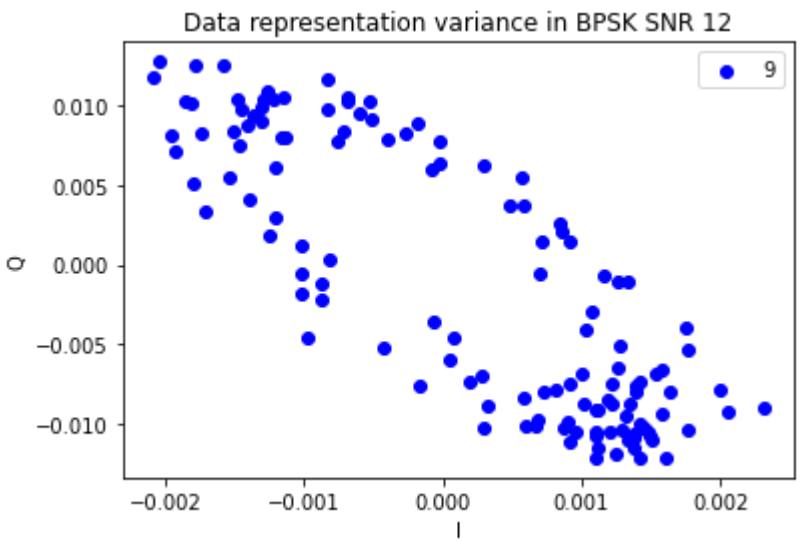

Data representation variance in BPSK SNR 12
4
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

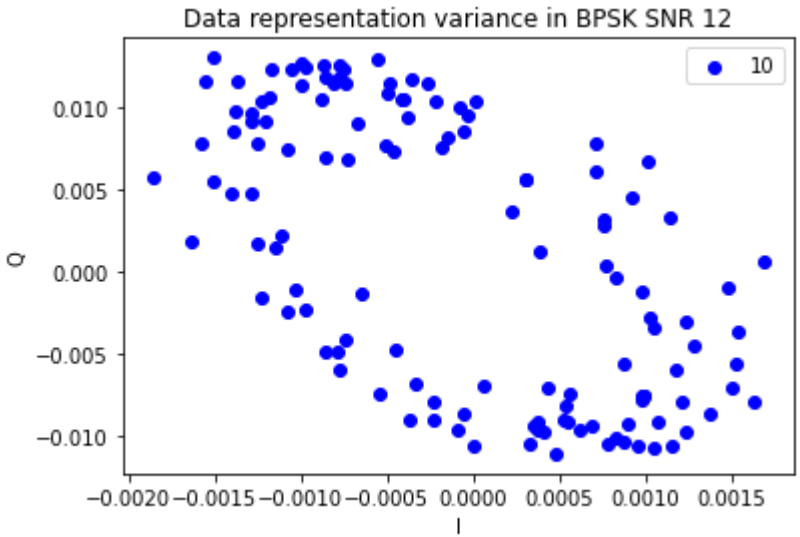

Data representation variance in BPSK SNR 12
5
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

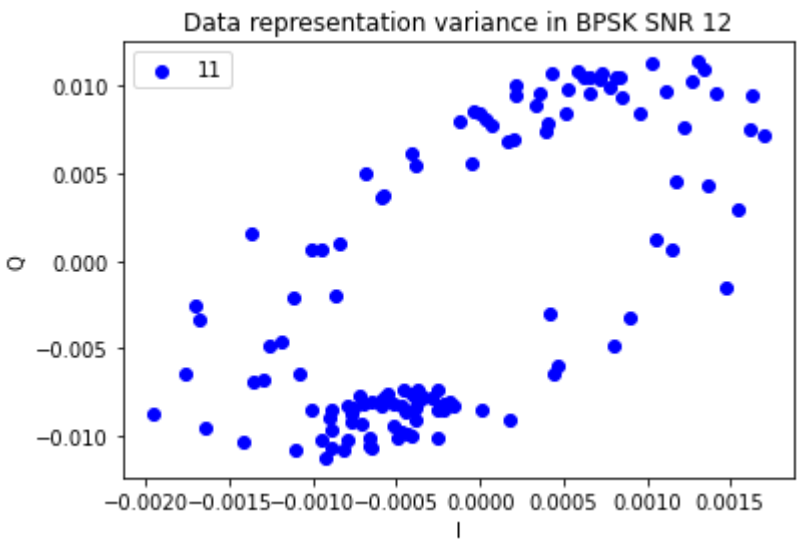

Data representation variance in BPSK SNR 12
6
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

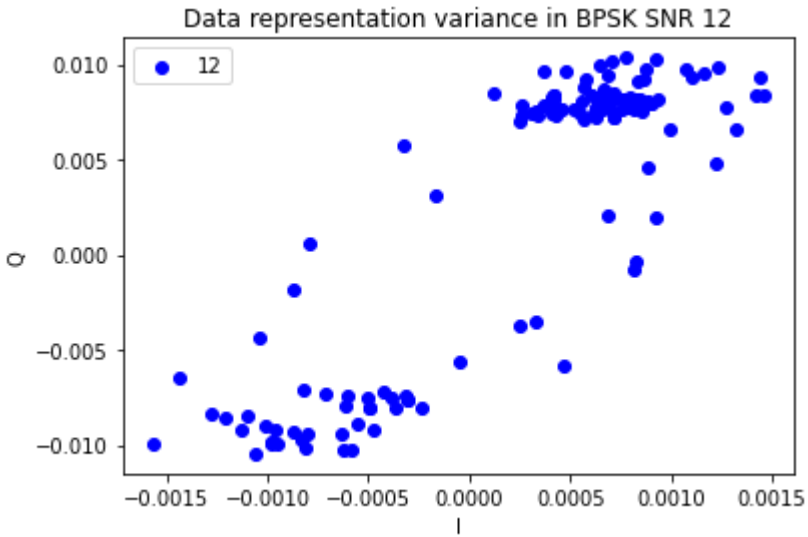

Data representation variance in BPSK SNR 12
7
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

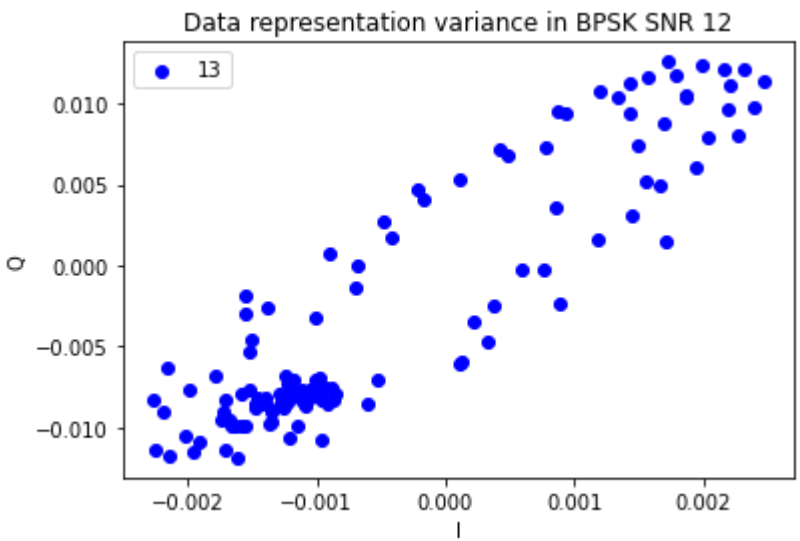

Data representation variance in BPSK SNR 12
8
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

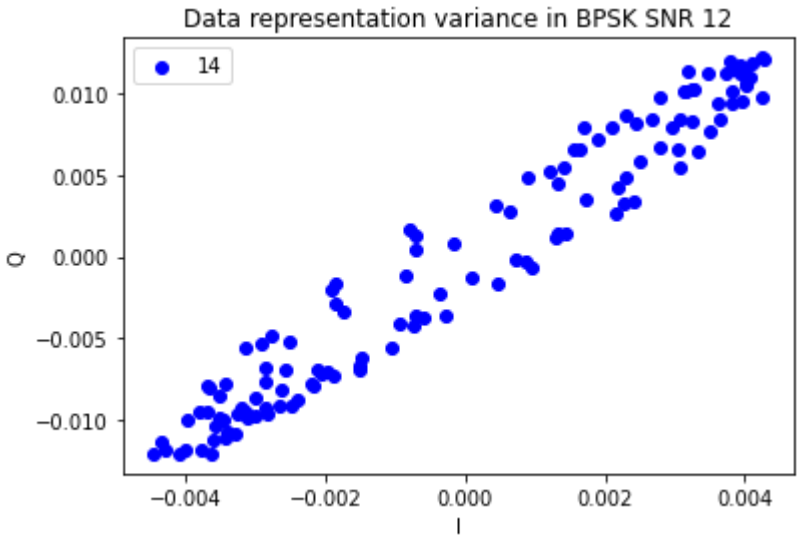

Data representation variance in BPSK SNR 12
9
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

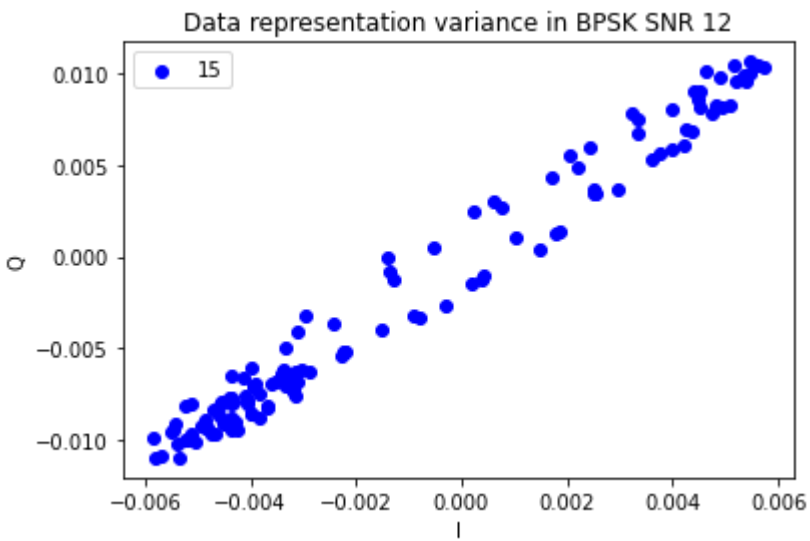

Data representation variance in BPSK SNR 12
10
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
I

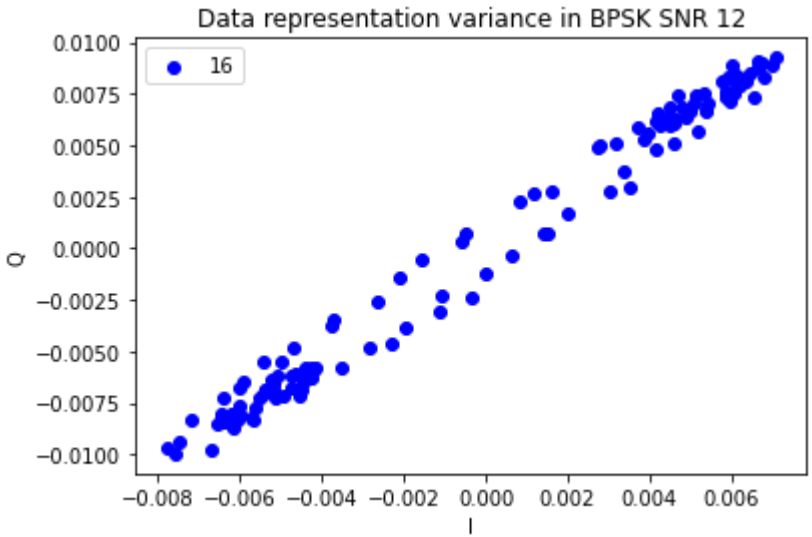

Data representation variance in BPSK SNR 12
11
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
I

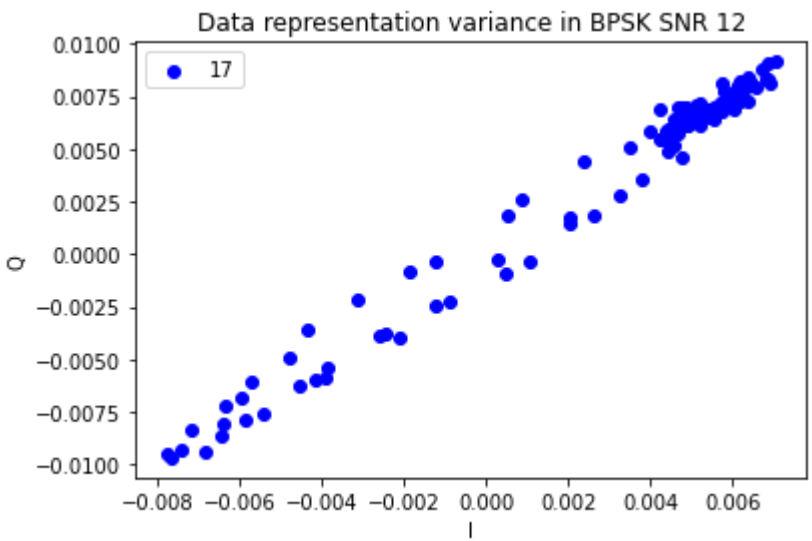

Data representation variance in BPSK SNR 12
12
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
I

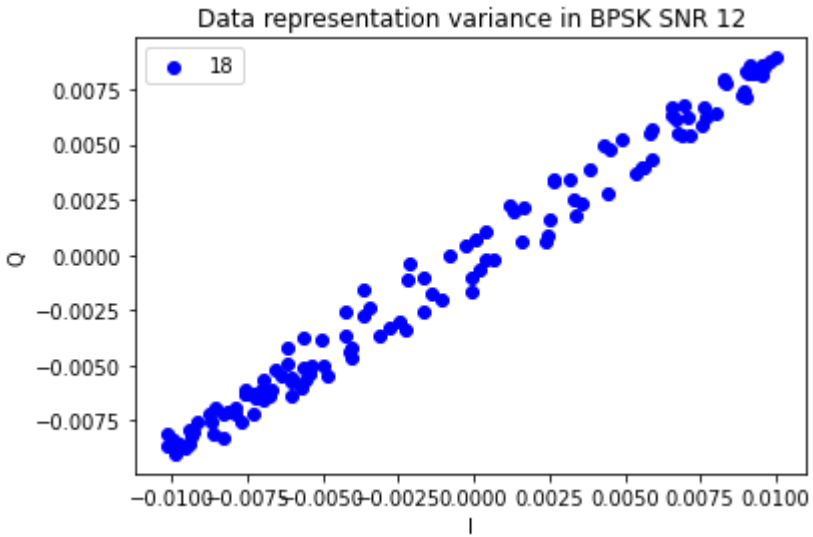

Data representation variance in BPSK SNR 12
13
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

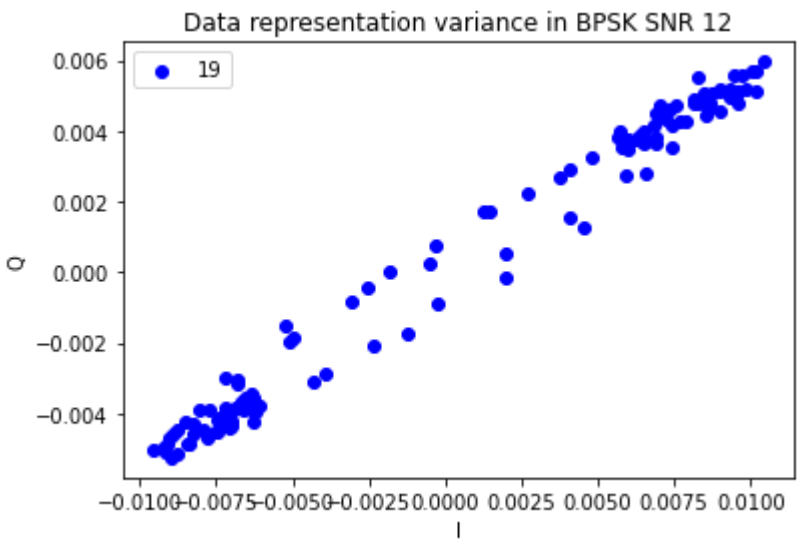

Data representation variance in BPSK SNR 12
14
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

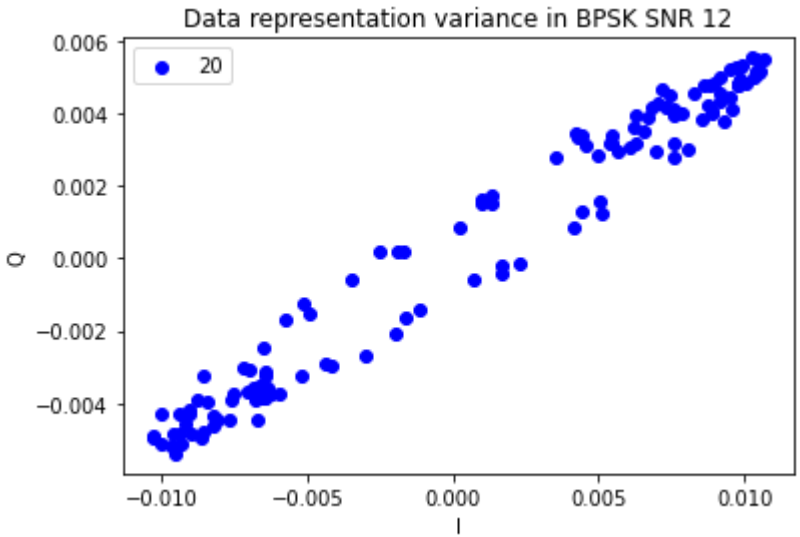

Data representation variance in BPSK SNR 12
15
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

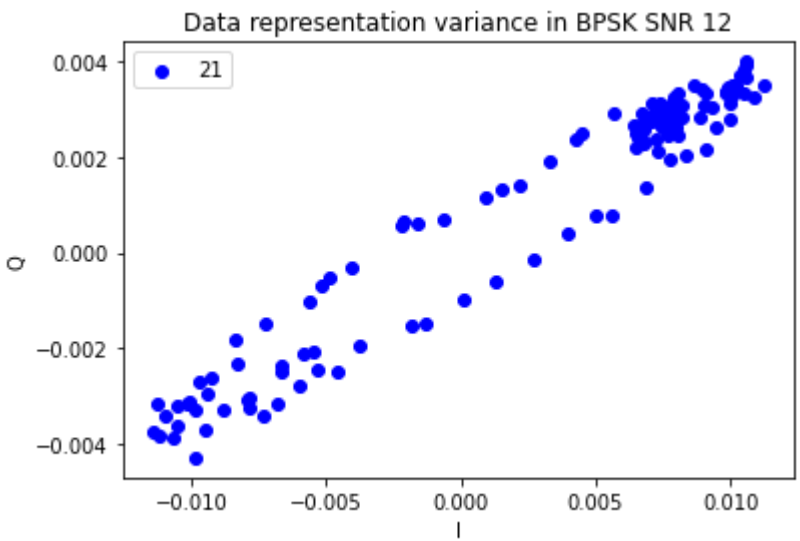

Data representation variance in BPSK SNR 12
16
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I

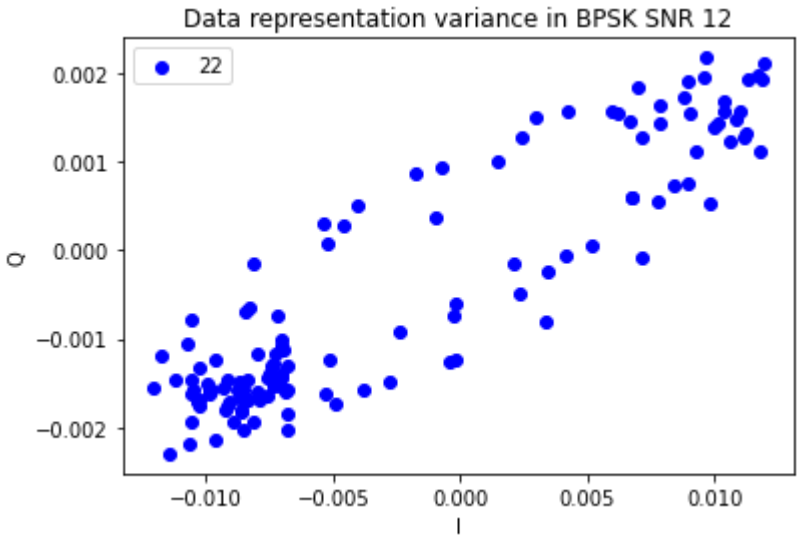

Data representation variance in BPSK SNR 12
17
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I

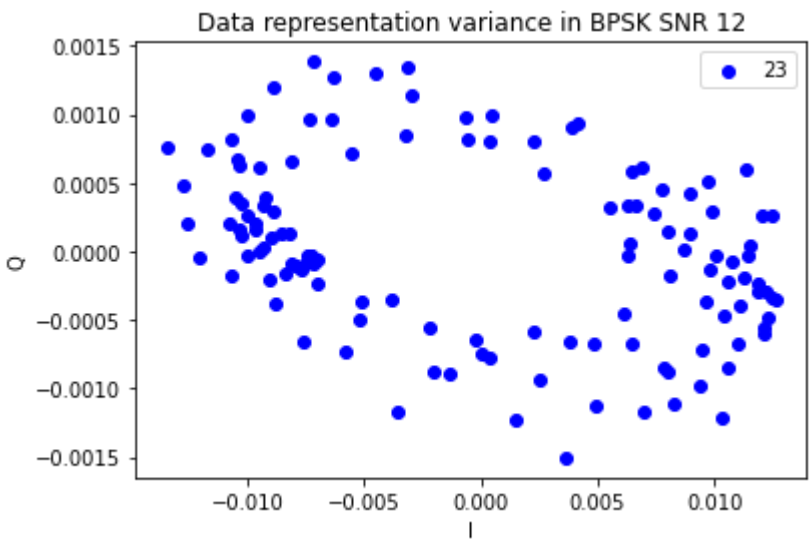

Data representation variance in BPSK SNR 12
18
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

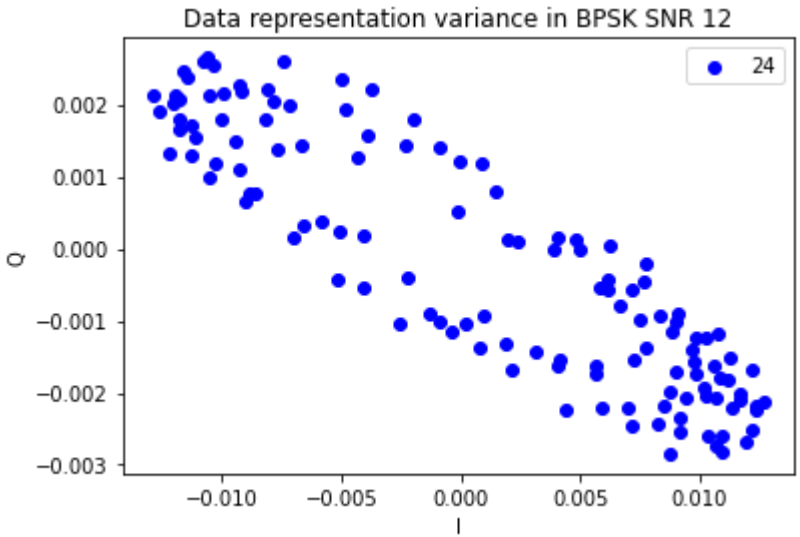

Data representation variance in BPSK SNR 12
19
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

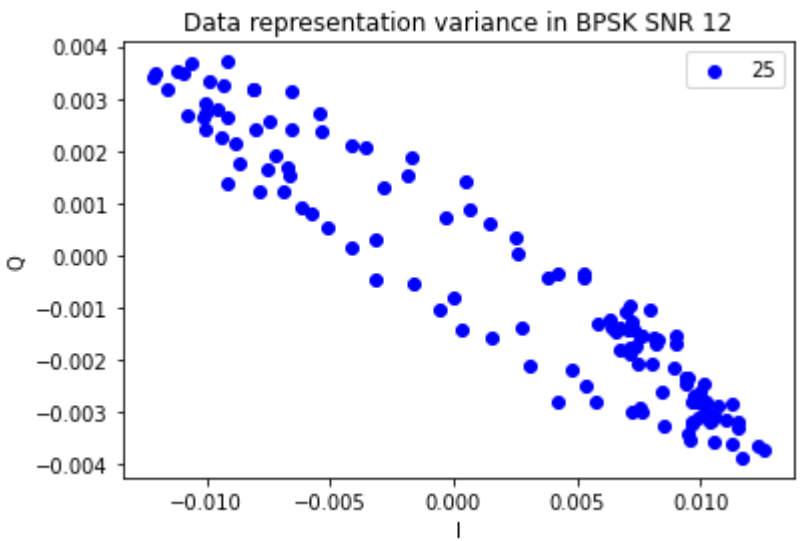

Data representation variance in BPSK SNR 12
20
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

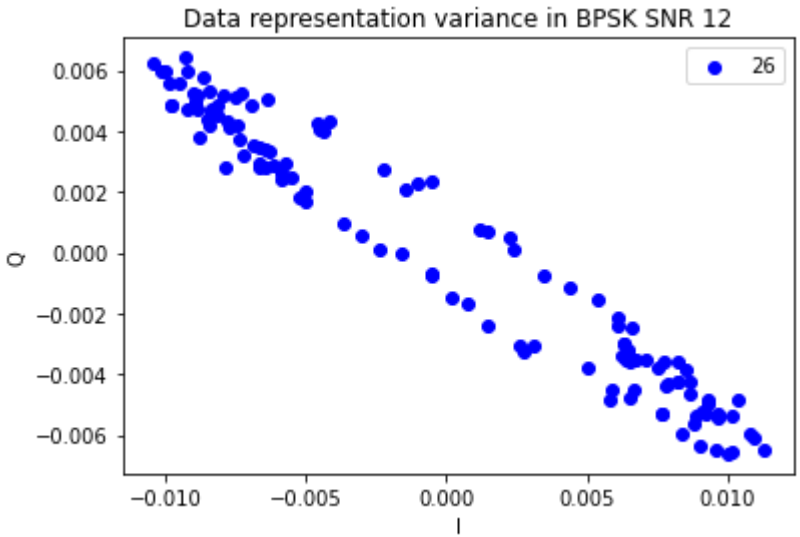

Data representation variance in BPSK SNR 12
21
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

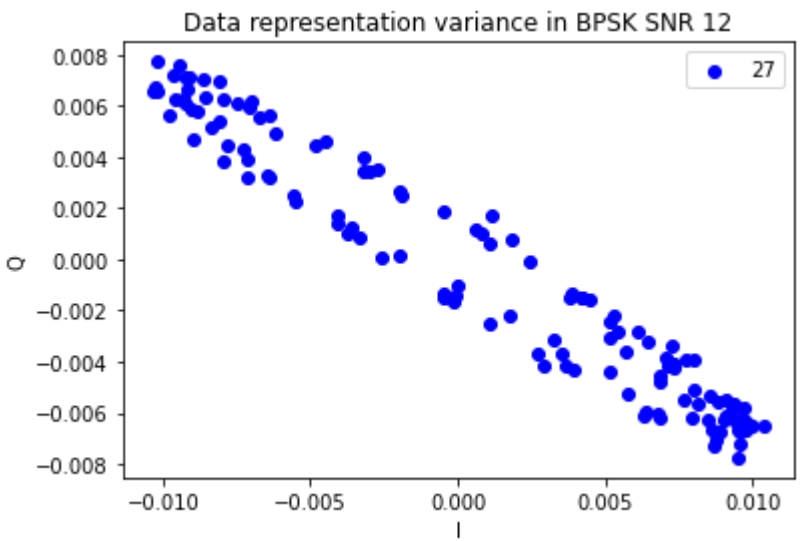

Data representation variance in BPSK SNR 12
22
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

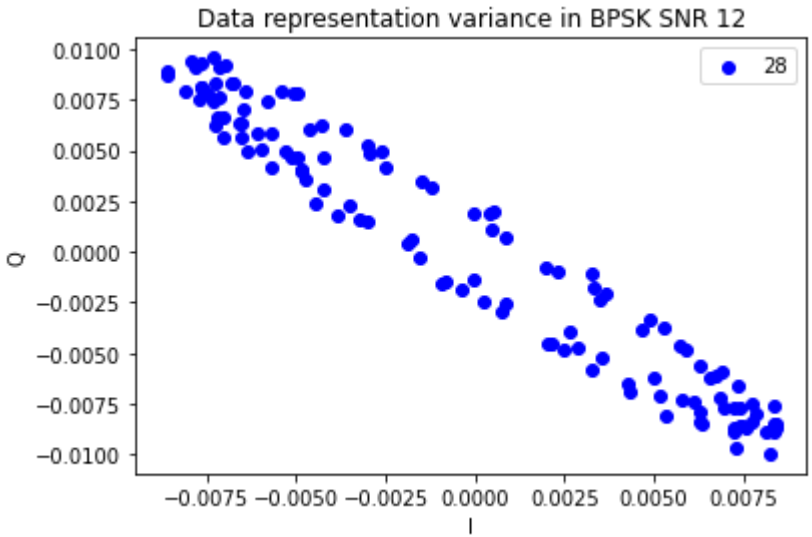

Data representation variance in BPSK SNR 12
23
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I

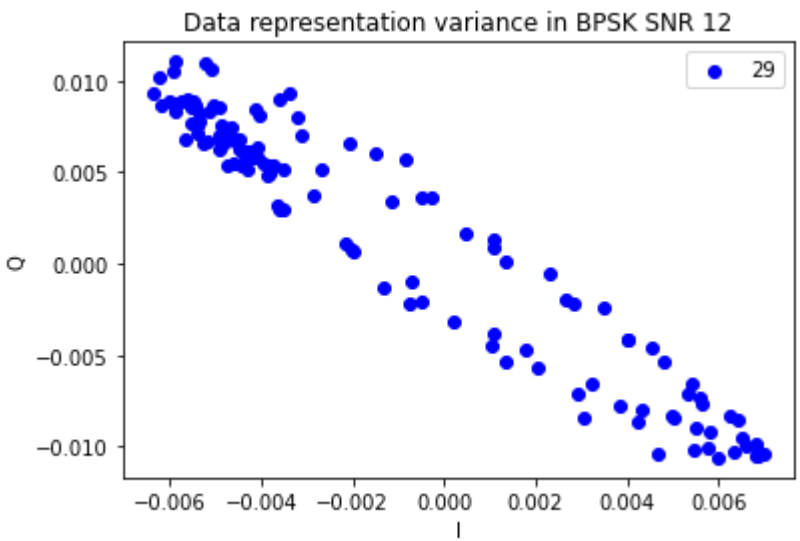

Data representation variance in BPSK SNR 12
24
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

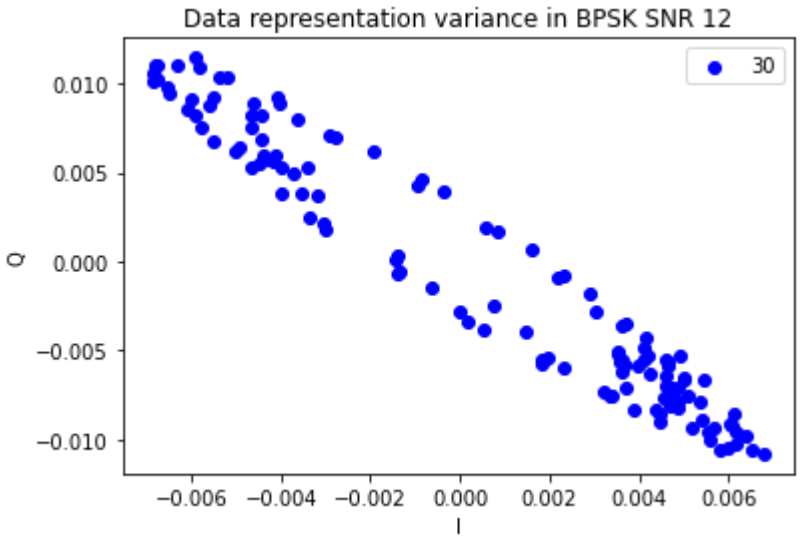

Data representation variance in BPSK SNR 12
25
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

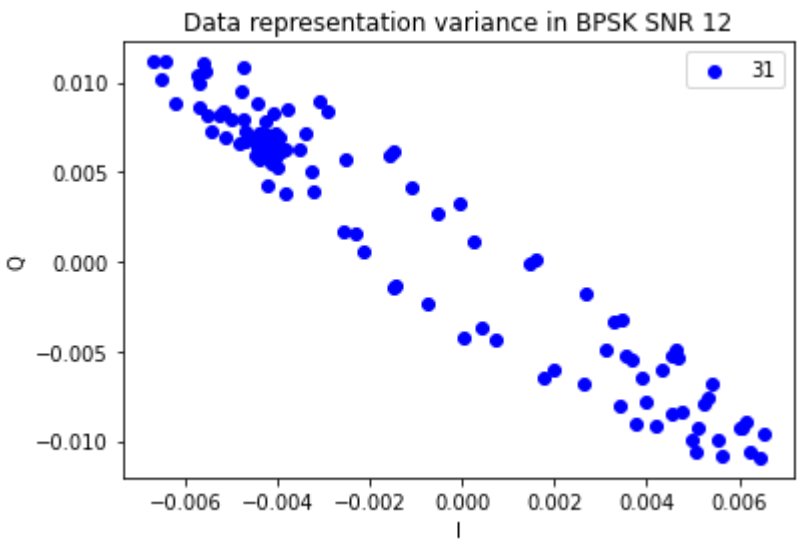

Data representation variance in BPSK SNR 12
26
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

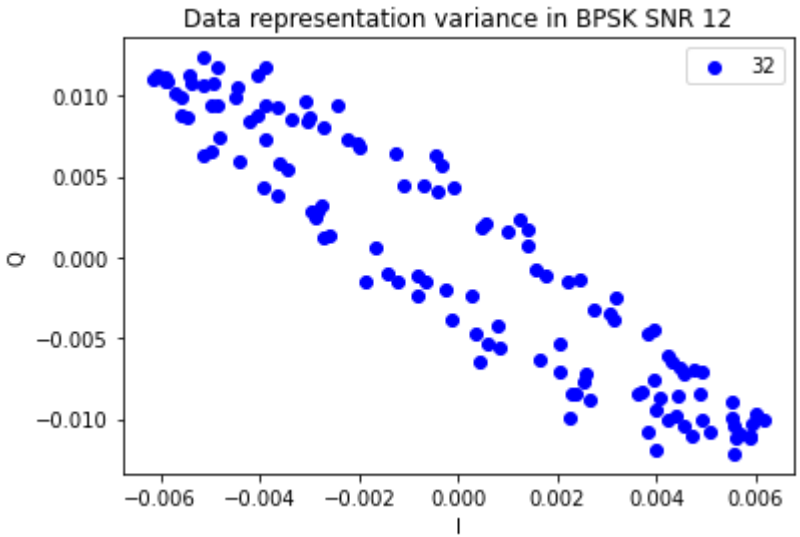

Data representation variance in BPSK SNR 12
27
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010
−0.005
0.000
0.005
0.010
I

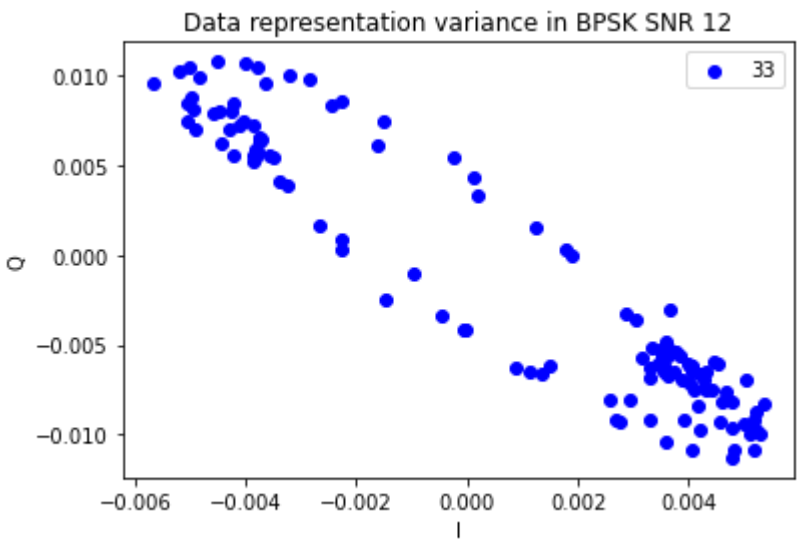

Data representation variance in BPSK SNR 12
28
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

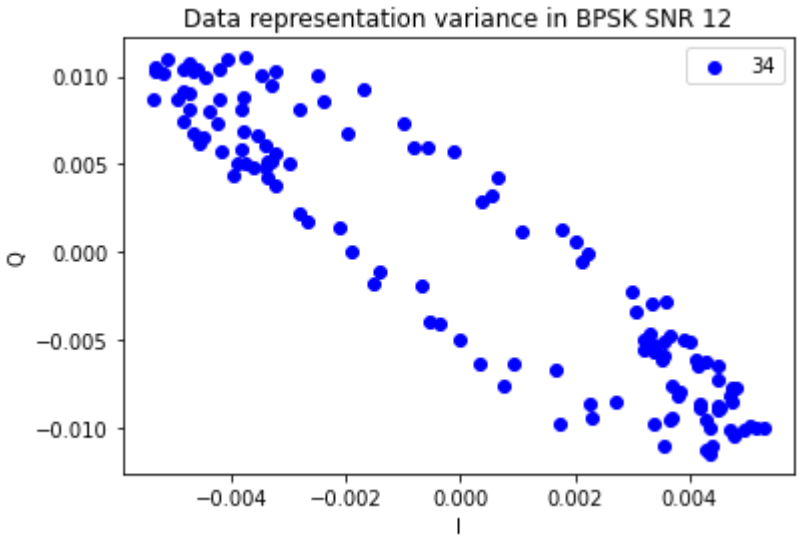

Data representation variance in BPSK SNR 12
29
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I

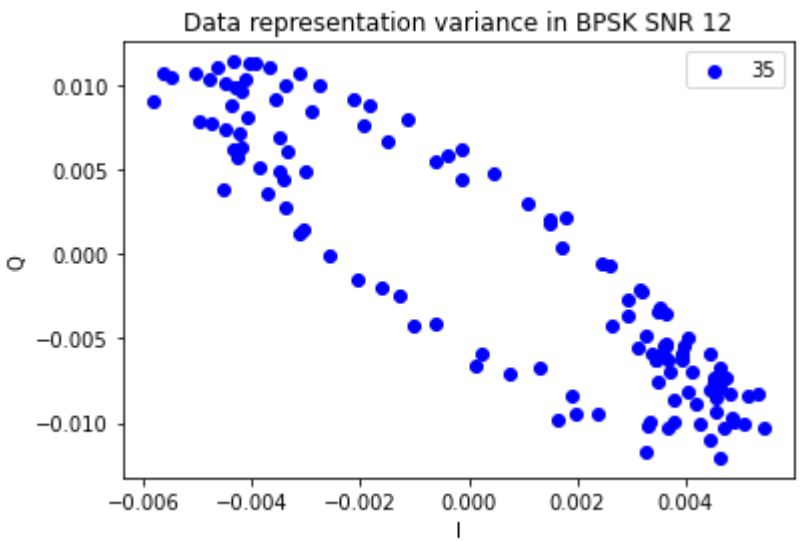

Data representation variance in BPSK SNR 12
30
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

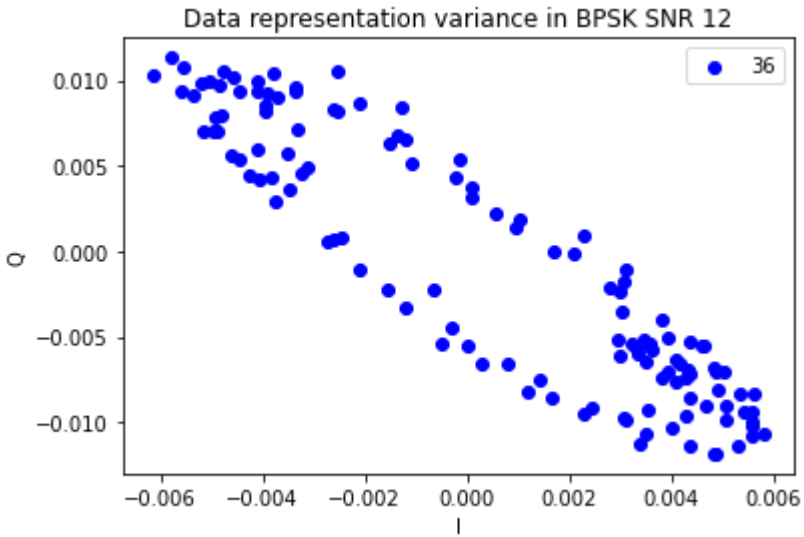

Data representation variance in BPSK SNR 12
31
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

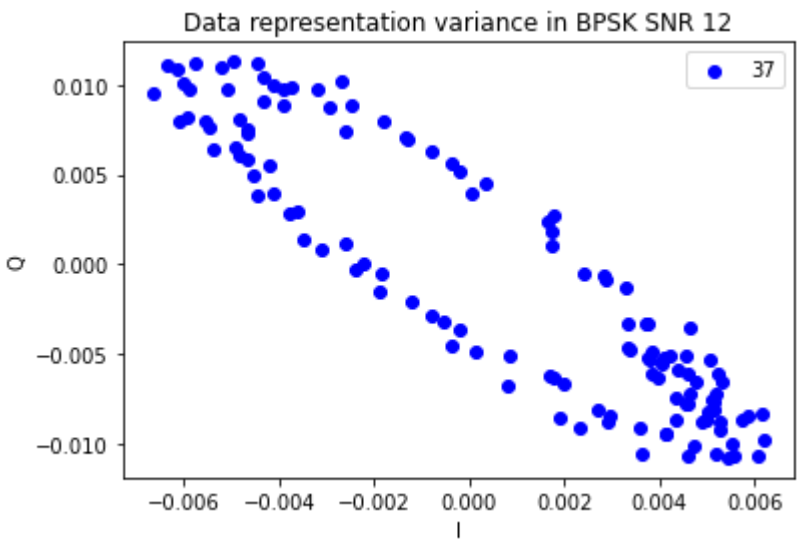

Data representation variance in BPSK SNR 12
32
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

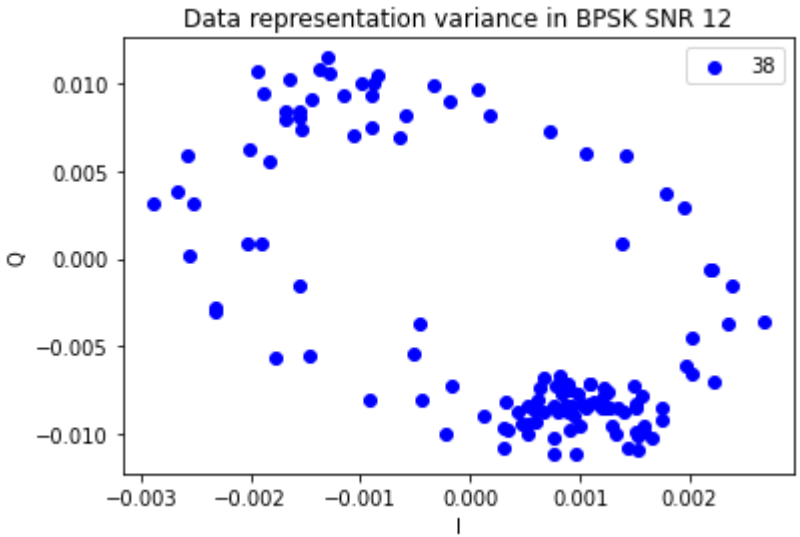

Data representation variance in BPSK SNR 12
33
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I

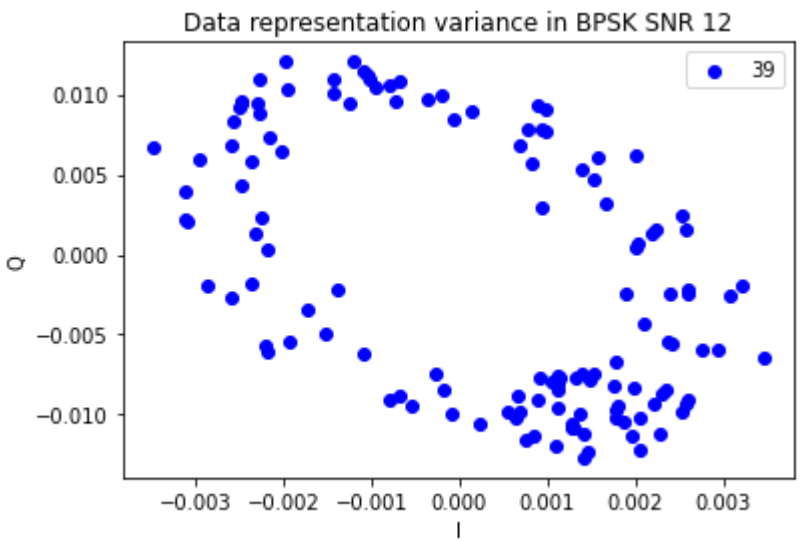

Data representation variance in BPSK SNR 12
34
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

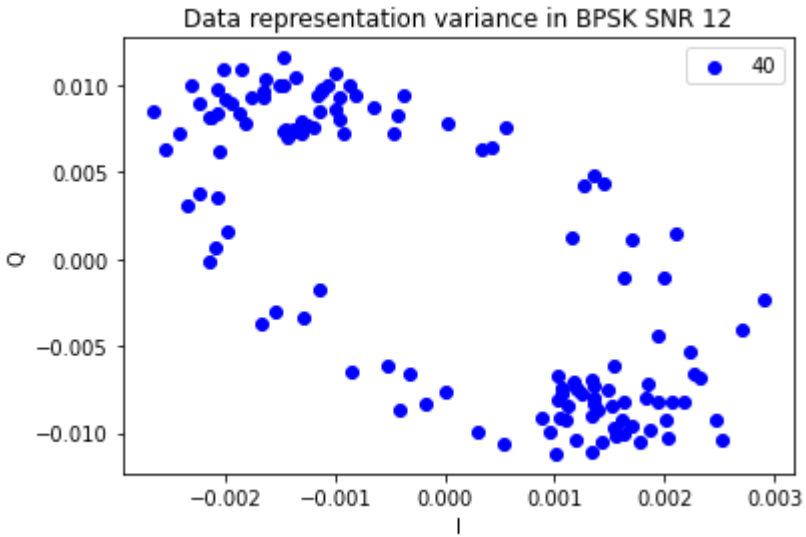

Data representation variance in BPSK SNR 12
35
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I

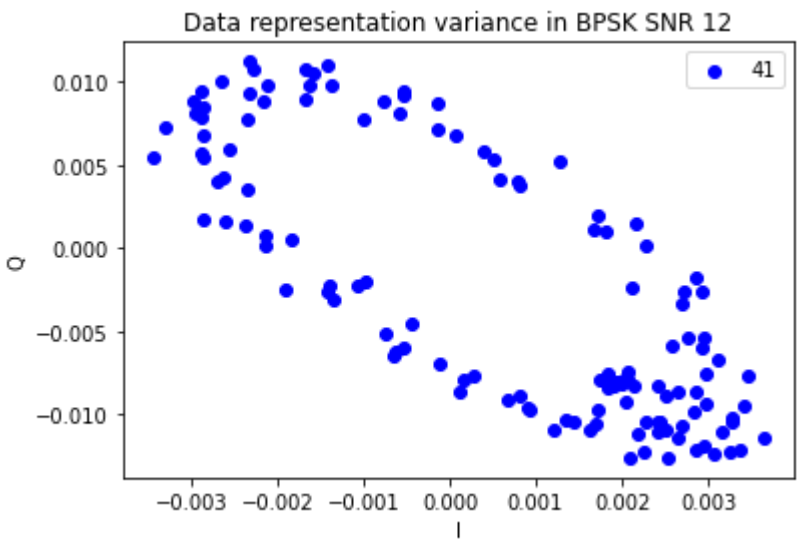

Data representation variance in BPSK SNR 12
36
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

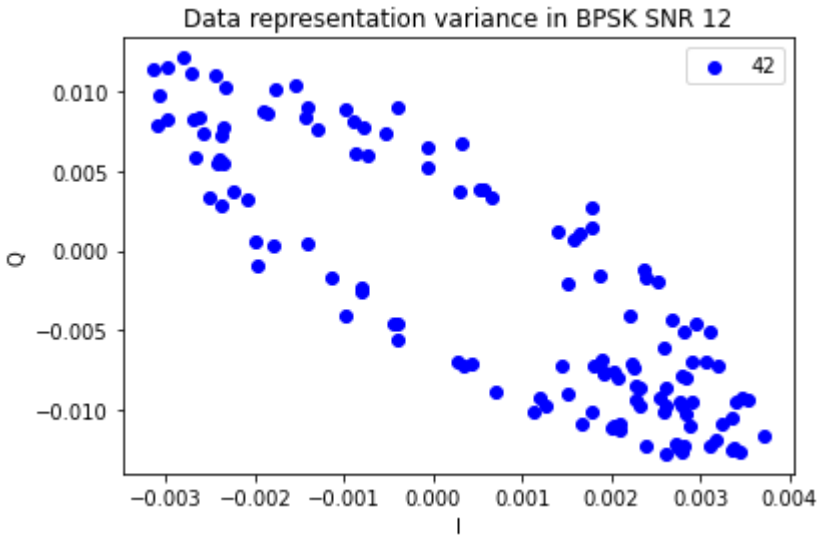

Data representation variance in BPSK SNR 12
37
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

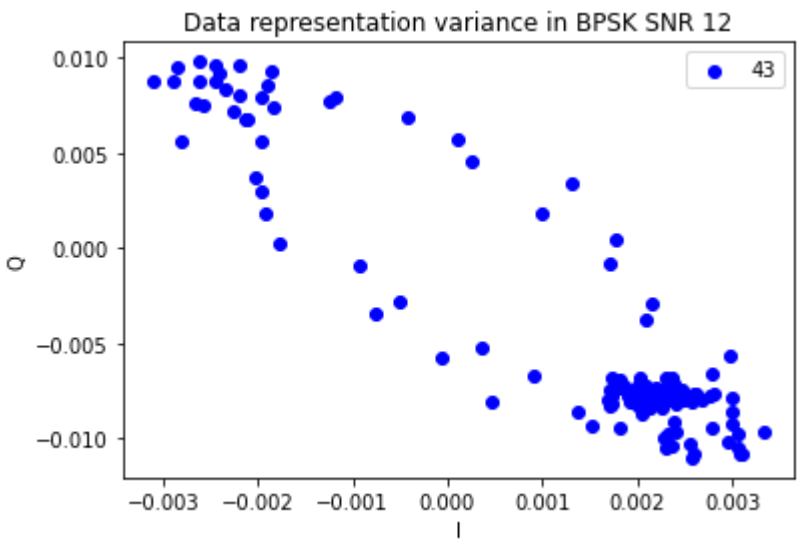

Data representation variance in BPSK SNR 12
38
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I

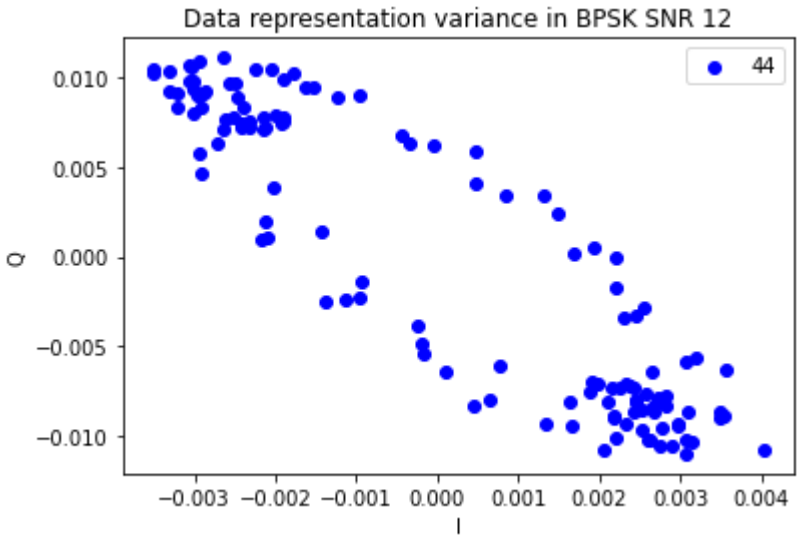

Data representation variance in BPSK SNR 12
39
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

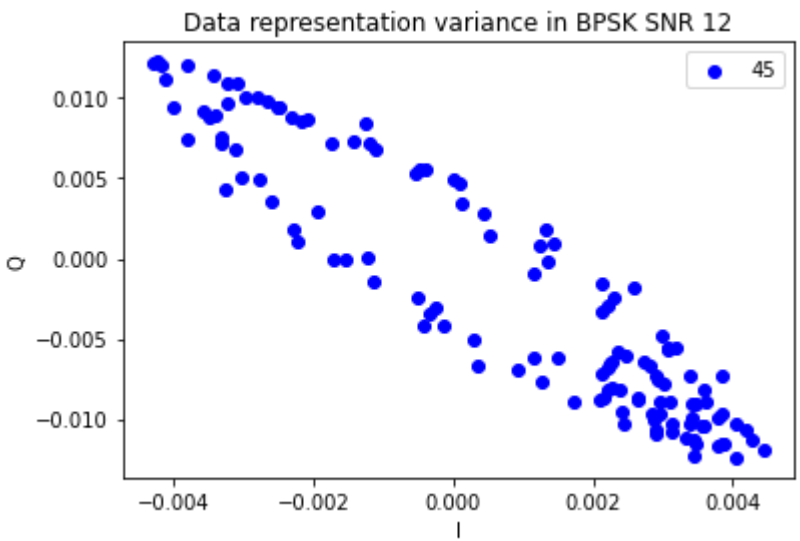

Data representation variance in BPSK SNR 12
40
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I

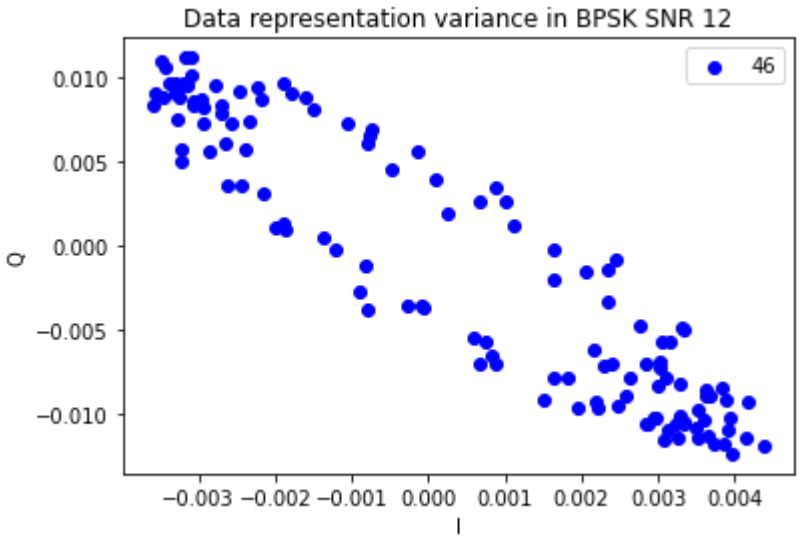

Data representation variance in BPSK SNR 12
41
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

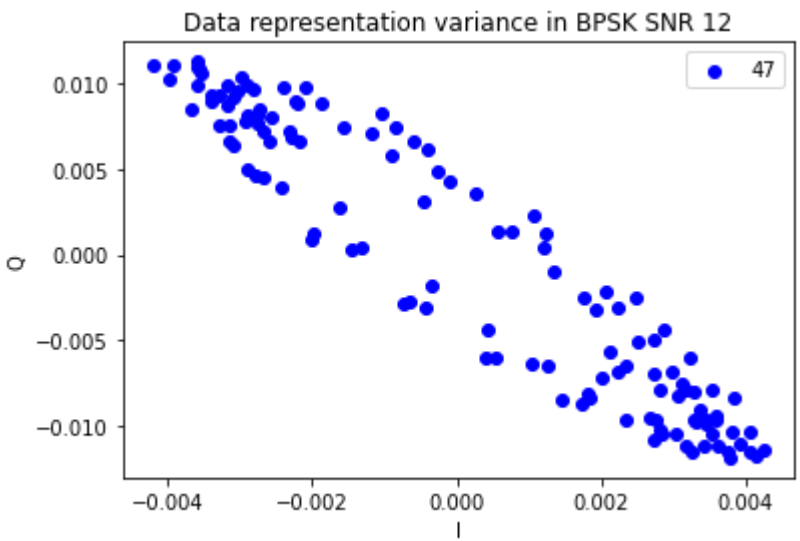

Data representation variance in BPSK SNR 12
42
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I

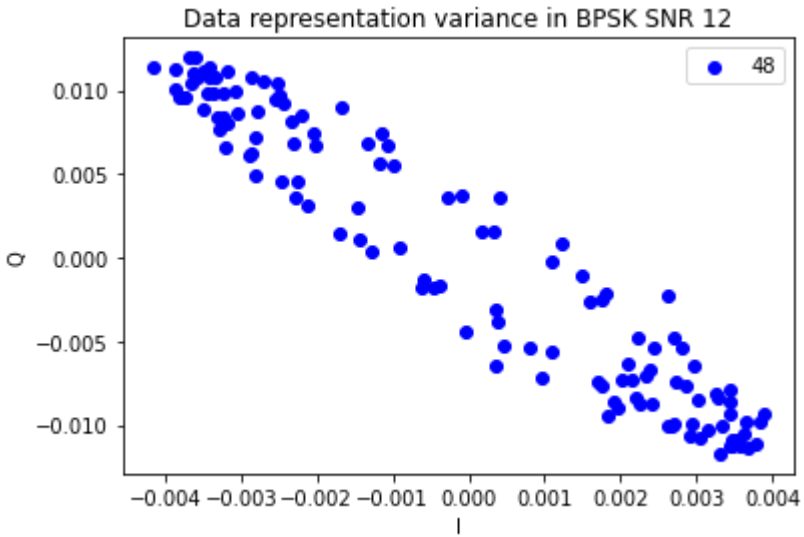

Data representation variance in BPSK SNR 12
43
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

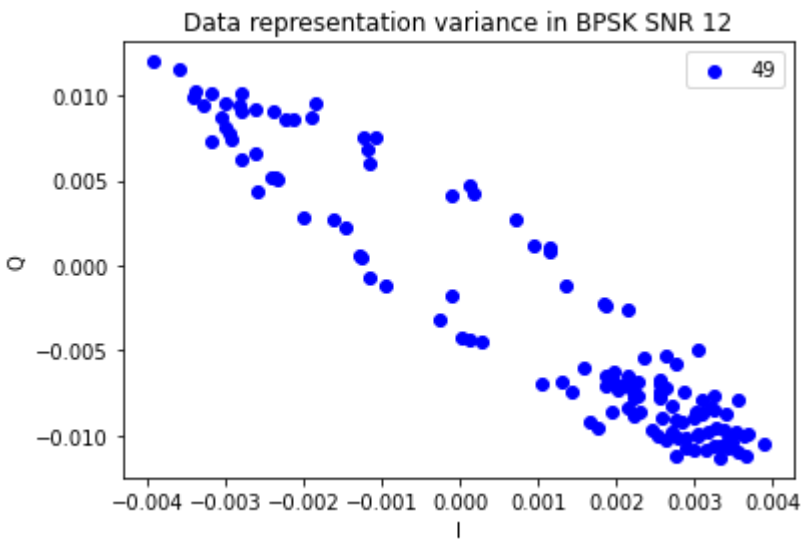

Data representation variance in BPSK SNR 12
44
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

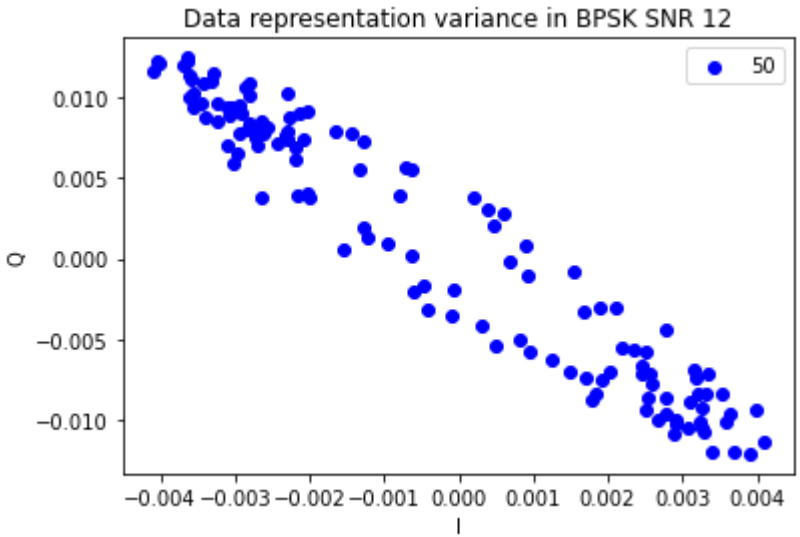

Data representation variance in BPSK SNR 12
45
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I

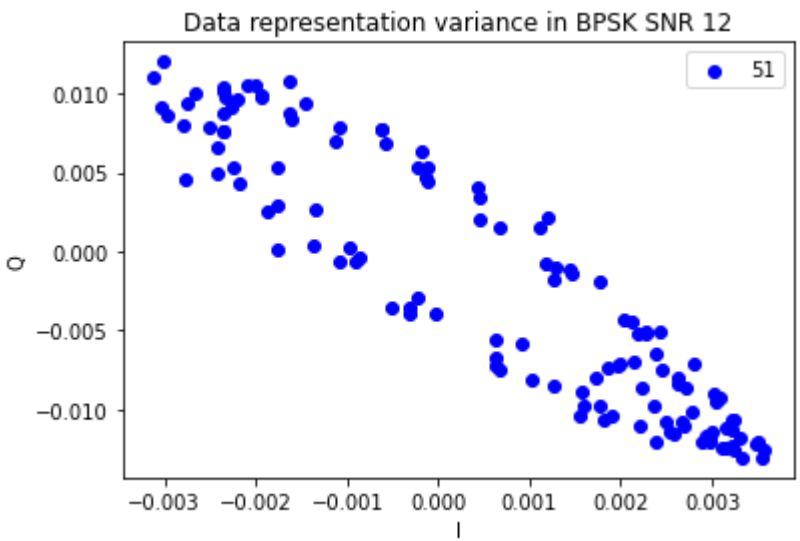

Data representation variance in BPSK SNR 12
46
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

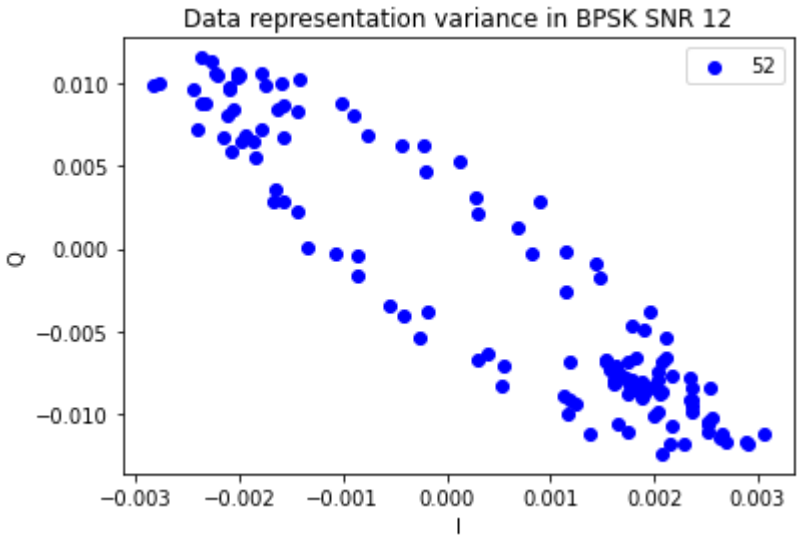

Data representation variance in BPSK SNR 12
47
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I

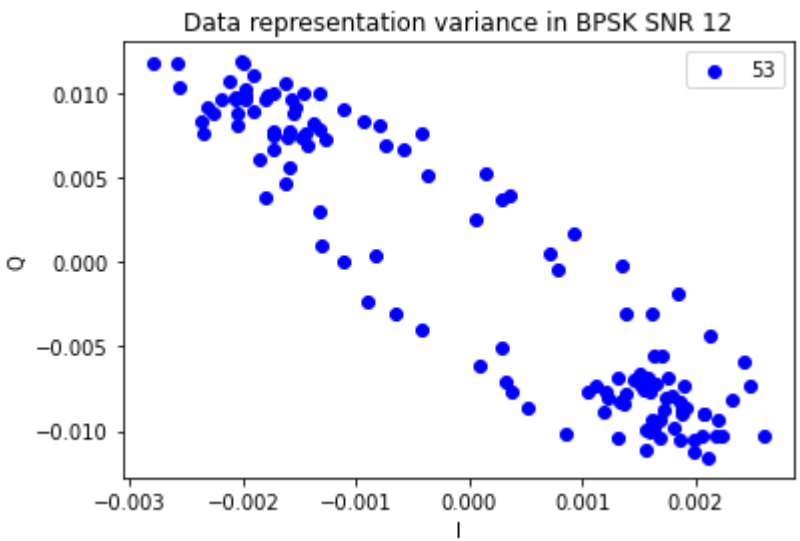

Data representation variance in BPSK SNR 12
48
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

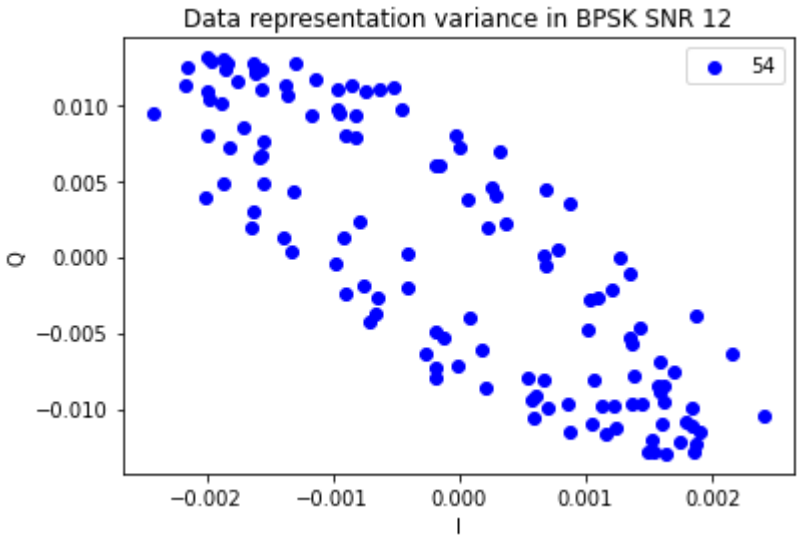

Data representation variance in BPSK SNR 12
49
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

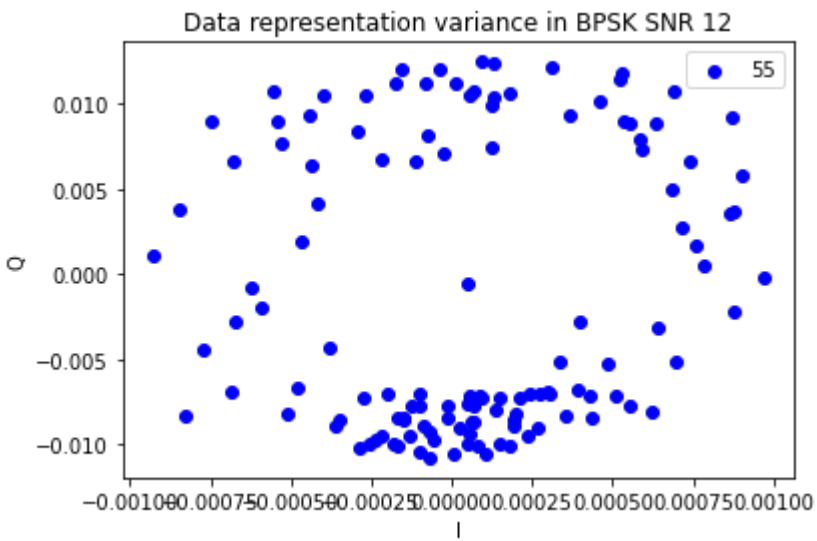

Data representation variance in BPSK SNR 12
50
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

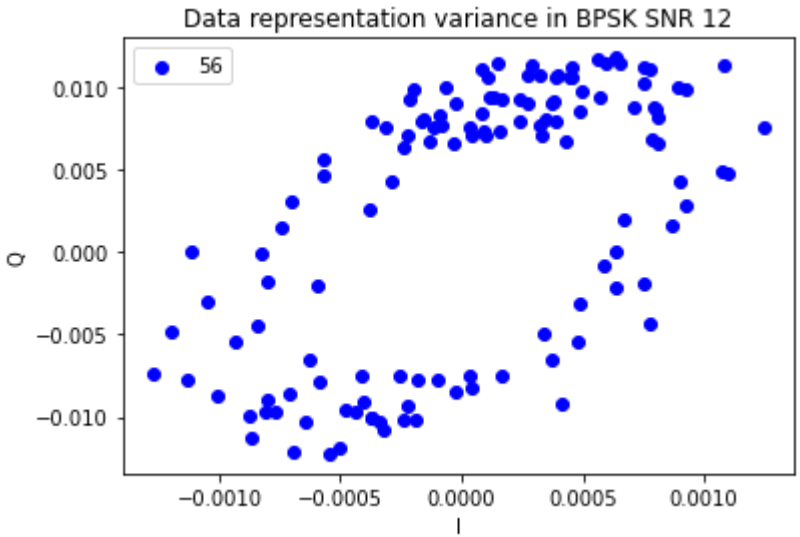

Data representation variance in BPSK SNR 12
51
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002 0.003
I

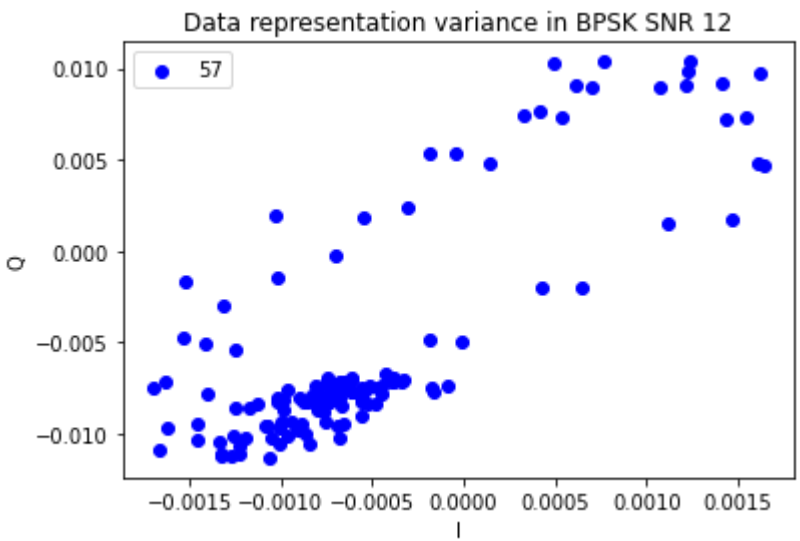

Data representation variance in BPSK SNR 12
52
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

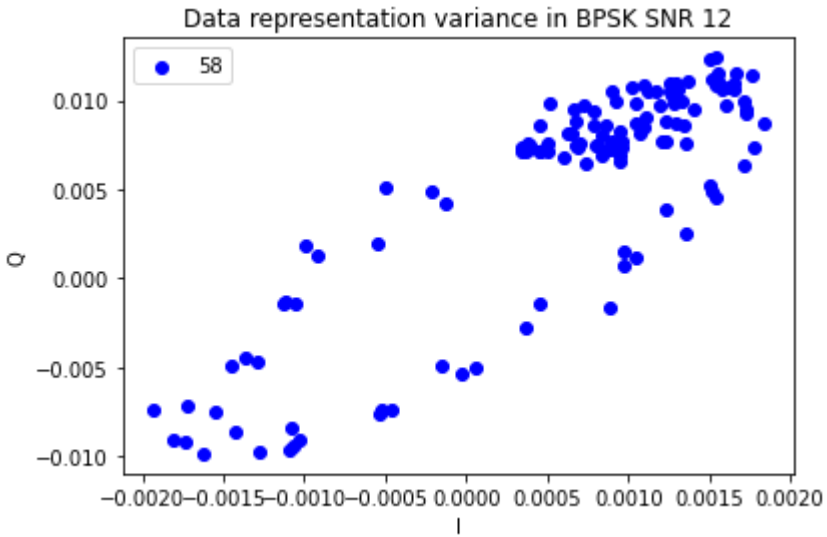

Data representation variance in BPSK SNR 12
53
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I

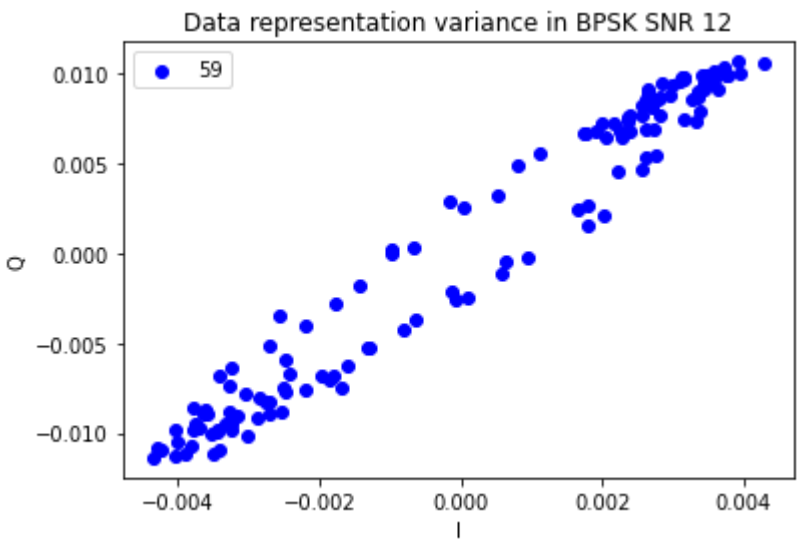

Data representation variance in BPSK SNR 12
54
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

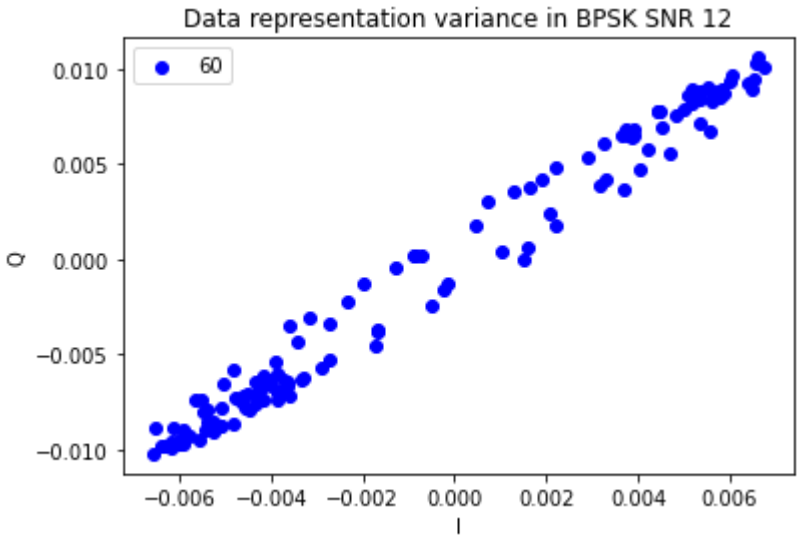

Data representation variance in BPSK SNR 12
55
0.010
0.005
0.000
−0.005
−0.010
Q
I

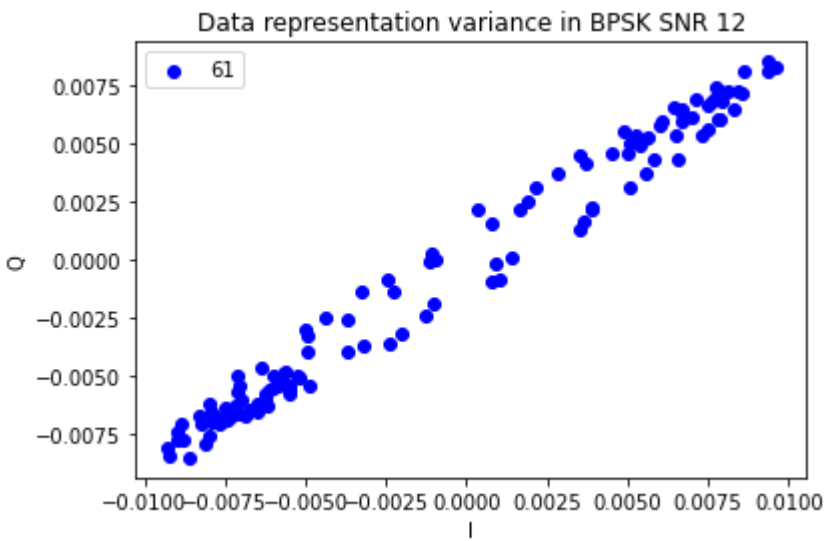

Data representation variance in BPSK SNR 12
56
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0010
−0.0005
0.0000
0.0005
0.0010
I

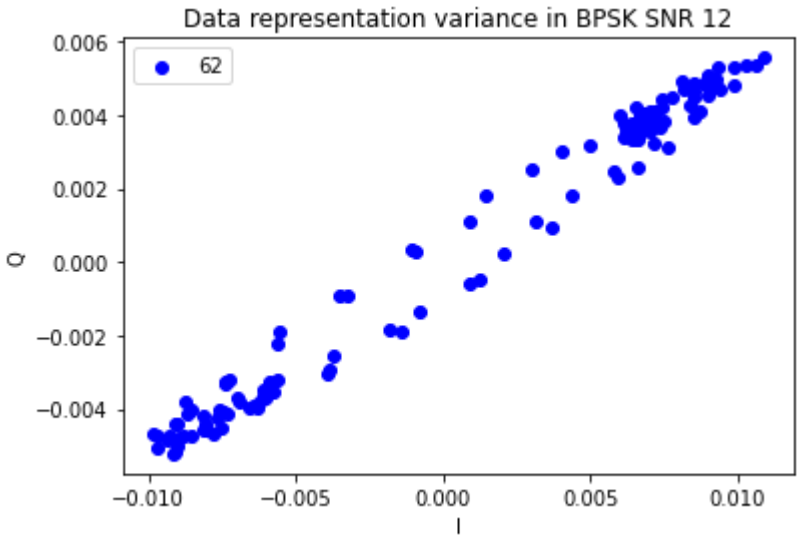

Data representation variance in BPSK SNR 12
57
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
I

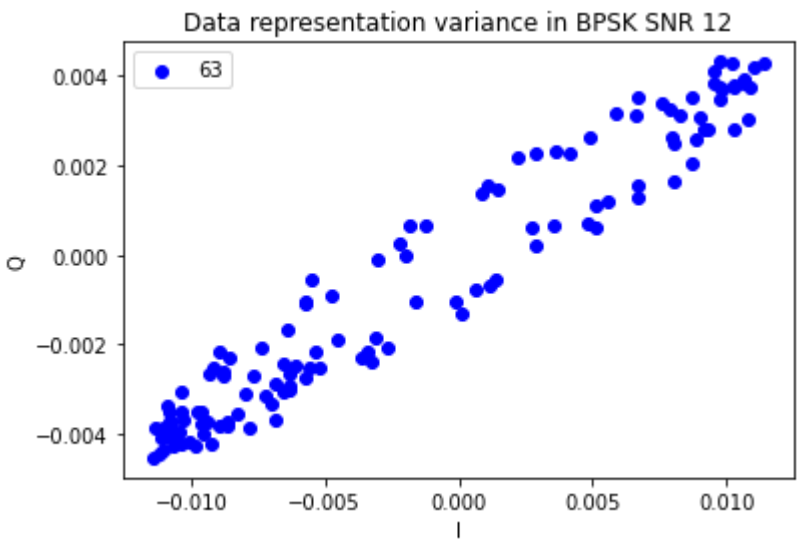

Data representation variance in BPSK SNR 12
58
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
I

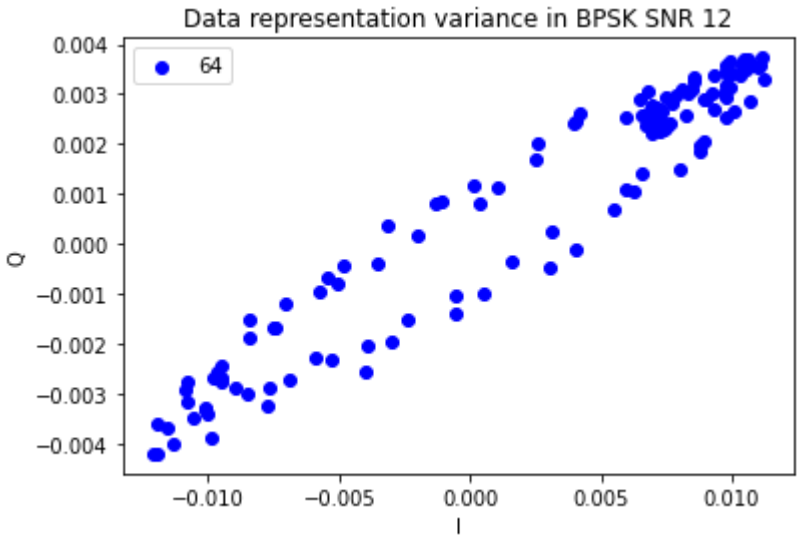

Data representation variance in BPSK SNR 12
59
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I

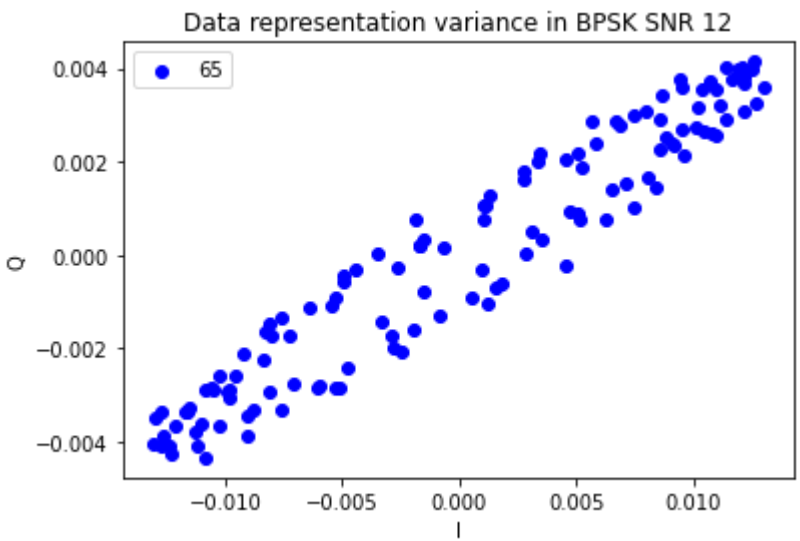

Data representation variance in BPSK SNR 12
60
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

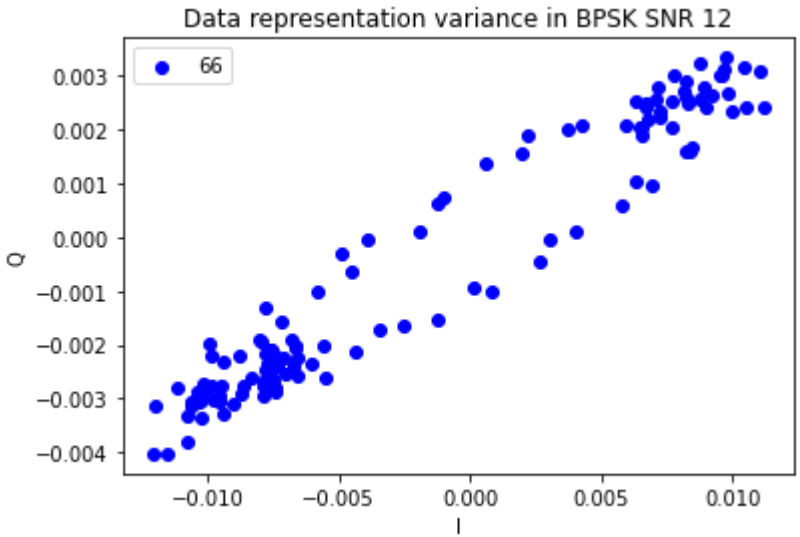

Data representation variance in BPSK SNR 12
61
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I

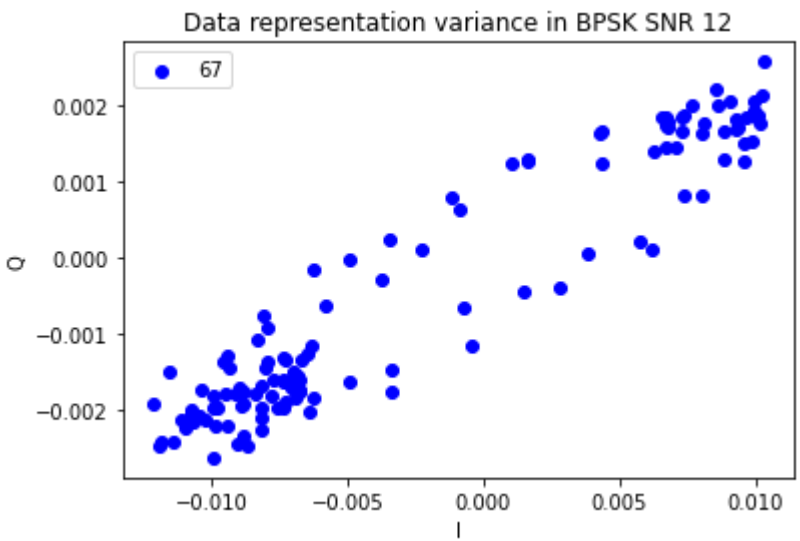

Data representation variance in BPSK SNR 12
62
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

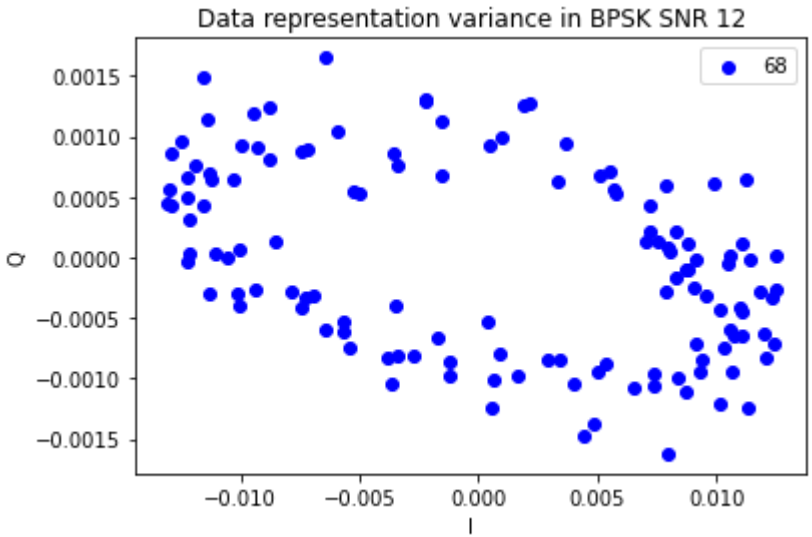

Data representation variance in BPSK SNR 12
63
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

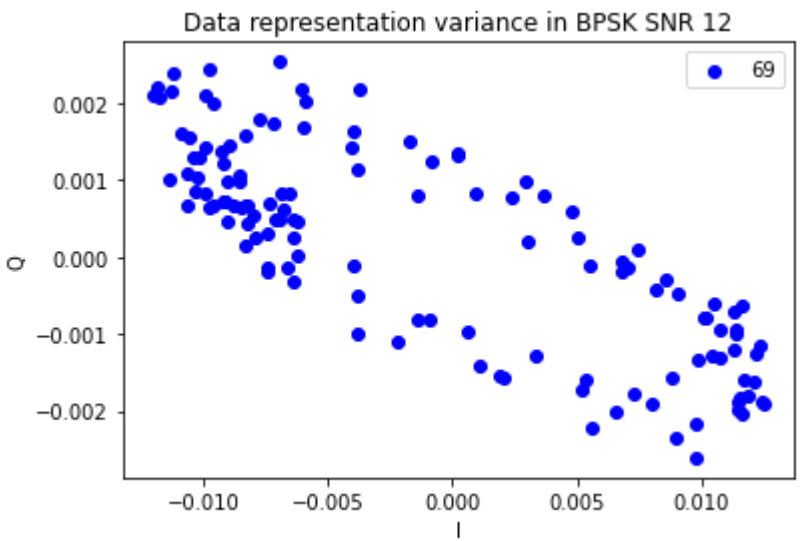

Data representation variance in BPSK SNR 12
64
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

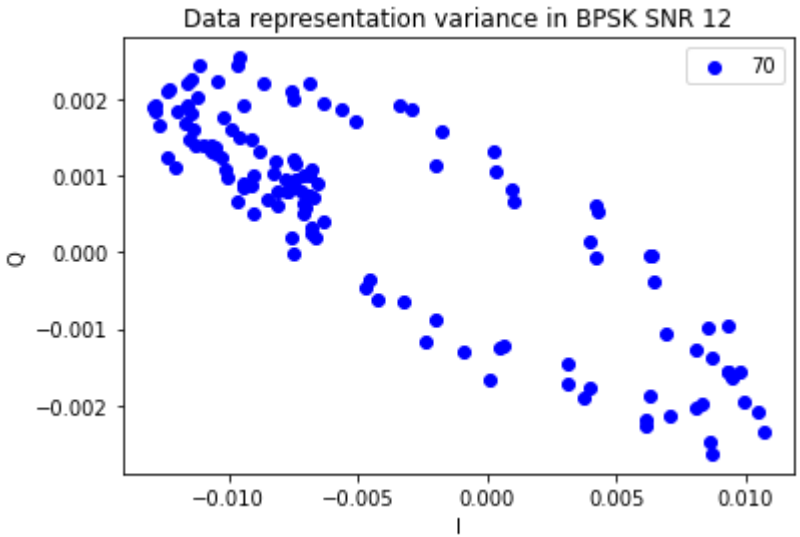

Data representation variance in BPSK SNR 12
65
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

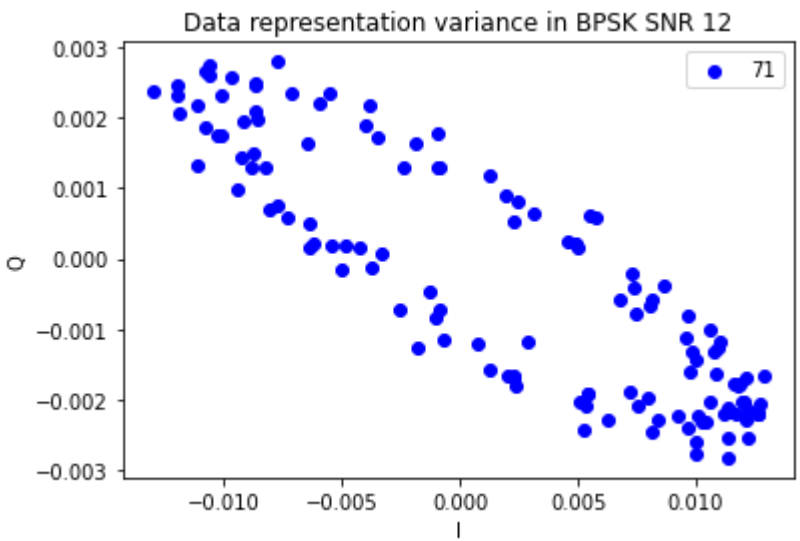

Data representation variance in BPSK SNR 12
66
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

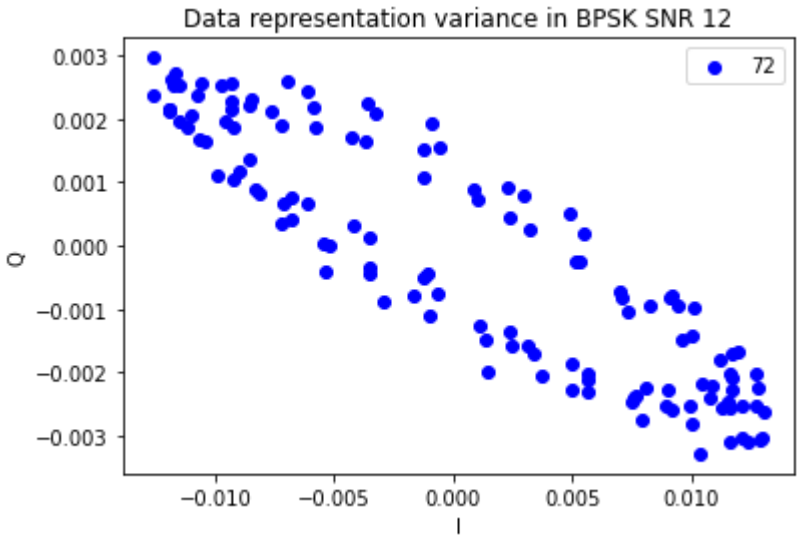

Data representation variance in BPSK SNR 12
67
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

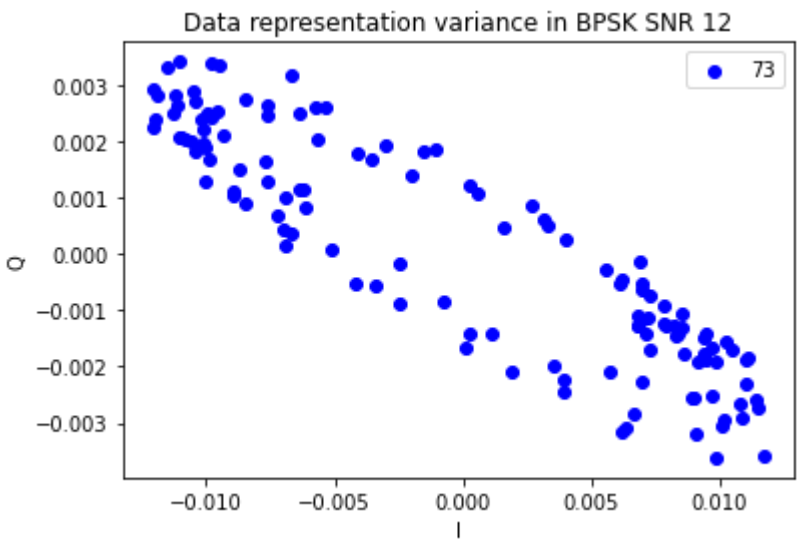

Data representation variance in BPSK SNR 12
68
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I

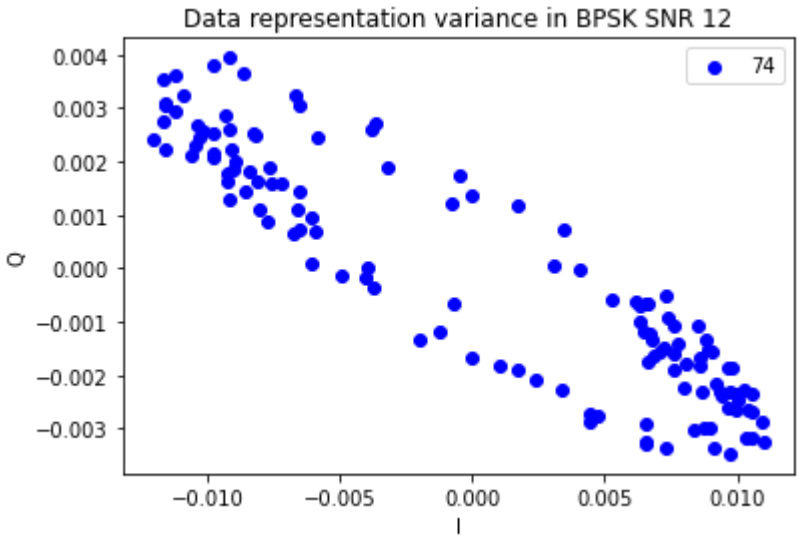

Data representation variance in BPSK SNR 12
69
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

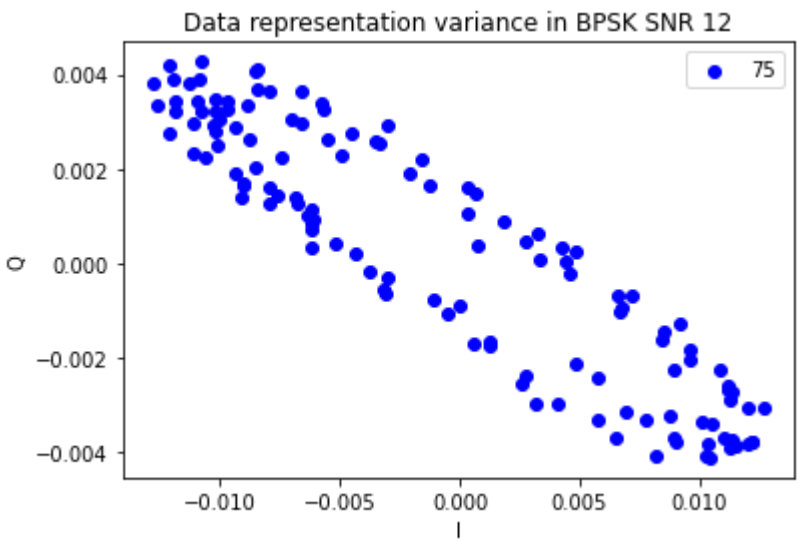

Data representation variance in BPSK SNR 12
70
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

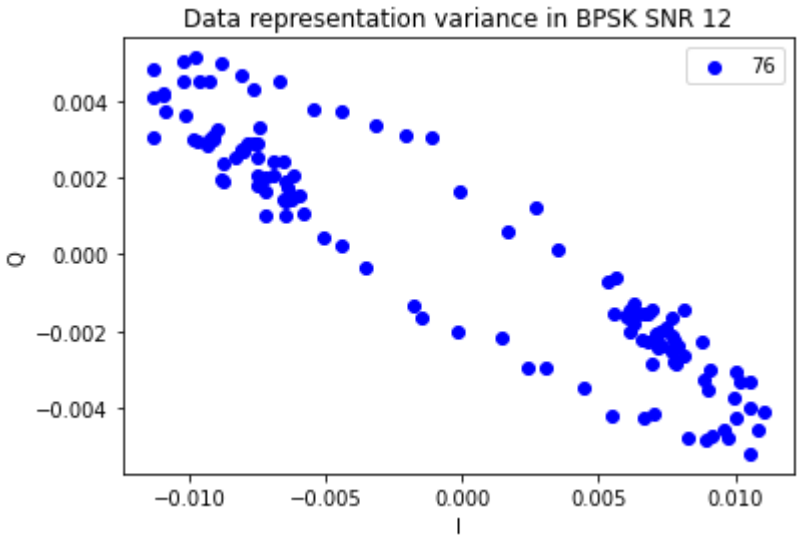

Data representation variance in BPSK SNR 12
71
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

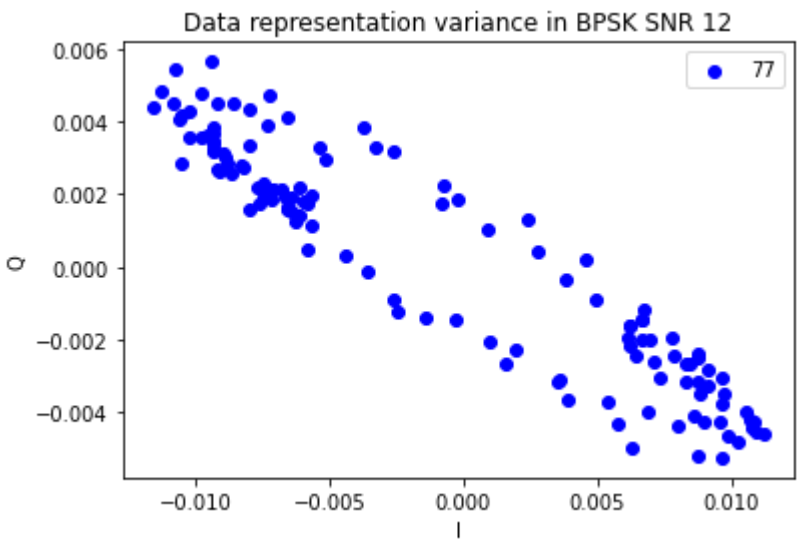

Data representation variance in BPSK SNR 12
72
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

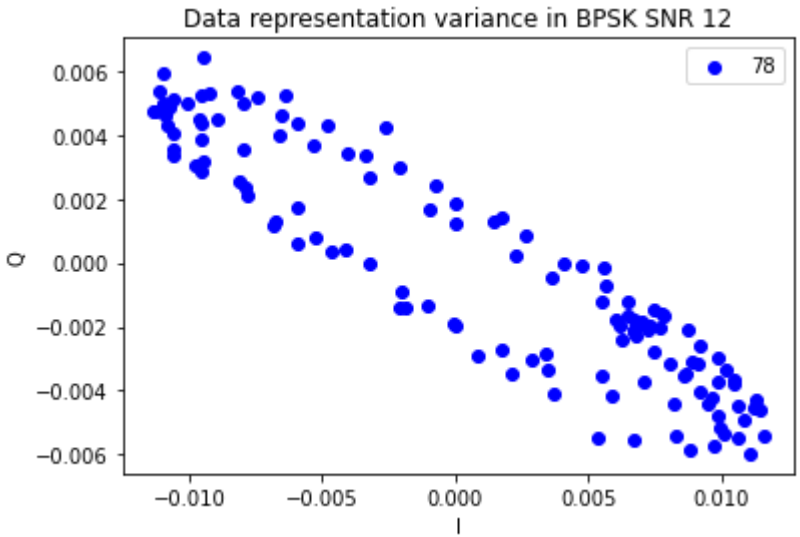

Data representation variance in BPSK SNR 12
73
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

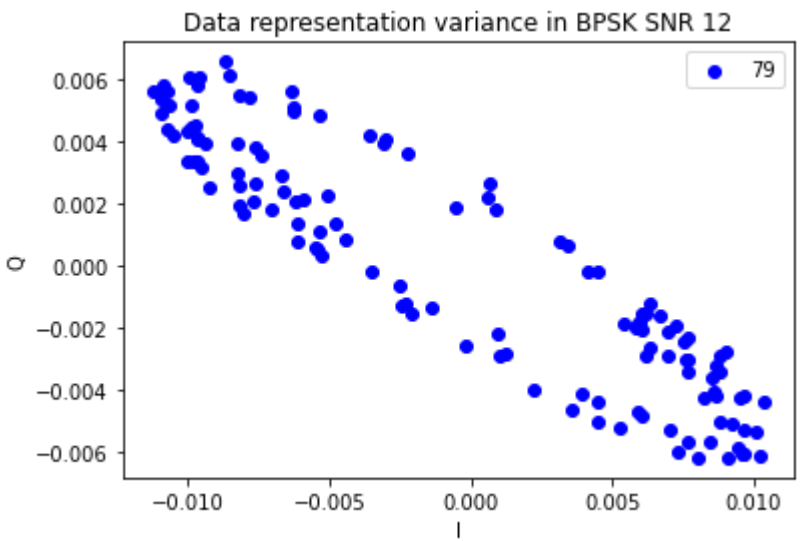

Data representation variance in BPSK SNR 12
74
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

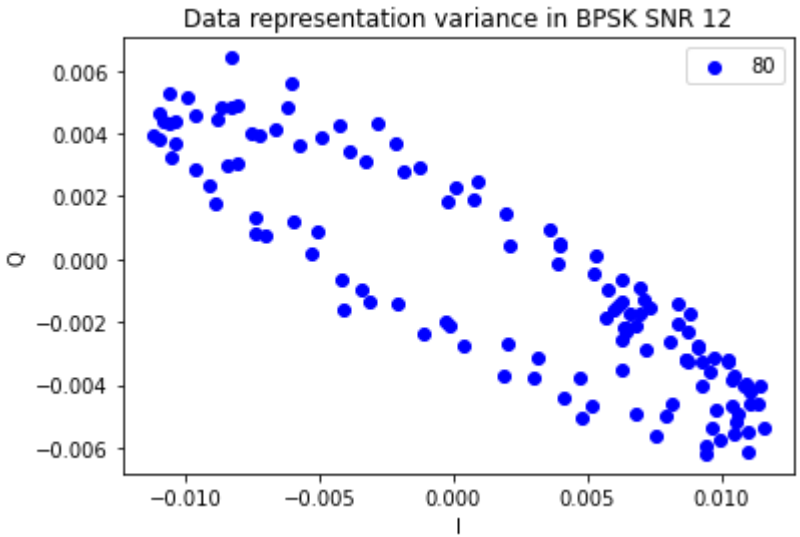

Data representation variance in BPSK SNR 12
75
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

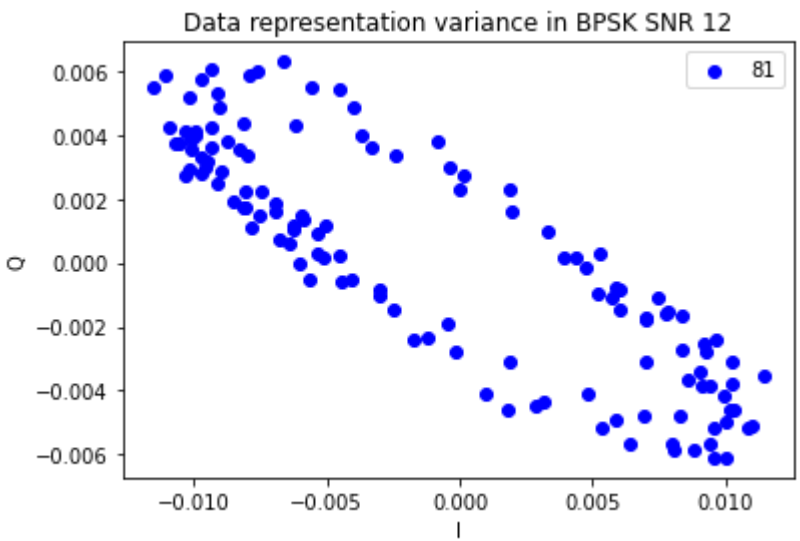

Data representation variance in BPSK SNR 12
76
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

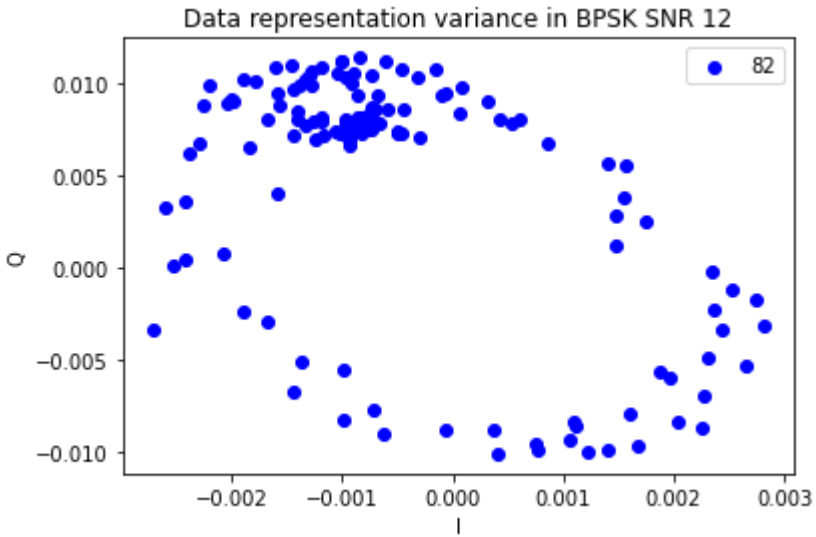

Data representation variance in BPSK SNR 12
77
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

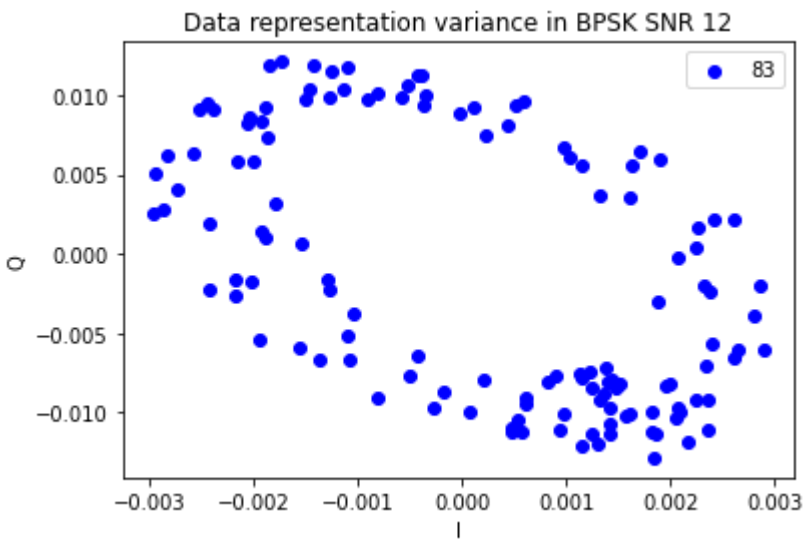

Data representation variance in BPSK SNR 12
78
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

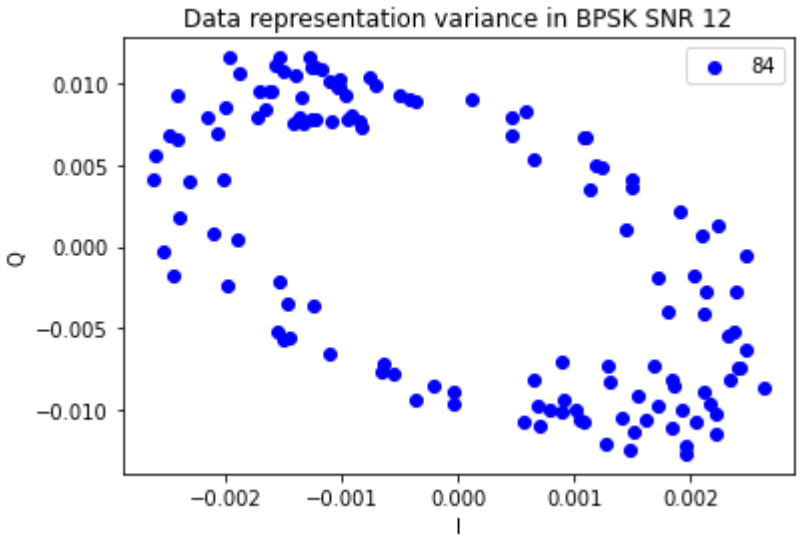

Data representation variance in BPSK SNR 12
79
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

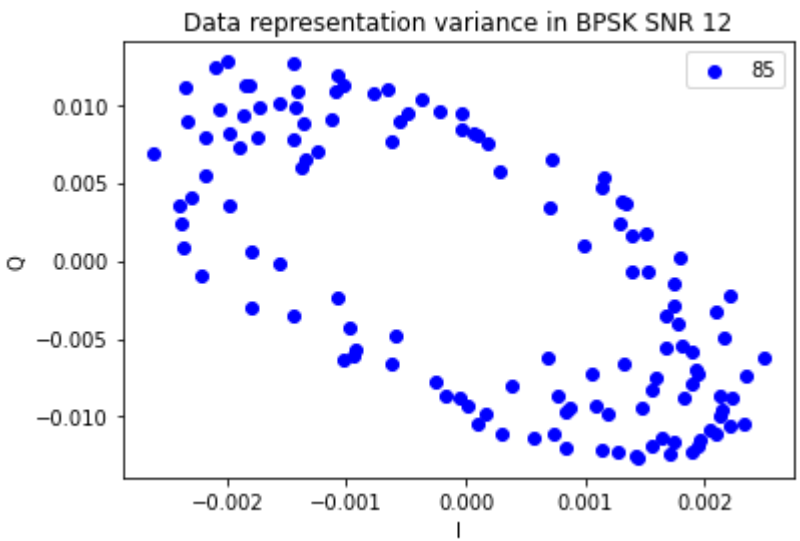

Data representation variance in BPSK SNR 12
80
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

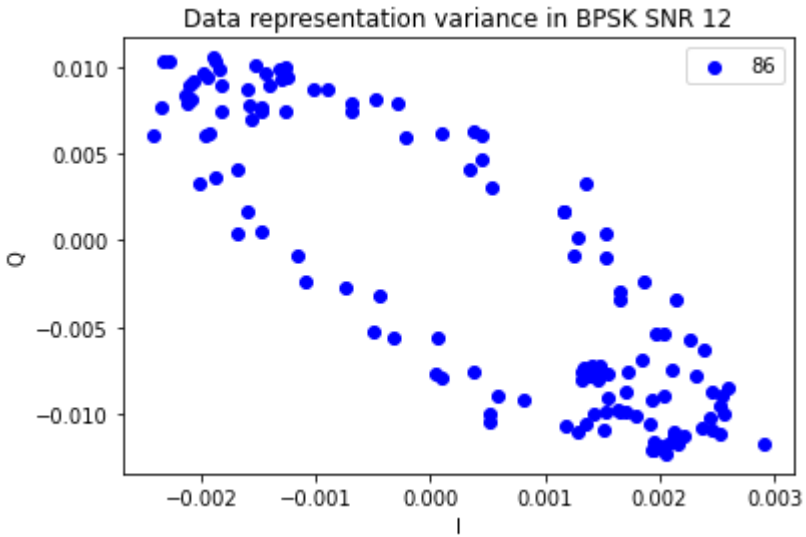

Data representation variance in BPSK SNR 12
81
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

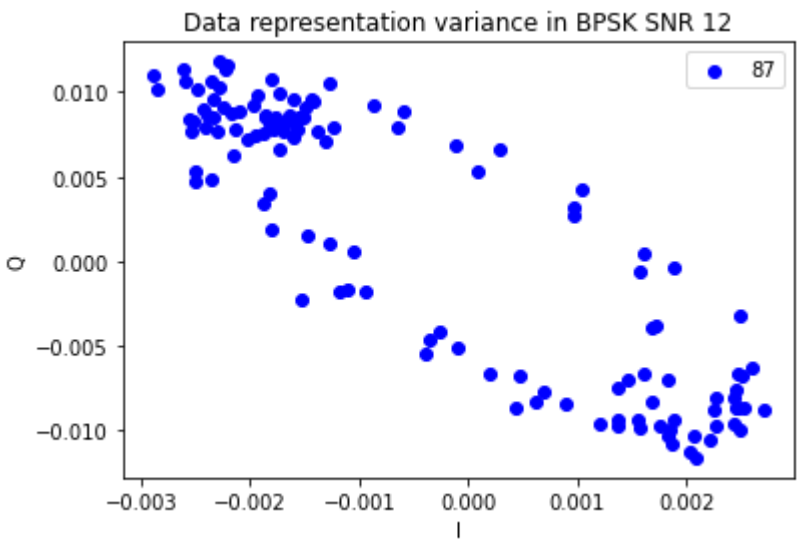

Data representation variance in BPSK SNR 12
82
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I

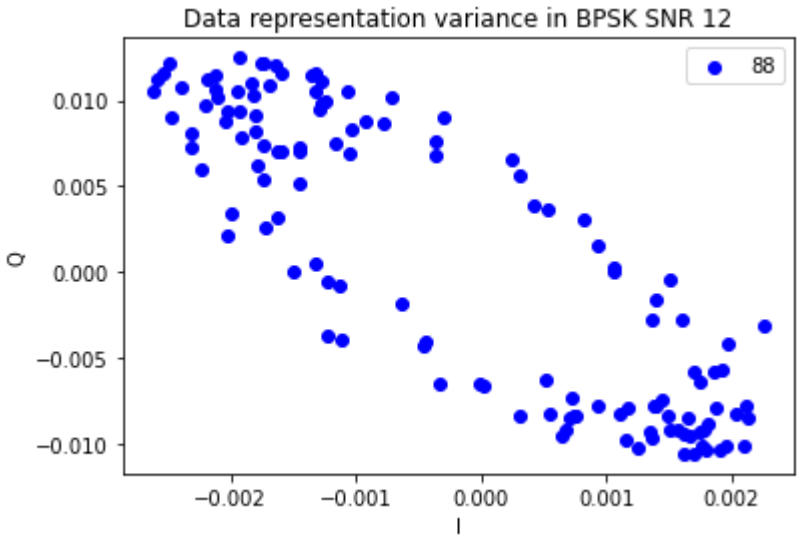

Data representation variance in BPSK SNR 12
83
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

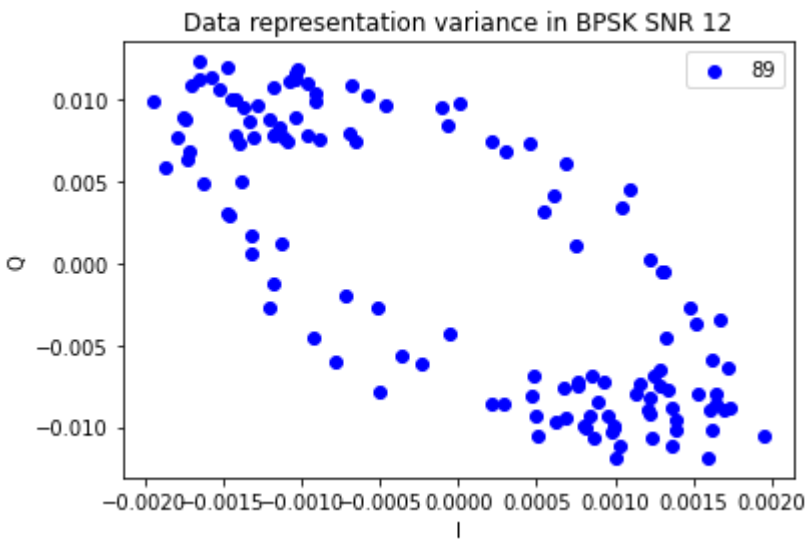

Data representation variance in BPSK SNR 12
84
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

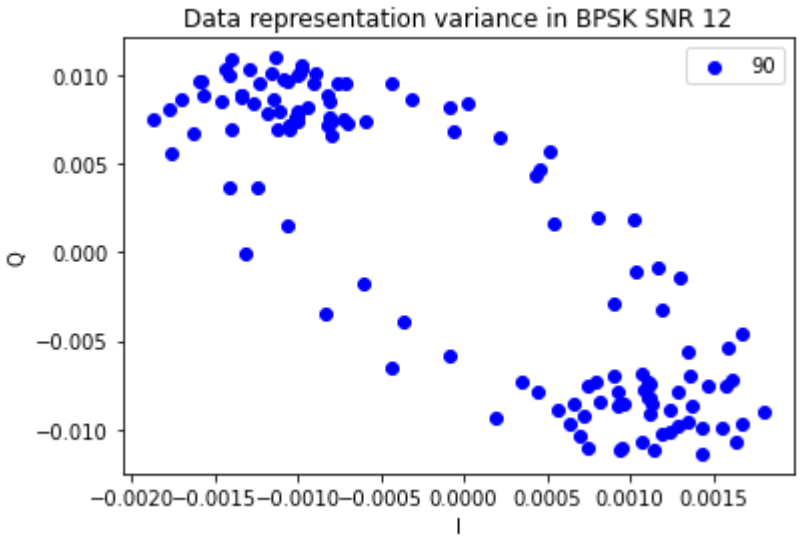

Data representation variance in BPSK SNR 12
85
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

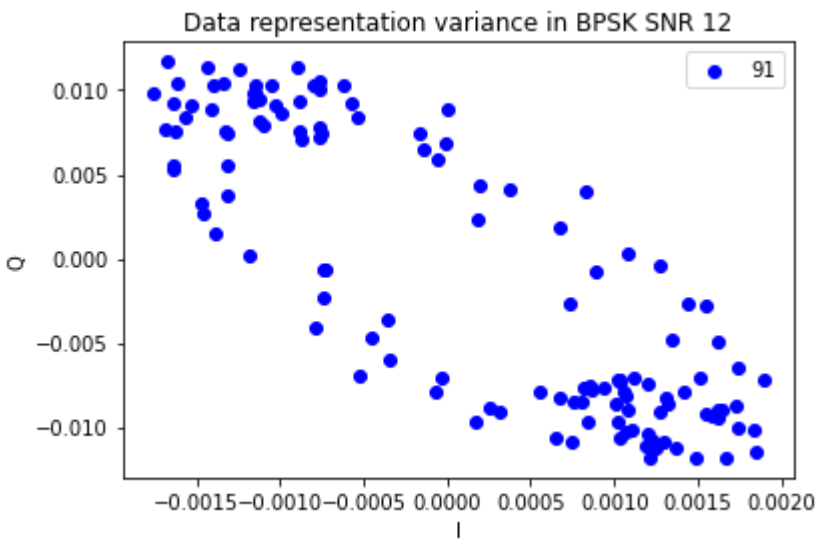

Data representation variance in BPSK SNR 12
86
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I

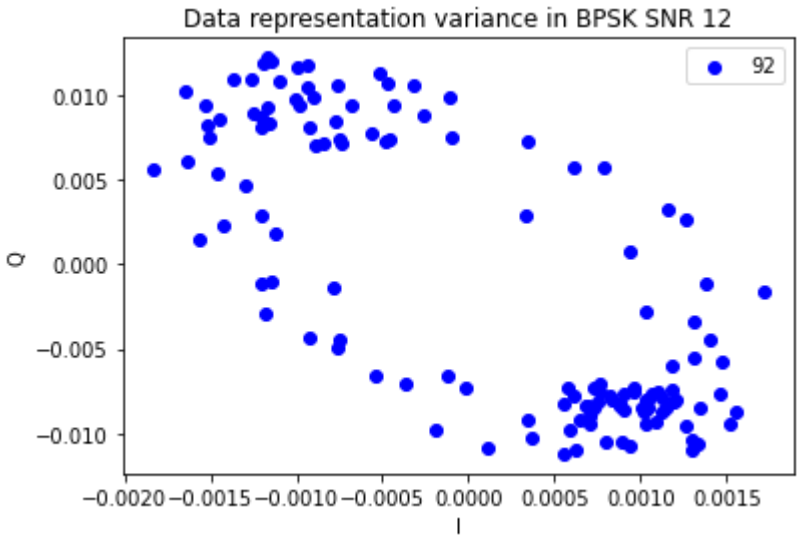

Data representation variance in BPSK SNR 12
87
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I

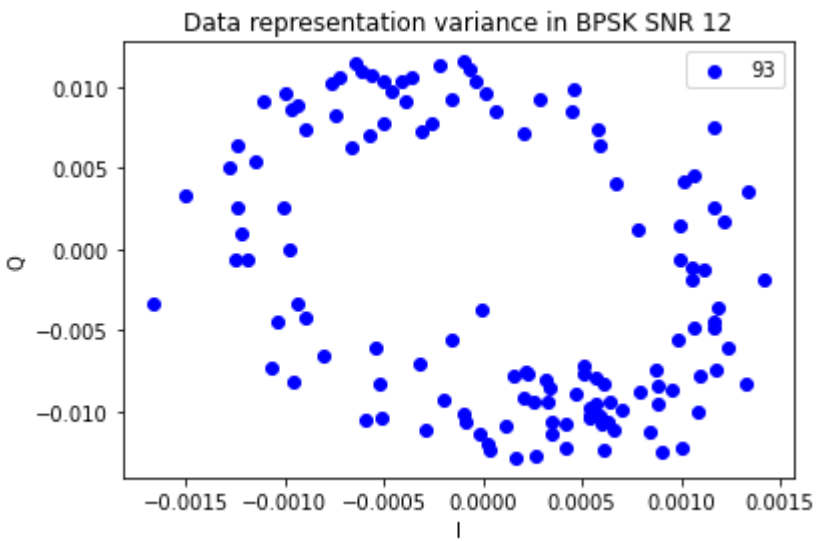

Data representation variance in BPSK SNR 12
88
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

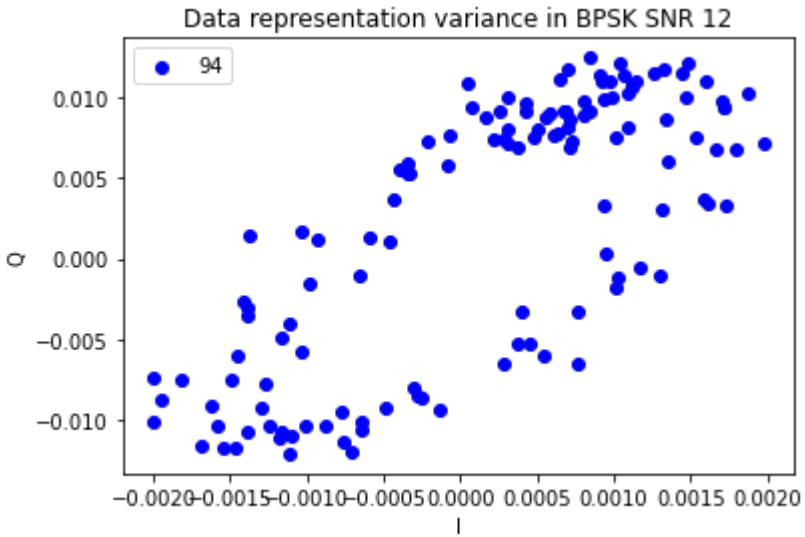

Data representation variance in BPSK SNR 12
89
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
0.0020
I

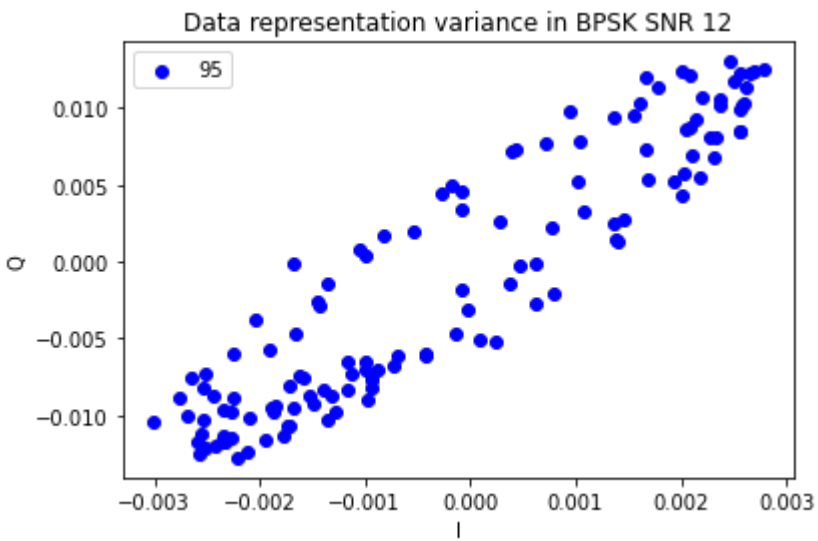

Data representation variance in BPSK SNR 12
90
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
I

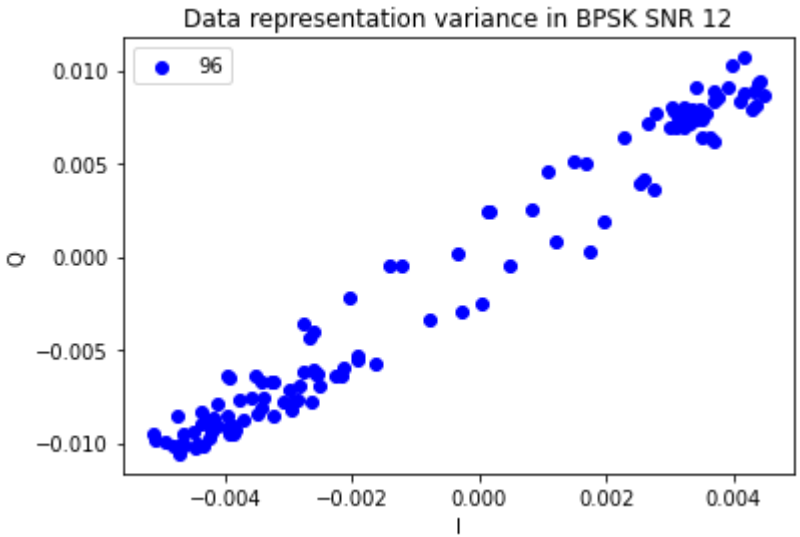

Data representation variance in BPSK SNR 12
91
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
I

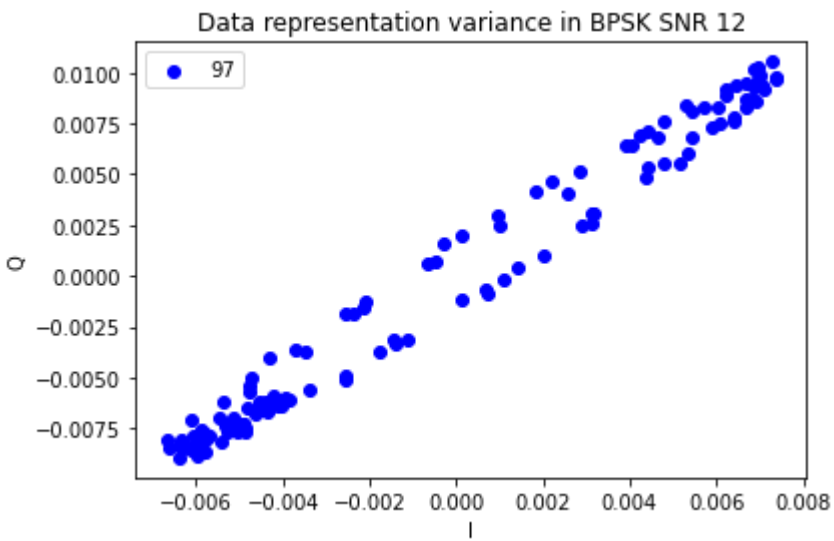

Data representation variance in BPSK SNR 12
92
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
I

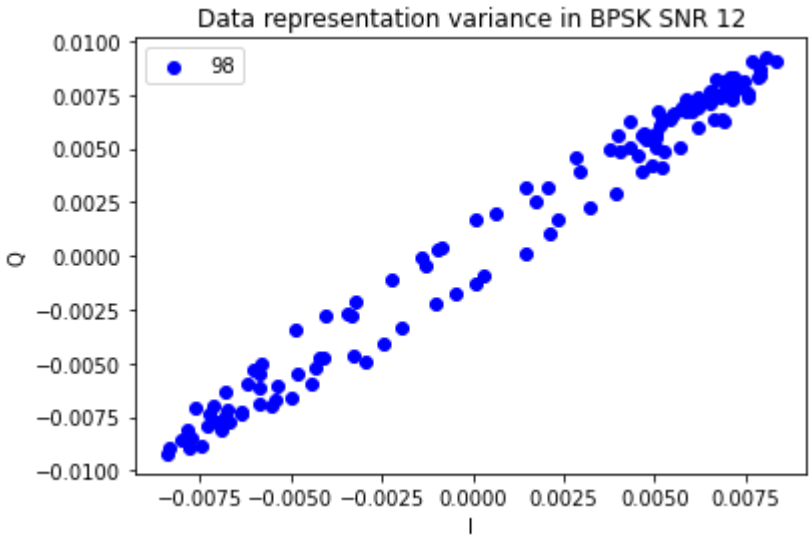

Data representation variance in BPSK SNR 12
93
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
I

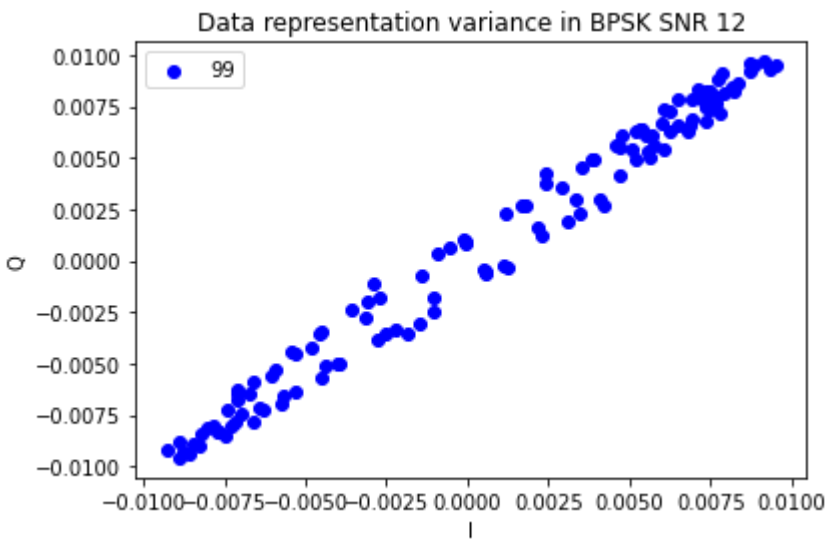

Data representation variance in BPSK SNR 12
94
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
0.0020
I

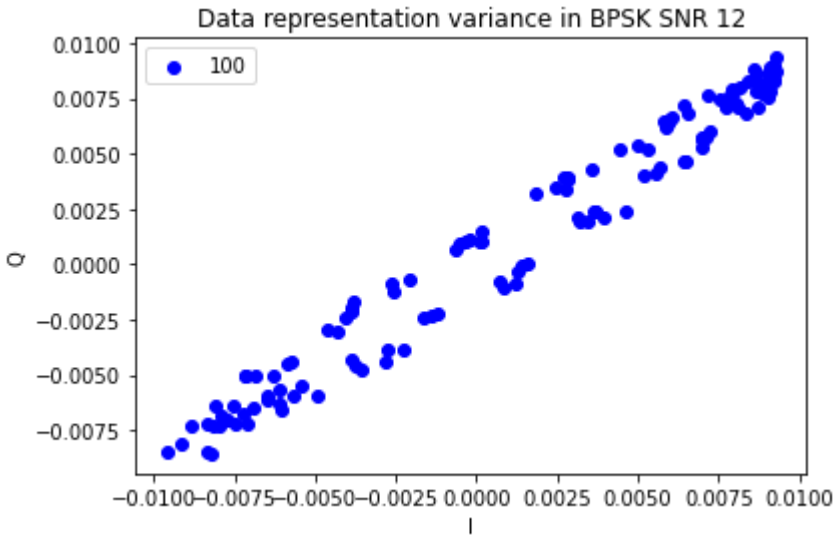

Data representation variance in BPSK SNR 12
95
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

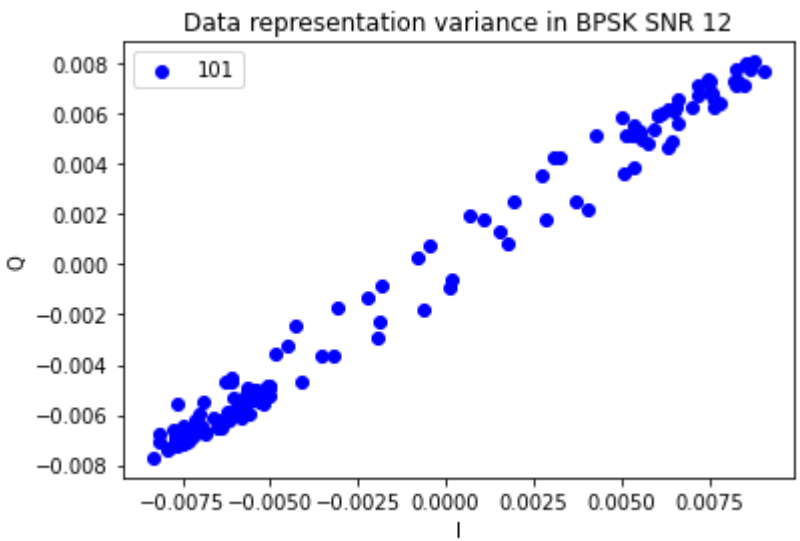

Data representation variance in BPSK SNR 12
96
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

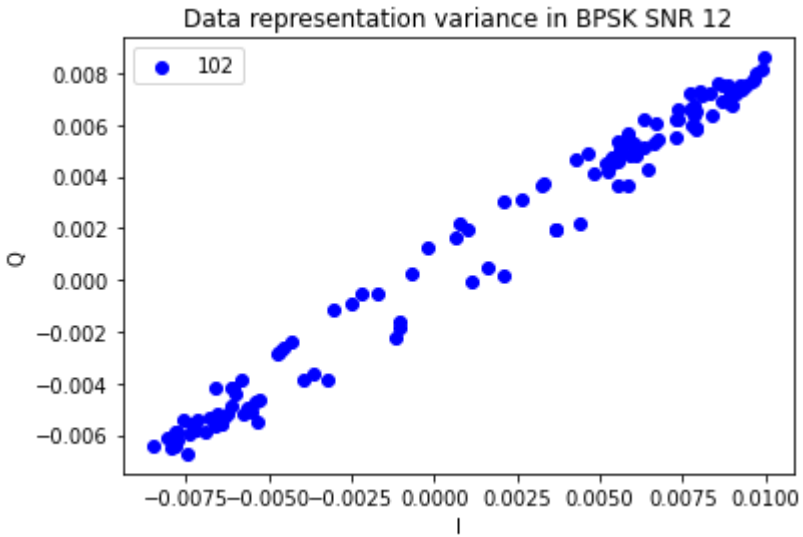

Data representation variance in BPSK SNR 12
97
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I

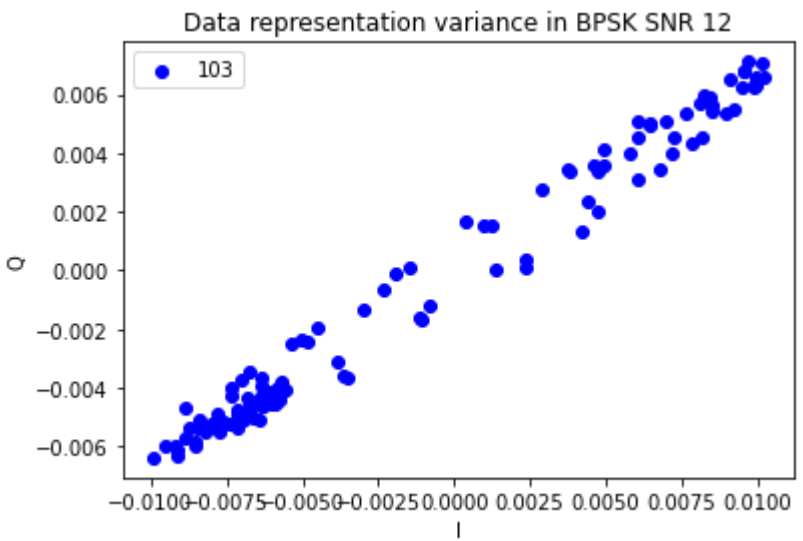

Data representation variance in BPSK SNR 12
98
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

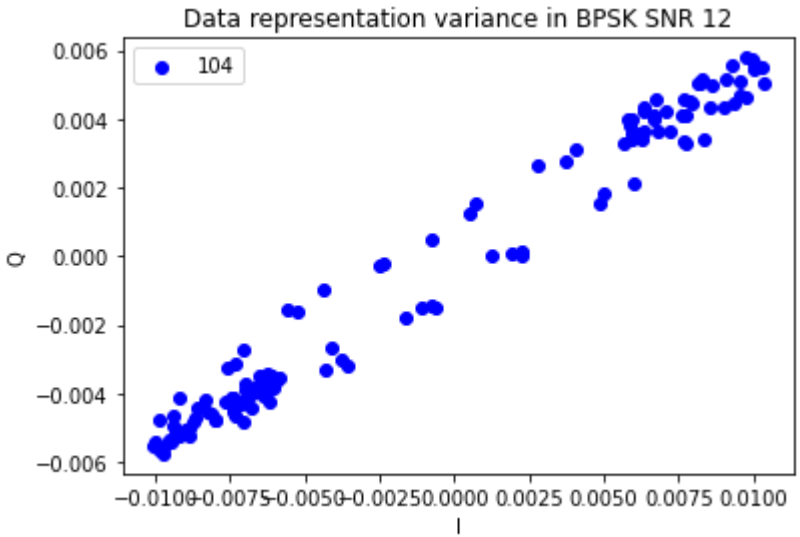

Data representation variance in BPSK SNR 12
99
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0100−0.0075−0.0050−0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

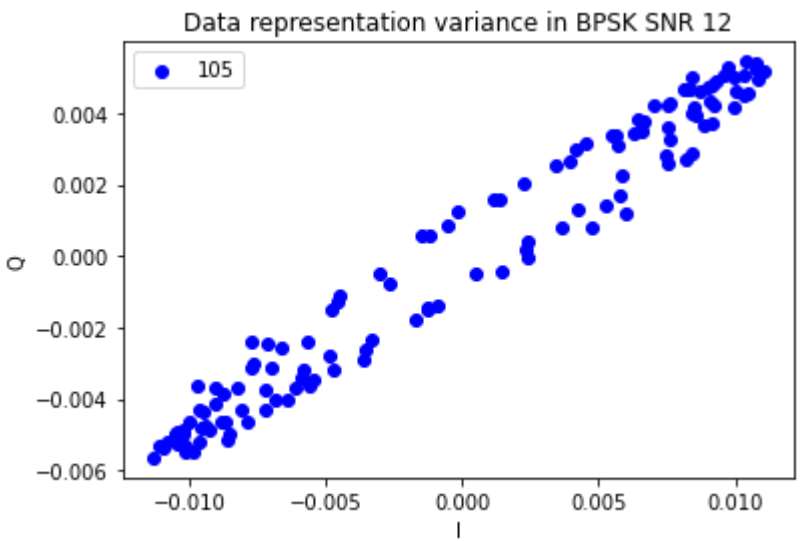

Data representation variance in BPSK SNR 12
100
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

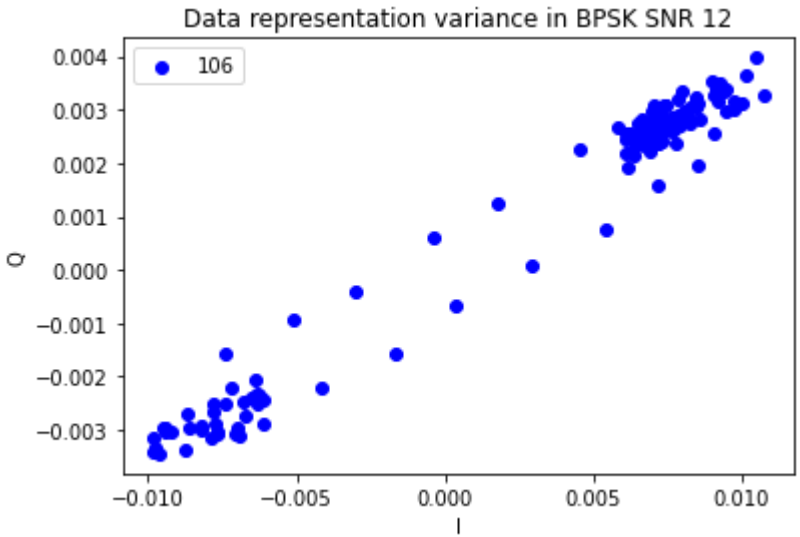

Data representation variance in BPSK SNR 12
101
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

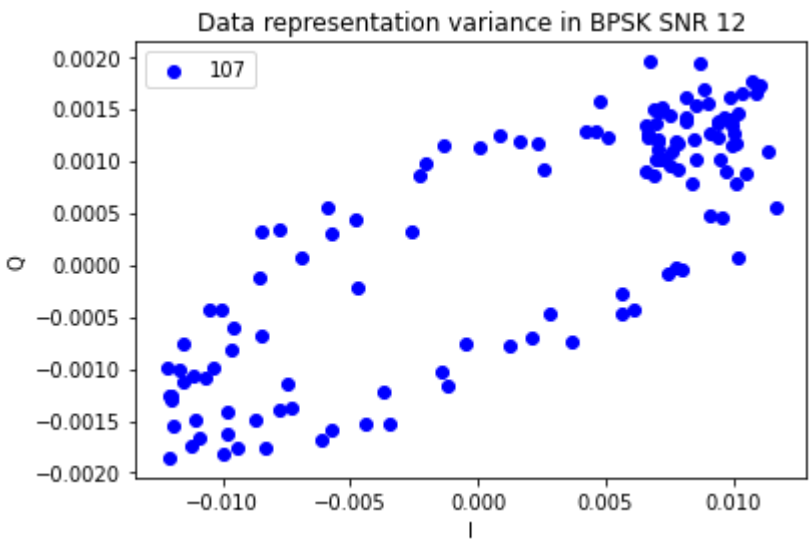

Data representation variance in BPSK SNR 12
102
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

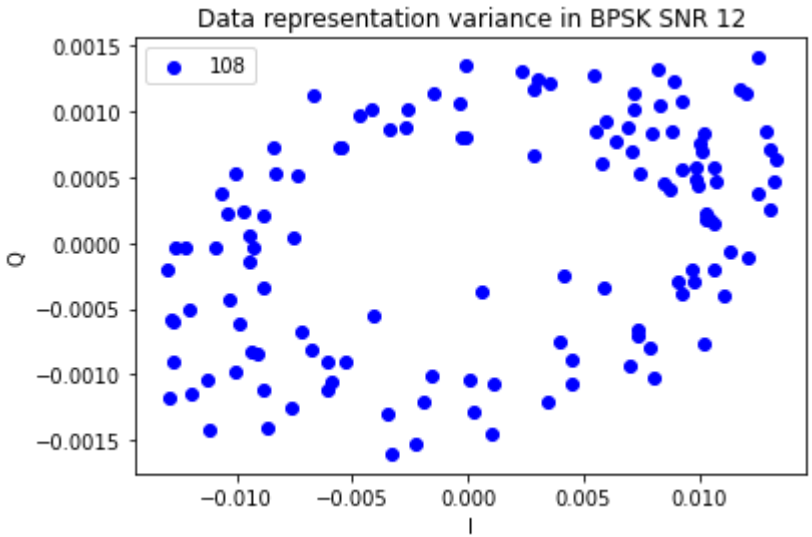

Data representation variance in BPSK SNR 12
103
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

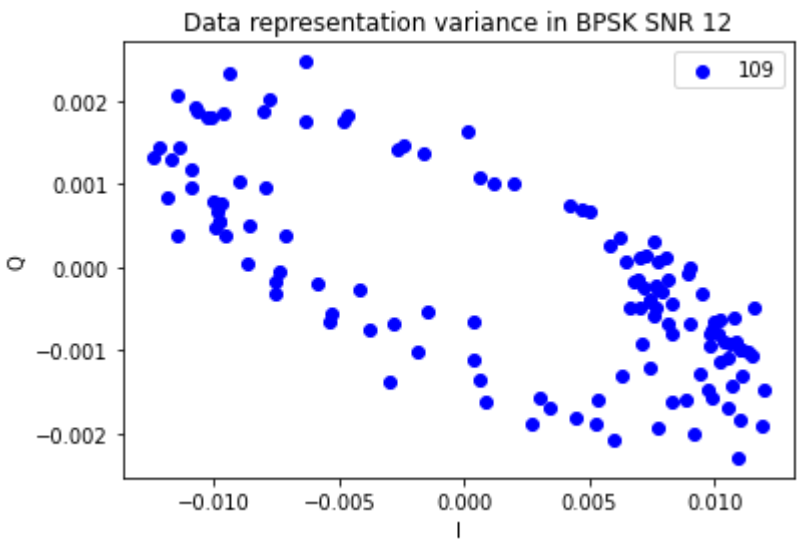

Data representation variance in BPSK SNR 12
104
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I

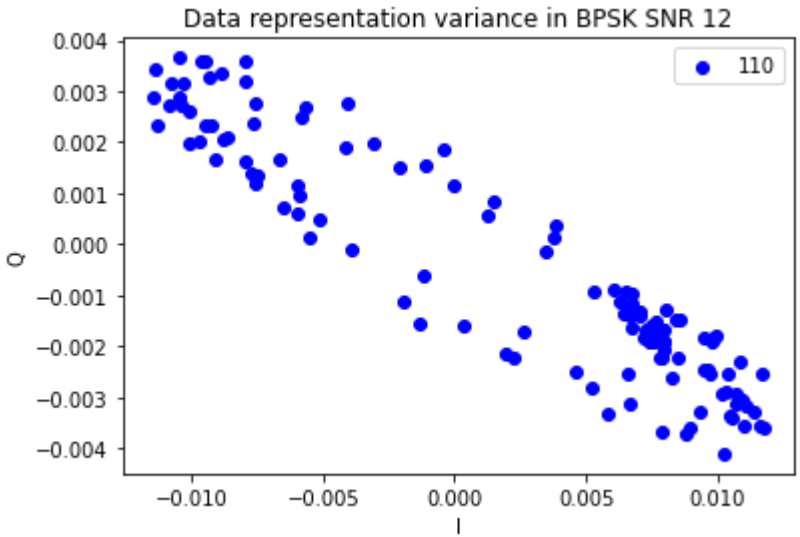

Data representation variance in BPSK SNR 12
105
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

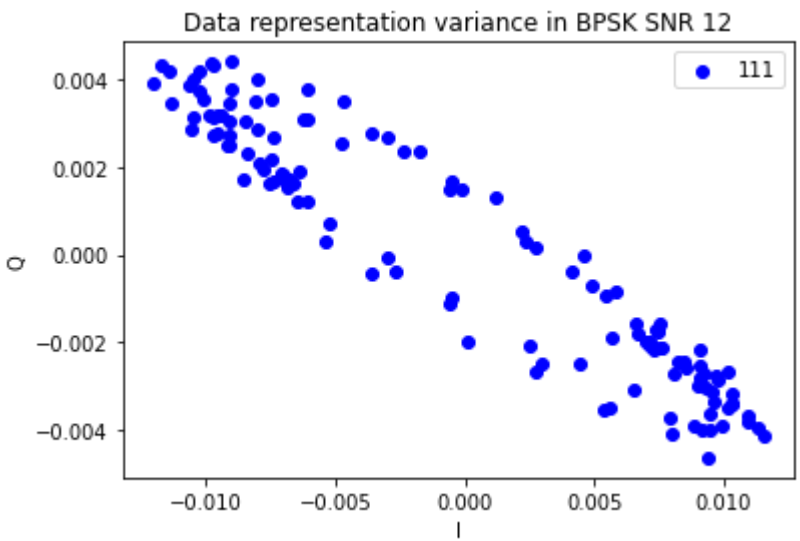

Data representation variance in BPSK SNR 12
106
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

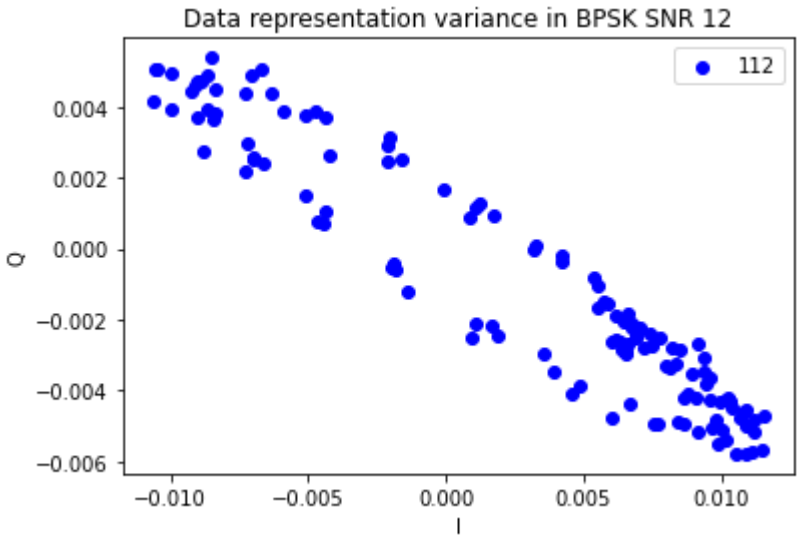

Data representation variance in BPSK SNR 12
107
0.0020
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
−0.0020
Q
−0.010
−0.005
0.000
0.005
0.010
I

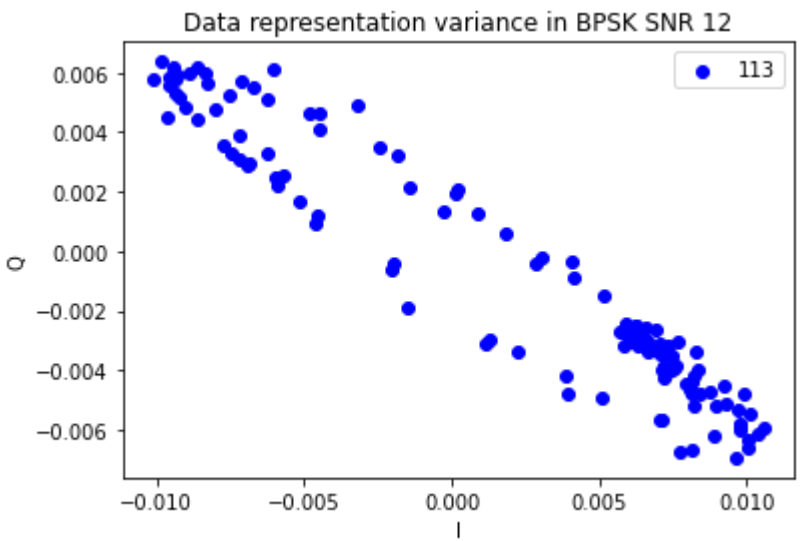

Data representation variance in BPSK SNR 12
108
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I

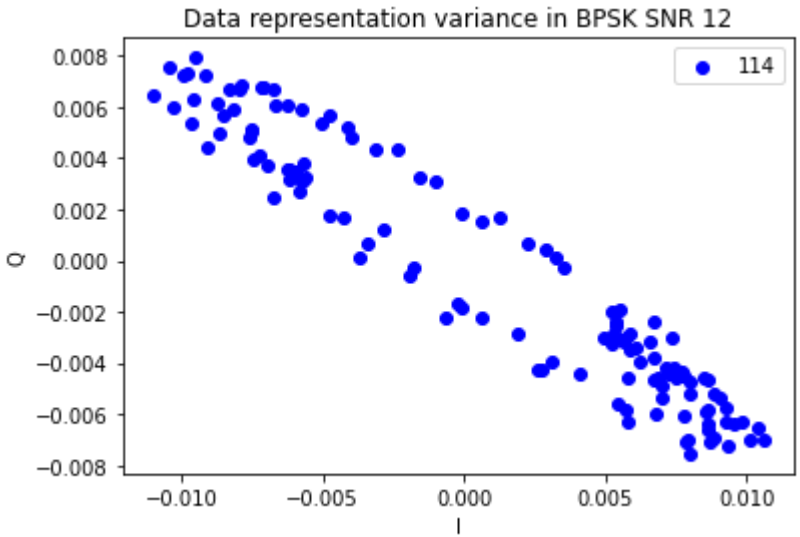

Data representation variance in BPSK SNR 12
109
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

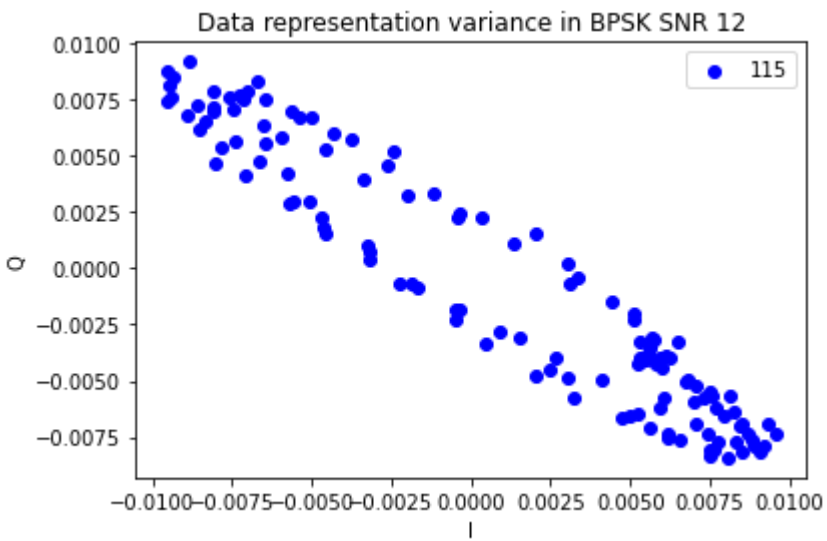

Data representation variance in BPSK SNR 12
110
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

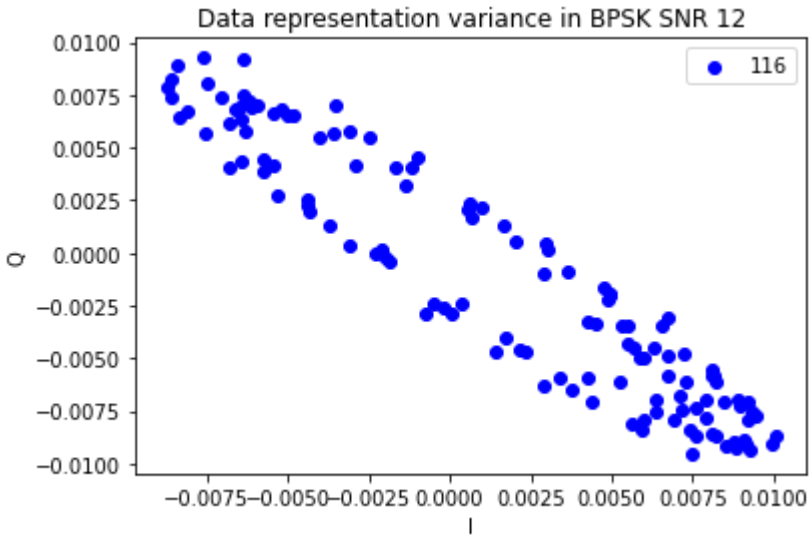

Data representation variance in BPSK SNR 12
111
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

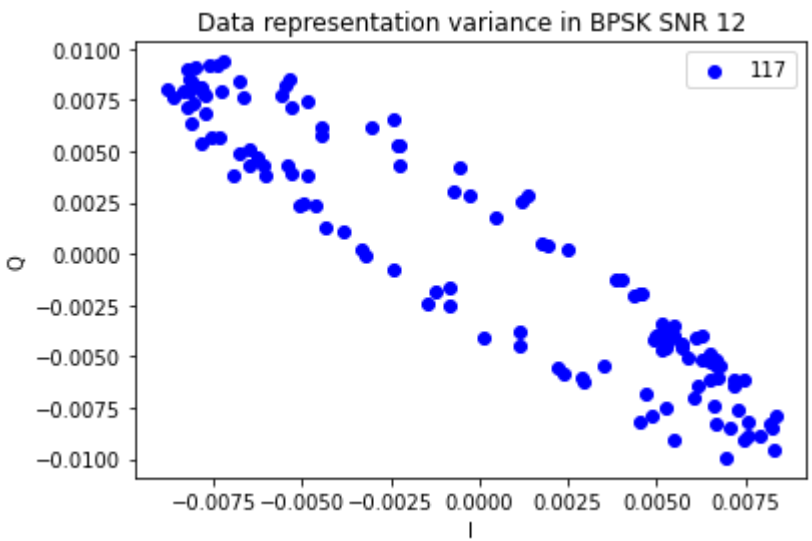

Data representation variance in BPSK SNR 12
112
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

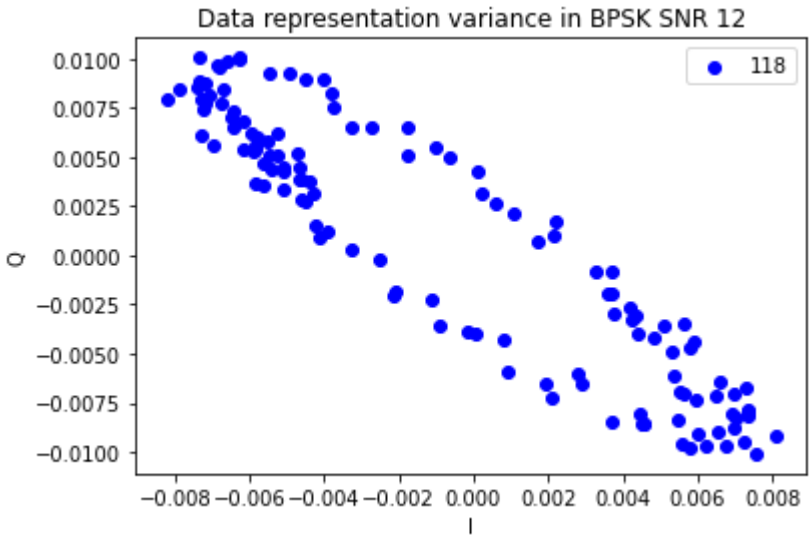

Data representation variance in BPSK SNR 12
113
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

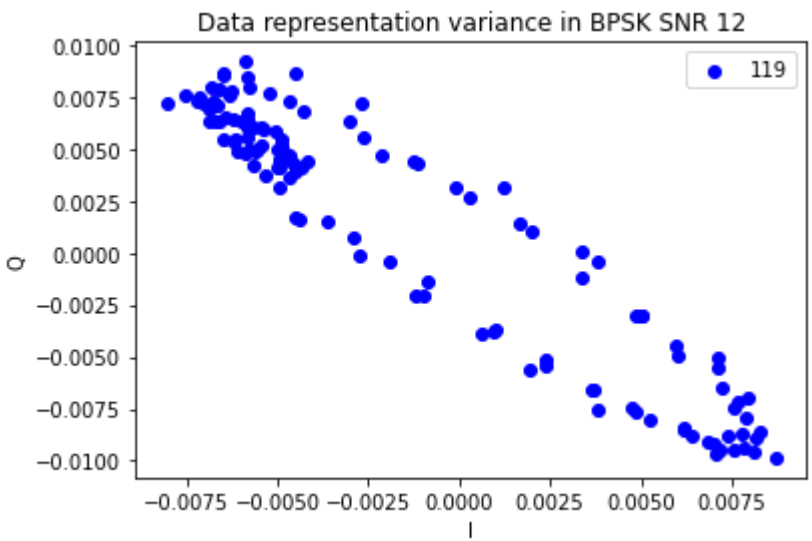

Data representation variance in BPSK SNR 12
114
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010
−0.005
0.000
0.005
0.010
I

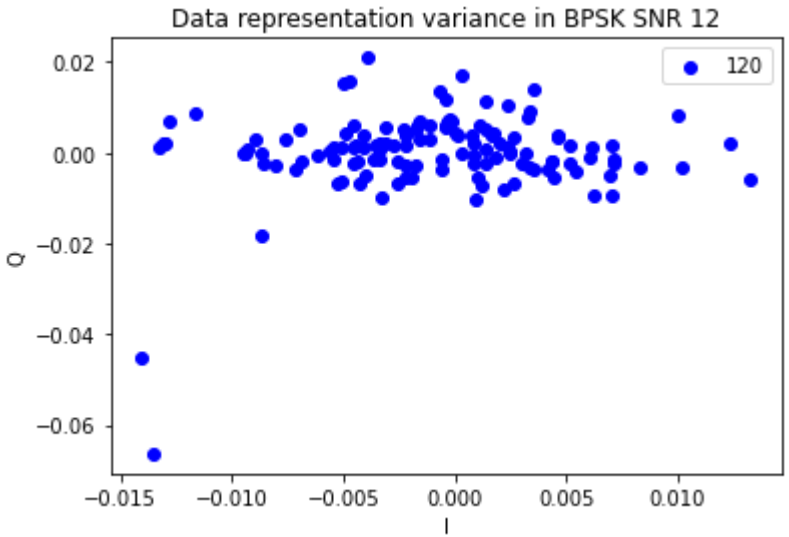

Data representation variance in BPSK SNR 12
115
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I

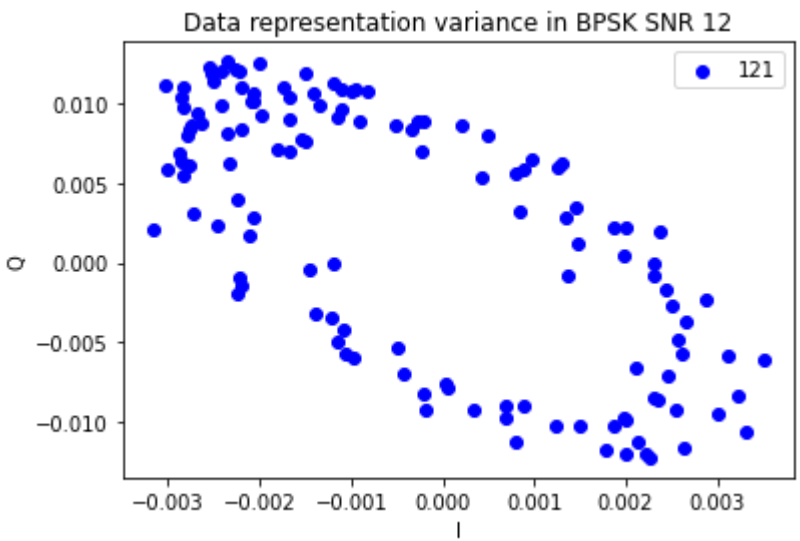

Data representation variance in BPSK SNR 12
116
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

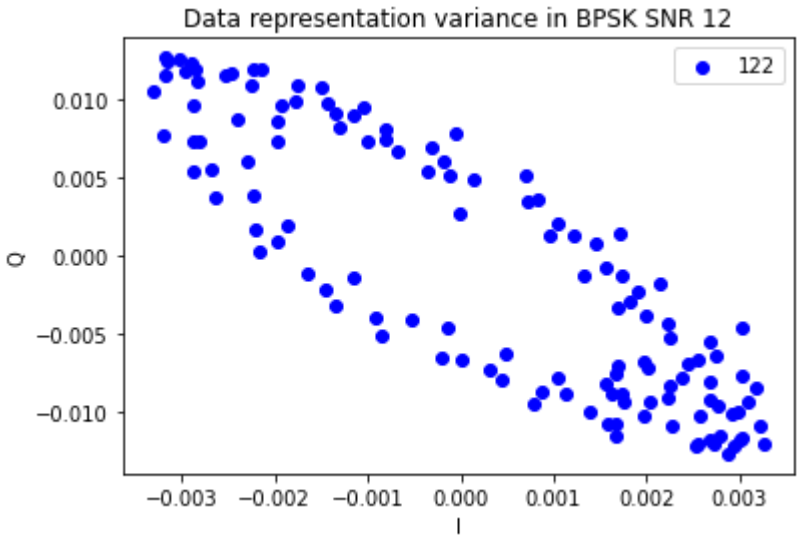

Data representation variance in BPSK SNR 12
117
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

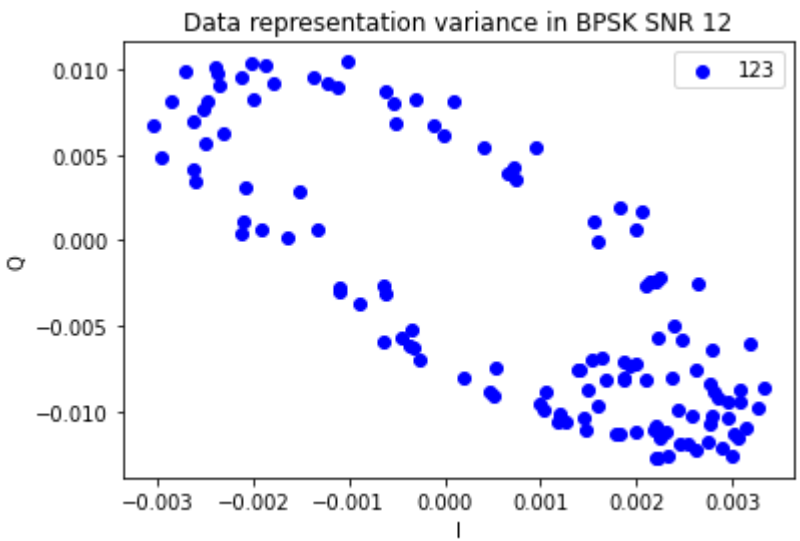

Data representation variance in BPSK SNR 12
118
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

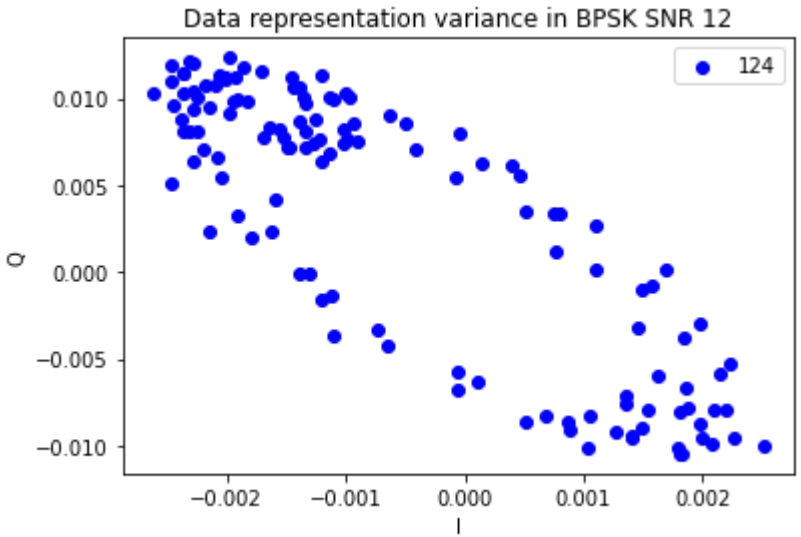

Data representation variance in BPSK SNR 12
119
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

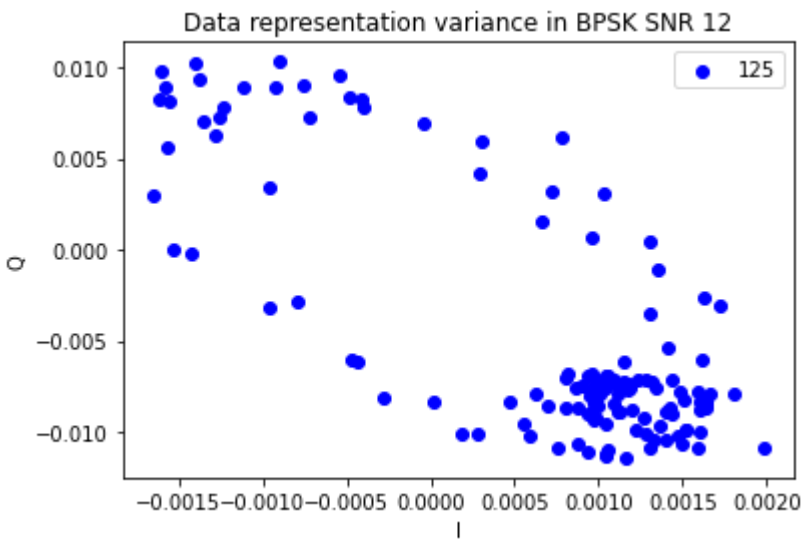

Data representation variance in BPSK SNR 12
120
0.02
0.00
−0.02
−0.04
−0.06
Q
−0.015
−0.010
−0.005
0.000
0.005
0.010
I

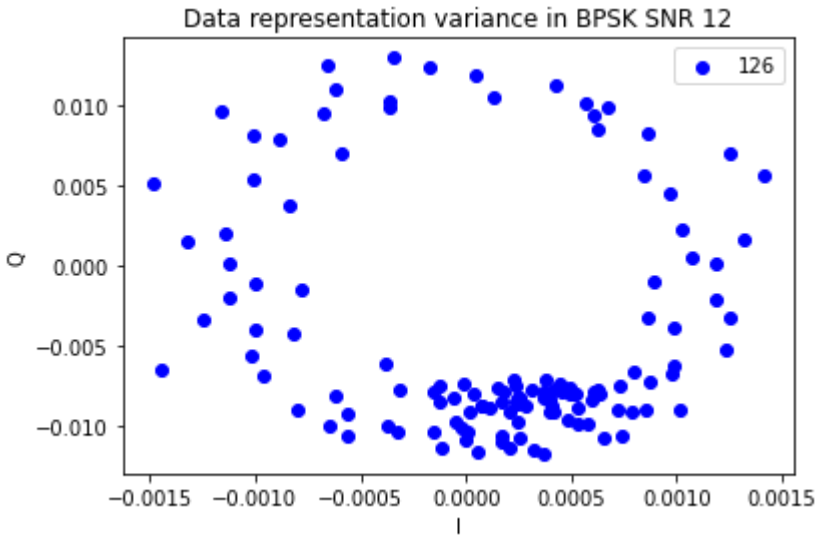

Data representation variance in BPSK SNR 12
121
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

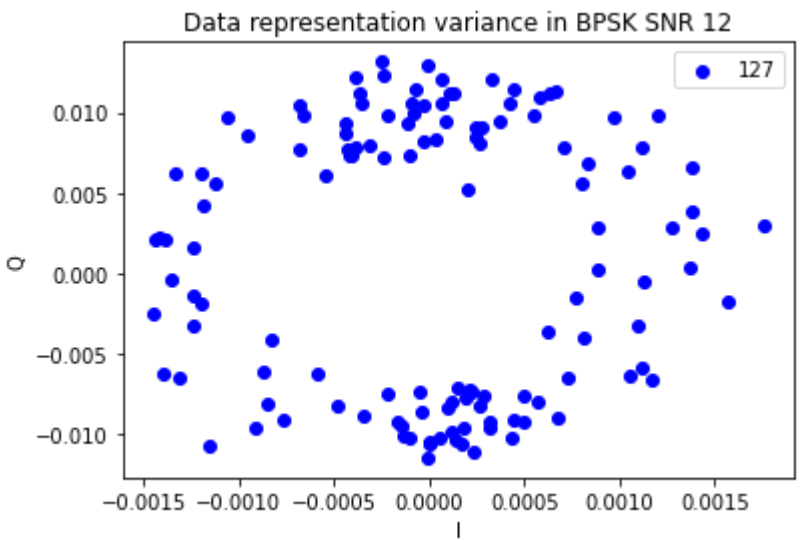

Data representation variance in BPSK SNR 12
122
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

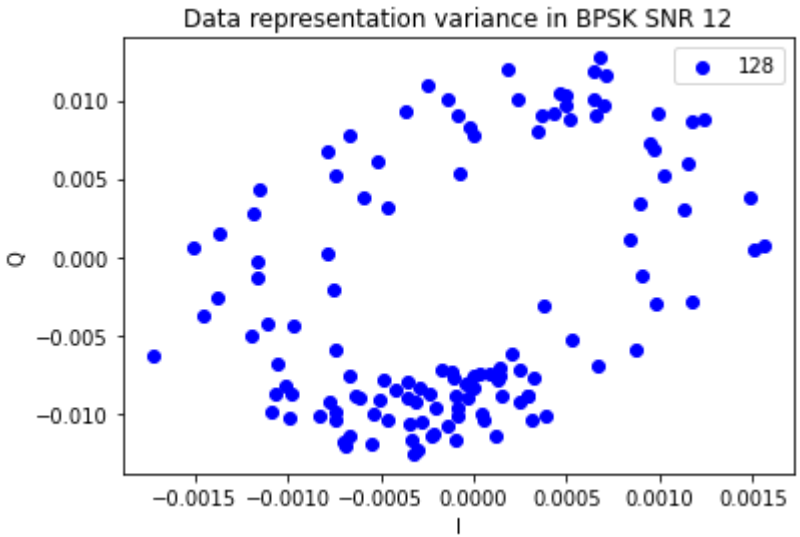

Data representation variance in BPSK SNR 12
123
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

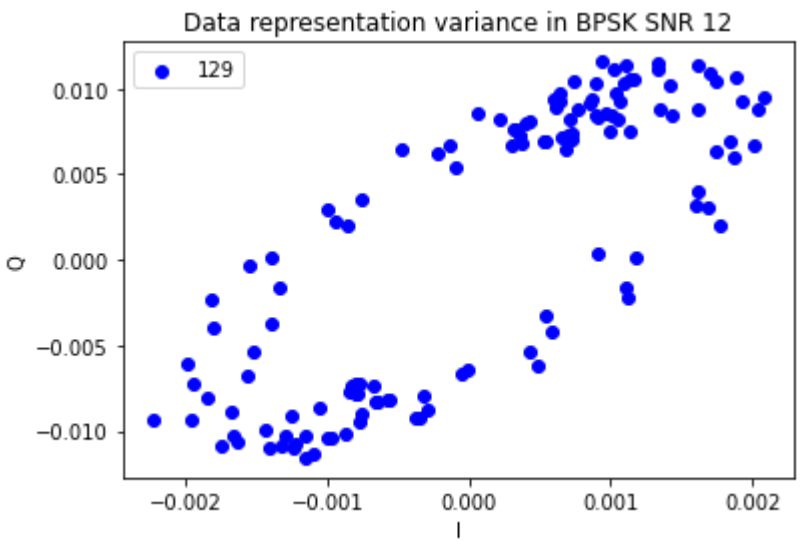

Data representation variance in BPSK SNR 12
124
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

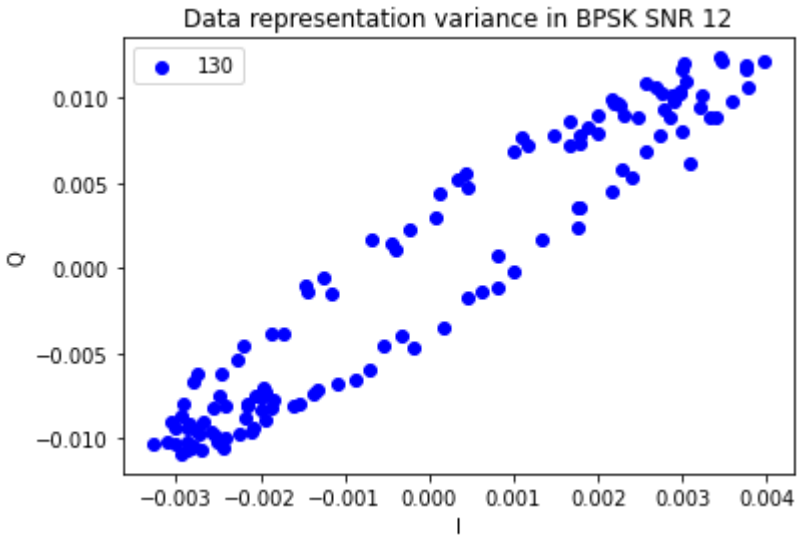

Data representation variance in BPSK SNR 12
125
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
0.0020
I

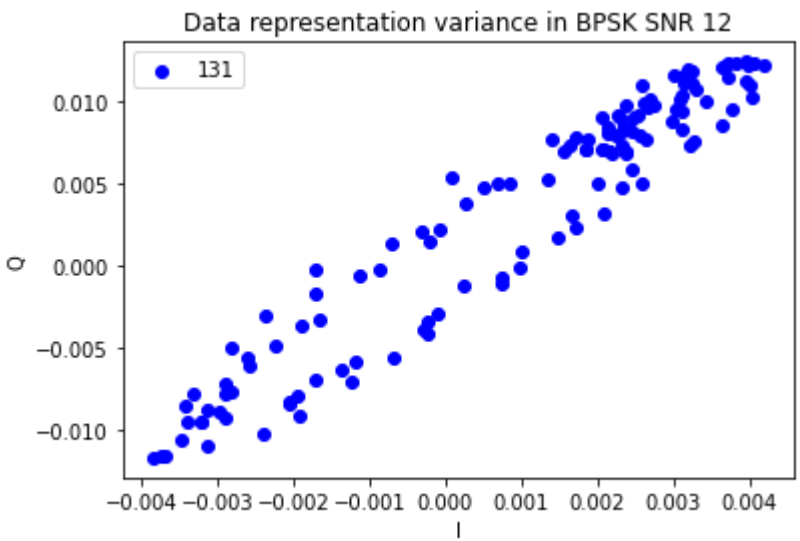

Data representation variance in BPSK SNR 12
126
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
I

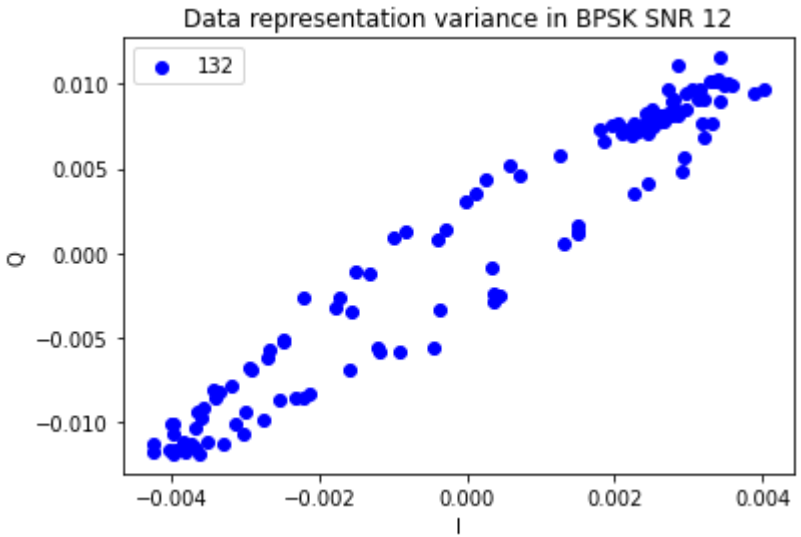

Data representation variance in BPSK SNR 12
127
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
I

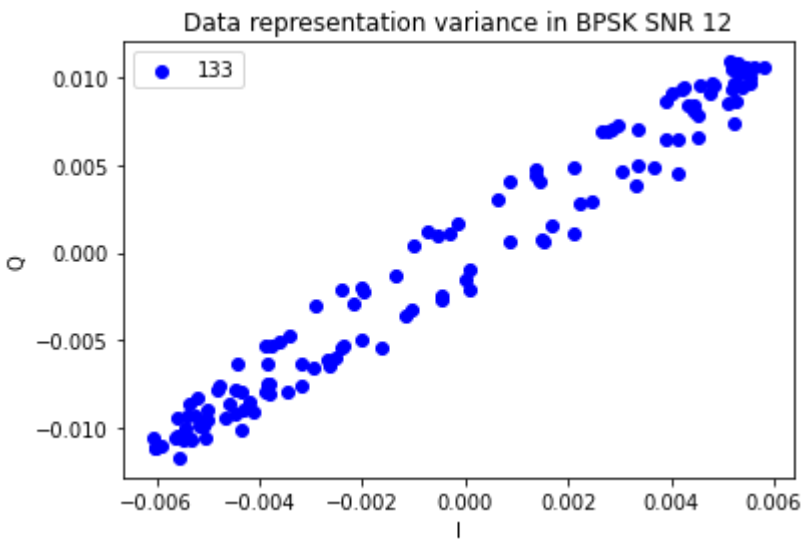

Data representation variance in BPSK SNR 12
128
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
I

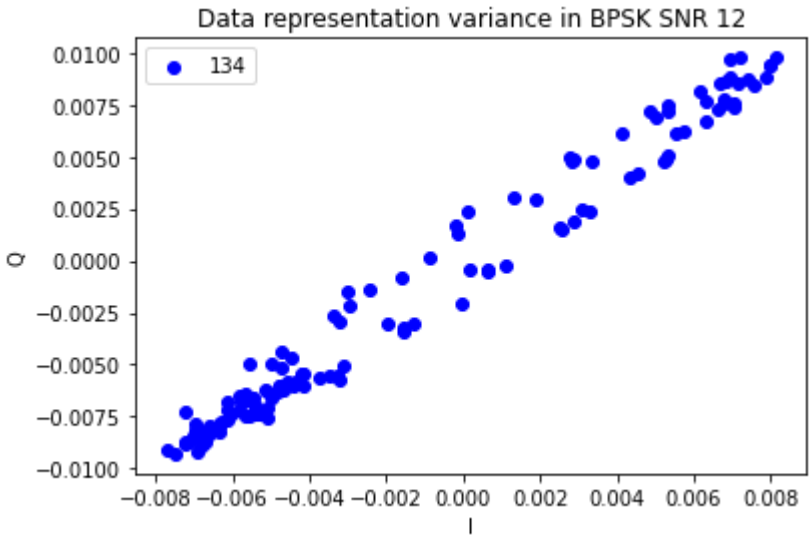

Data representation variance in BPSK SNR 12
129
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

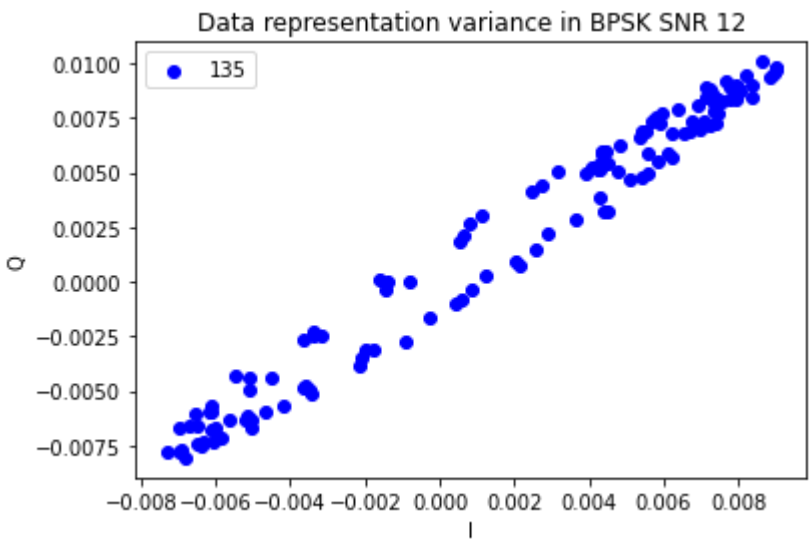

Data representation variance in BPSK SNR 12
130
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

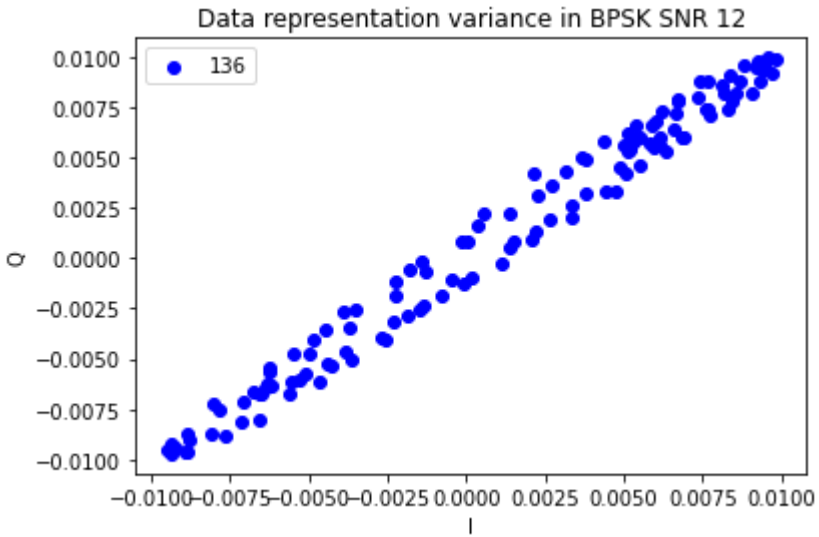

Data representation variance in BPSK SNR 12
131
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

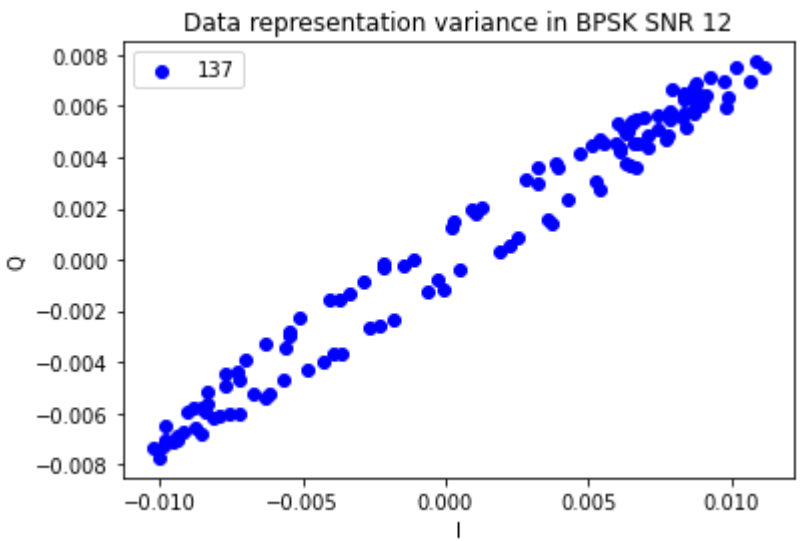

Data representation variance in BPSK SNR 12
132
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

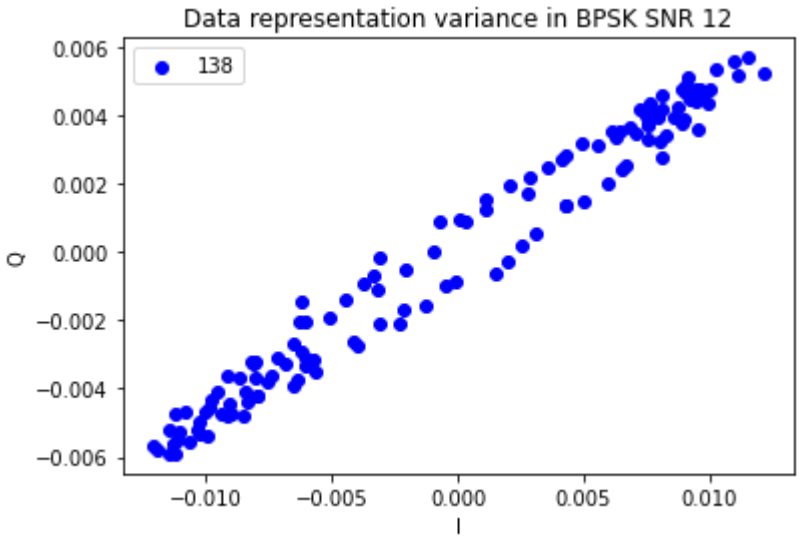

Data representation variance in BPSK SNR 12
133
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

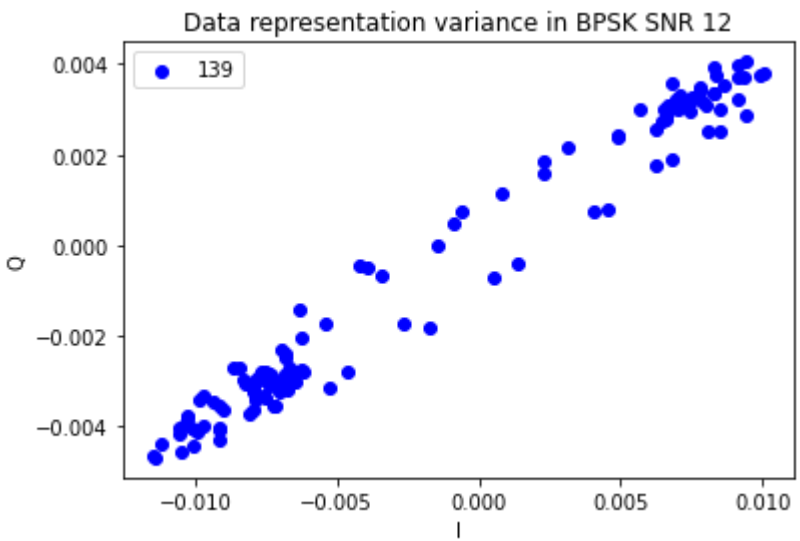

Data representation variance in BPSK SNR 12
134
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

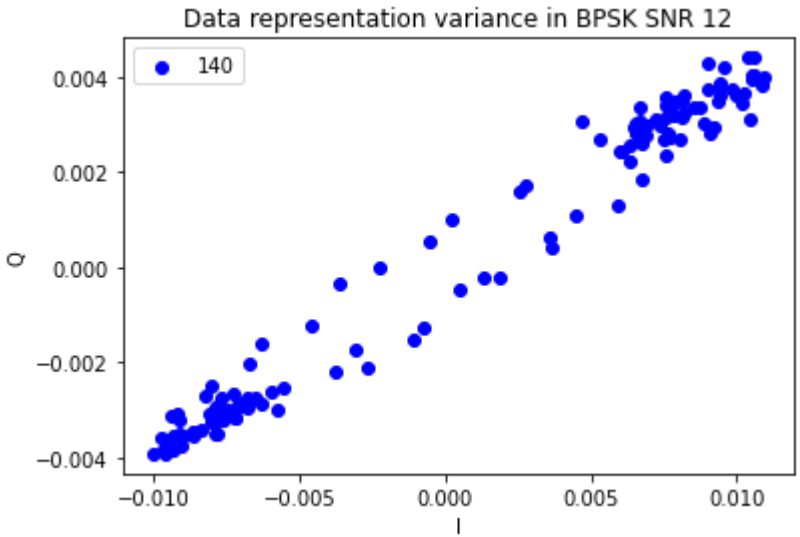

Data representation variance in BPSK SNR 12
135
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

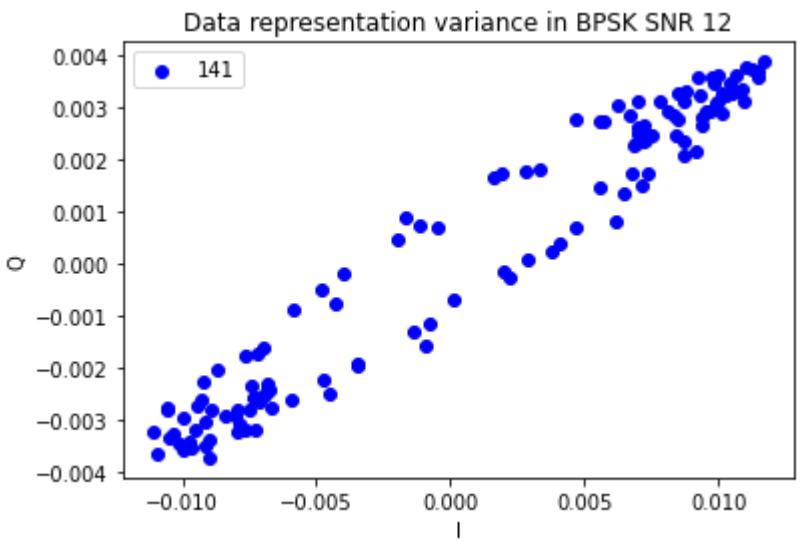

Data representation variance in BPSK SNR 12
136
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

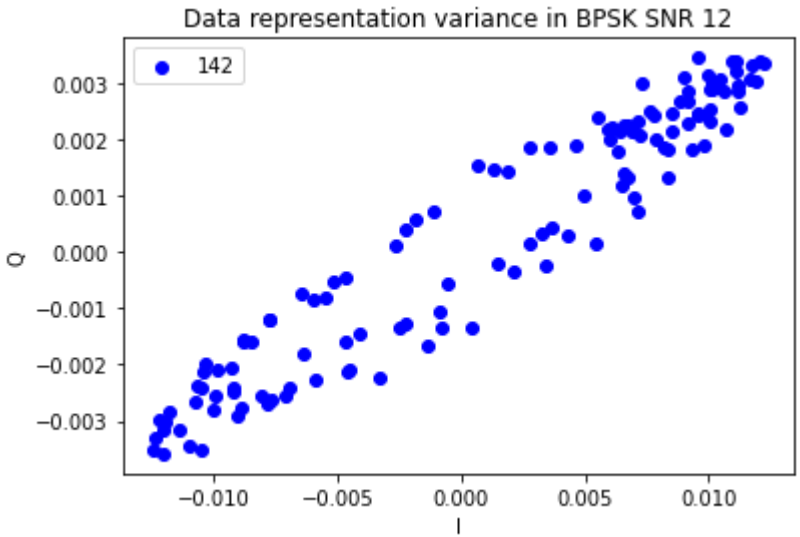

Data representation variance in BPSK SNR 12
137
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010 −0.005 0.000 0.005 0.010
I

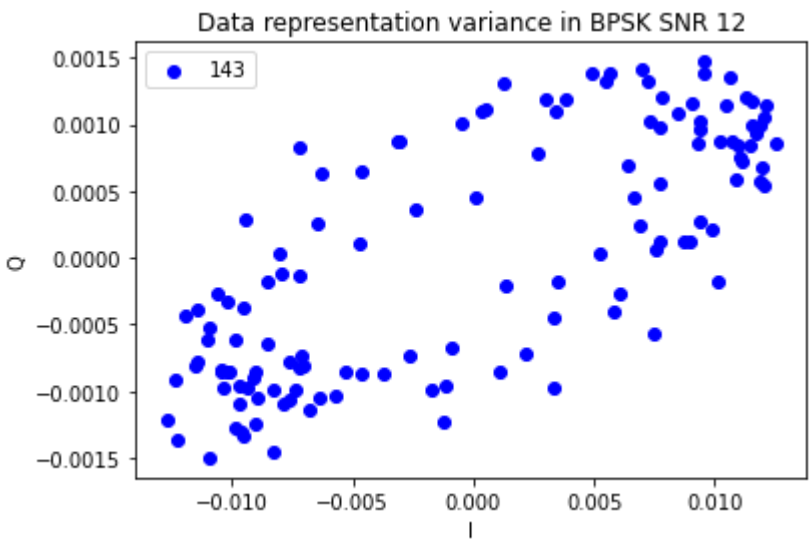

Data representation variance in BPSK SNR 12
138
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

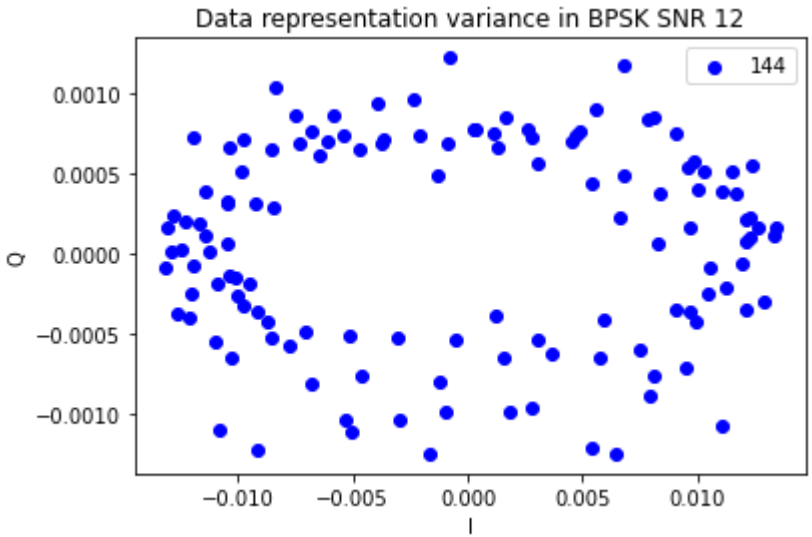

Data representation variance in BPSK SNR 12
139
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

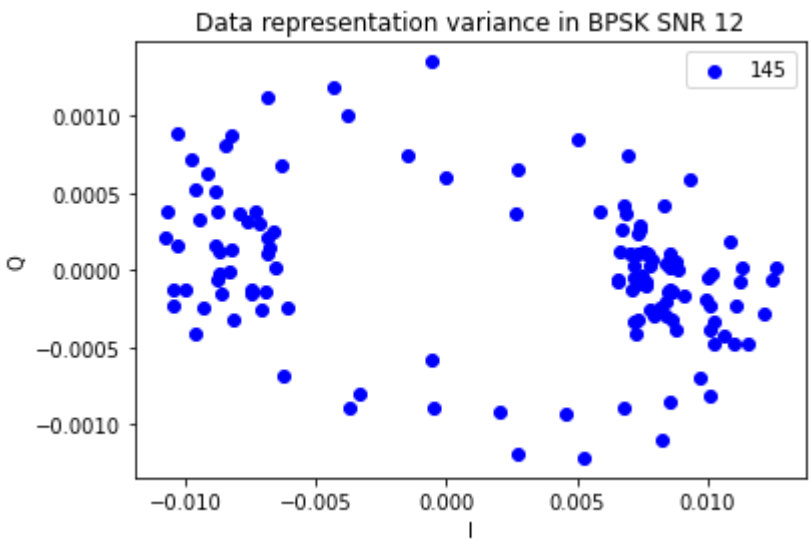

Data representation variance in BPSK SNR 12
140
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

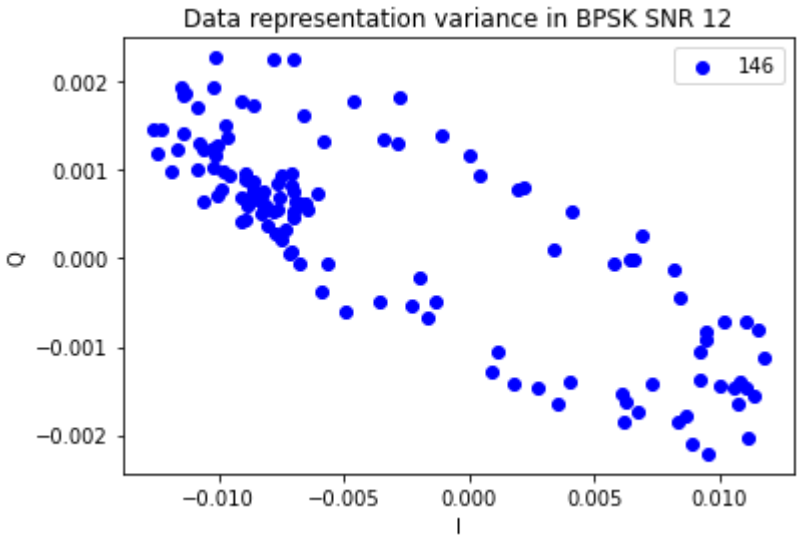

Data representation variance in BPSK SNR 12
141
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

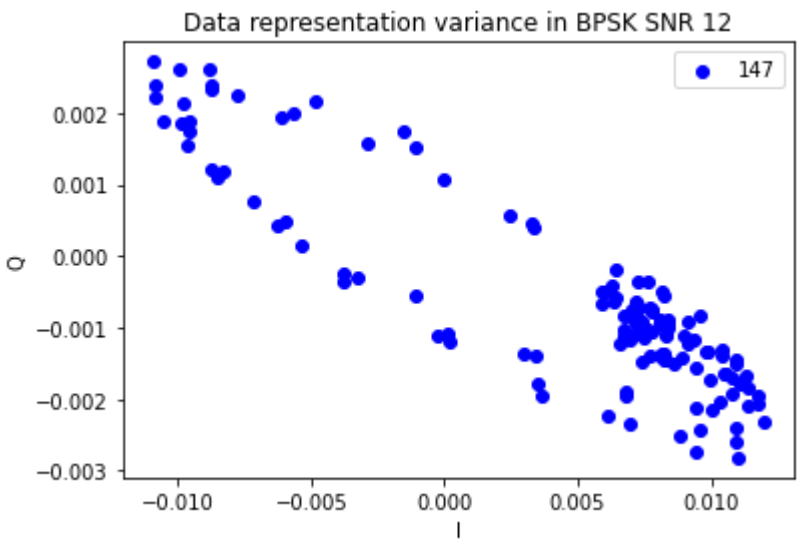

Data representation variance in BPSK SNR 12
142
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

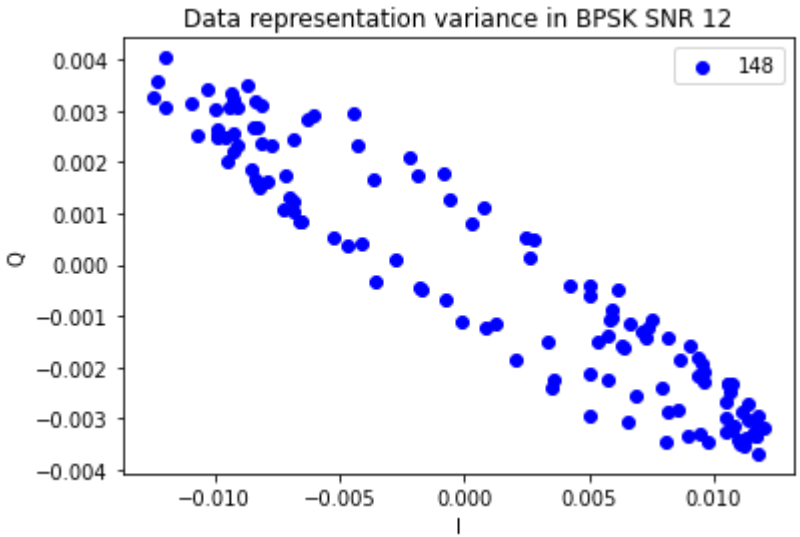

Data representation variance in BPSK SNR 12
143
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I

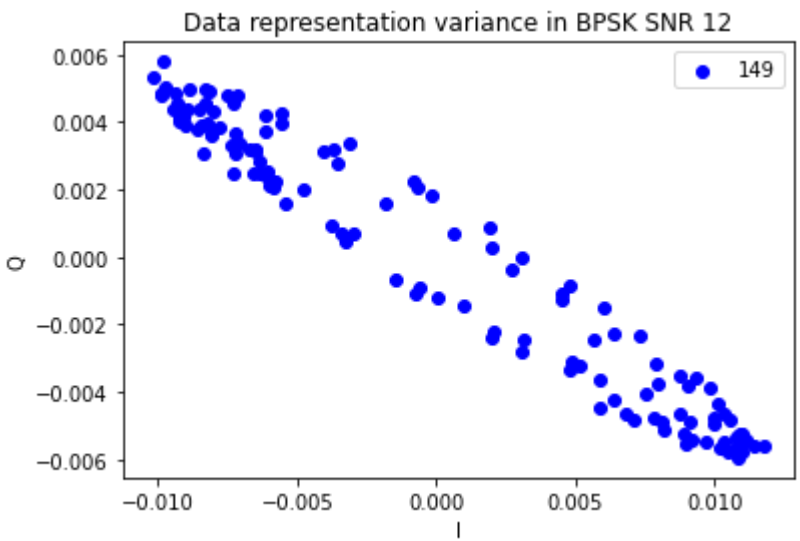

Data representation variance in BPSK SNR 12
144
0.0010
0.0005
0.0000
−0.0005
−0.0010
Q
−0.010
−0.005
0.000
0.005
0.010
I

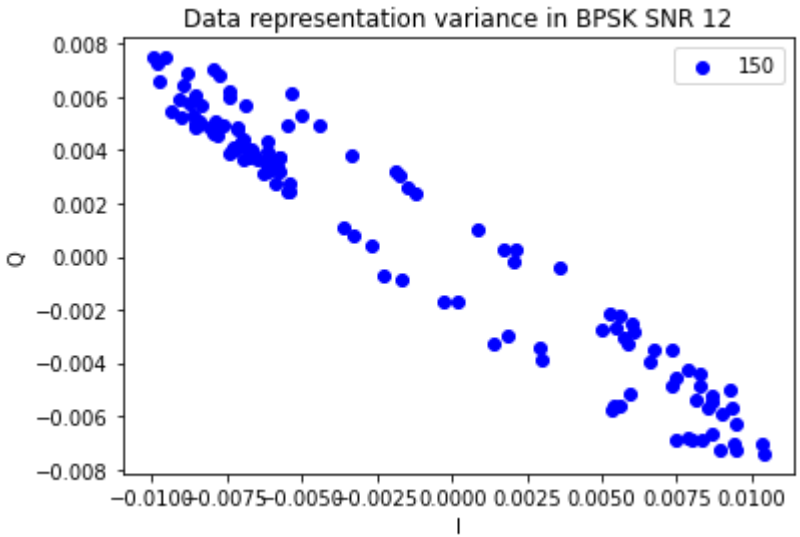

Data representation variance in BPSK SNR 12
145
0.0010
0.0005
0.0000
−0.0005
−0.0010
Q
−0.010
−0.005
0.000
0.005
0.010
I

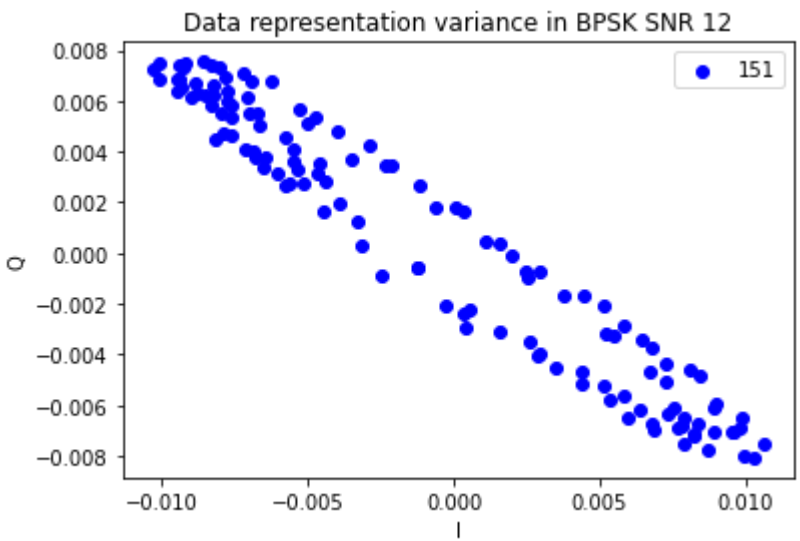

Data representation variance in BPSK SNR 12
146
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

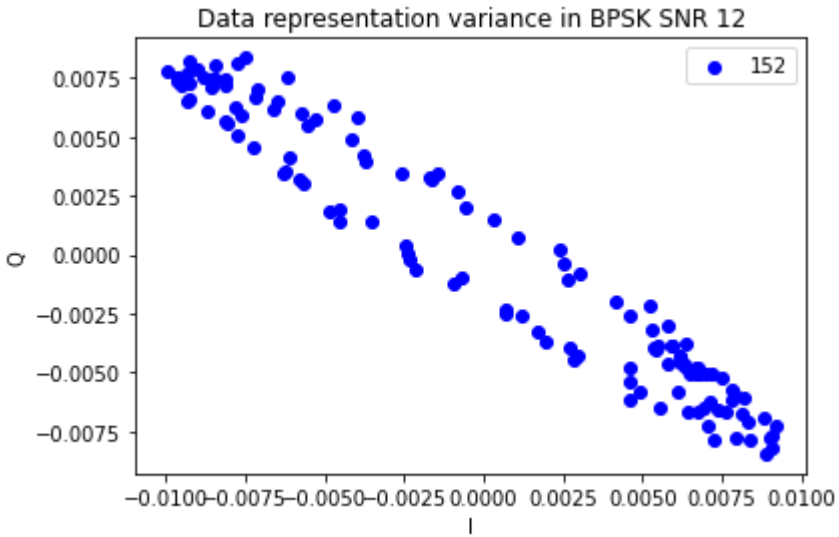

Data representation variance in BPSK SNR 12
147
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
148
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
149
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
150
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
151
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010 −0.005 0.000 0.005 0.010
I


Data representation variance in BPSK SNR 12
152
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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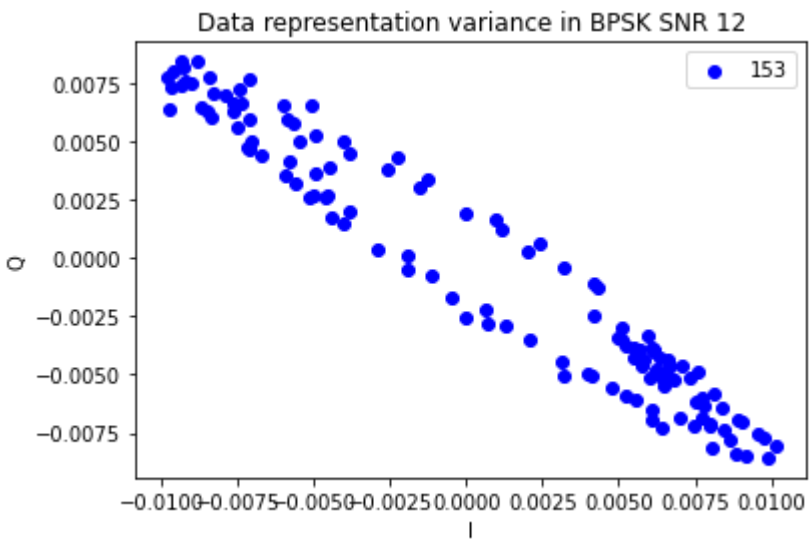
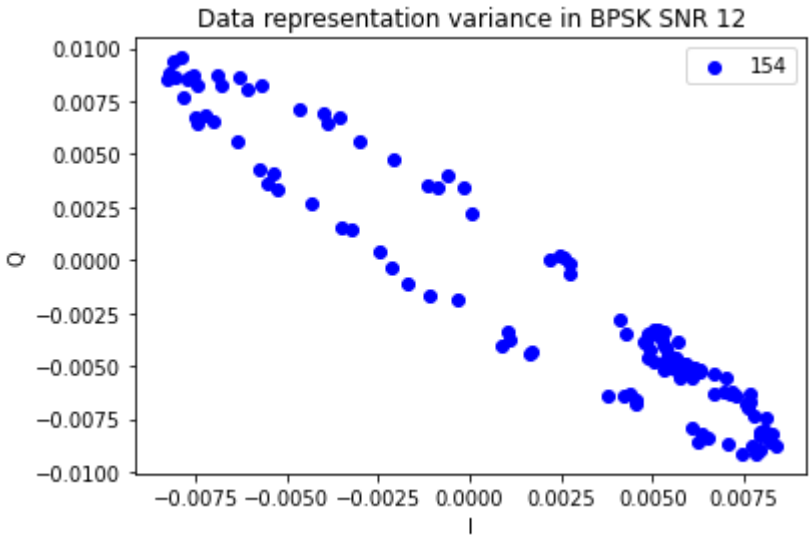
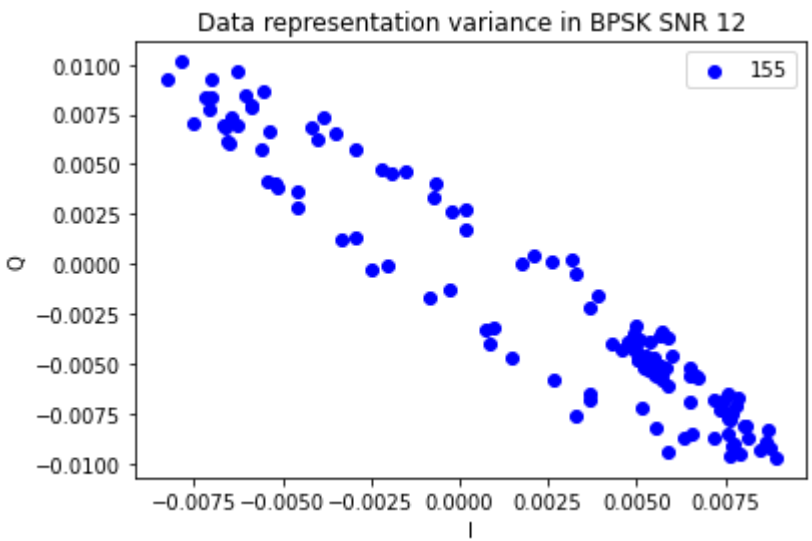

Data representation variance in BPSK SNR 12
153
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
154
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
155
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
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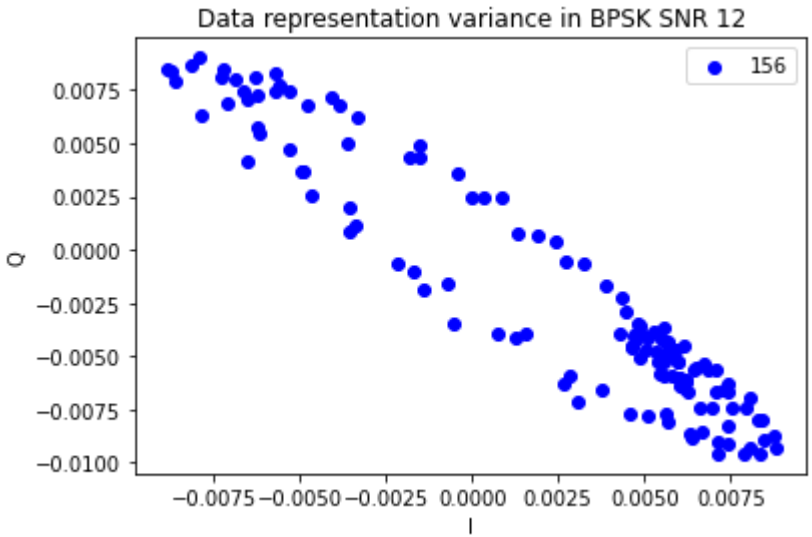
Data representation variance in BPSK SNR 12
156
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
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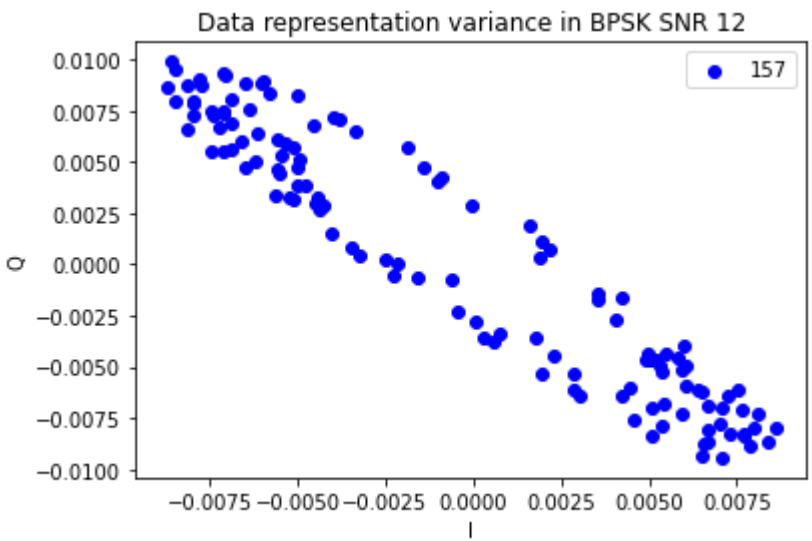
Data representation variance in BPSK SNR 12
157
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
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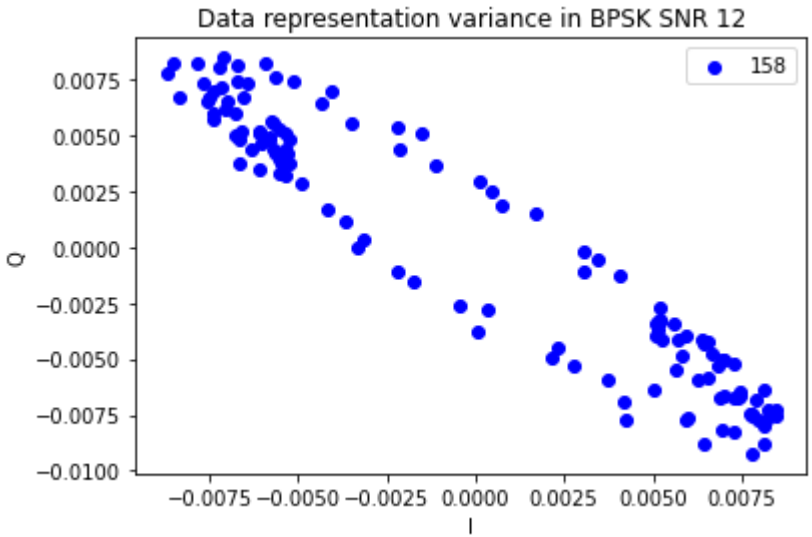
Data representation variance in BPSK SNR 12
158
0.0075
0.0050
0.0025
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−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
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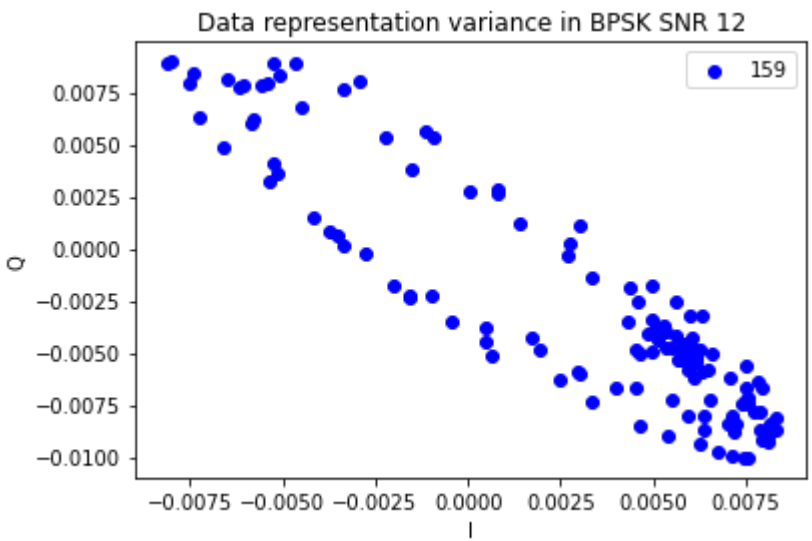
Data representation variance in BPSK SNR 12
159
0.0075
0.0050
0.0025
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−0.0025
−0.0050
−0.0075
−0.0100
Q
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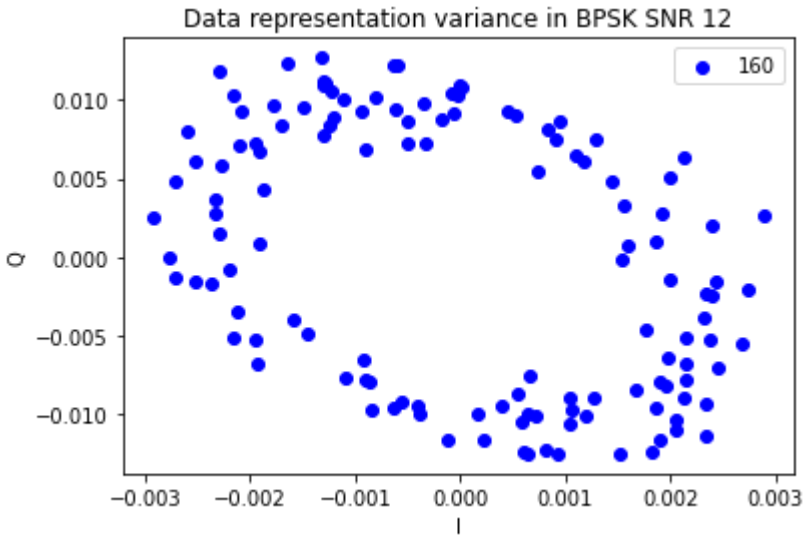
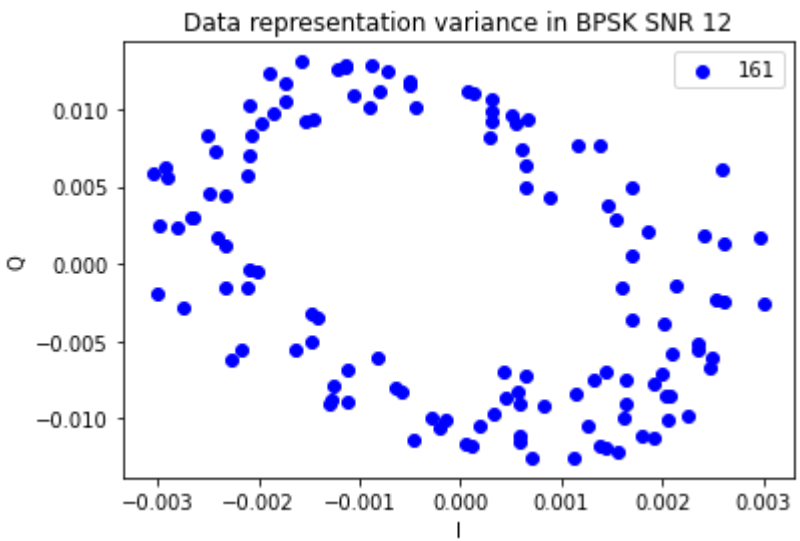
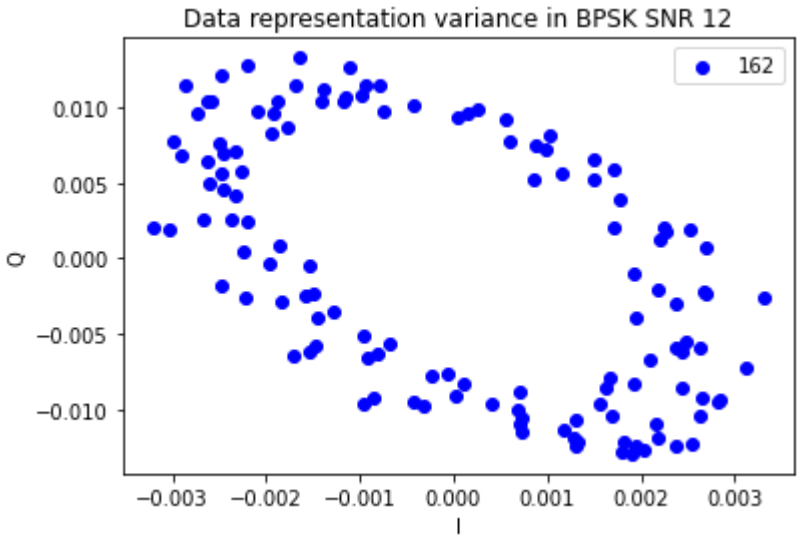

Data representation variance in BPSK SNR 12
160
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
161
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
162
0.010
0.005
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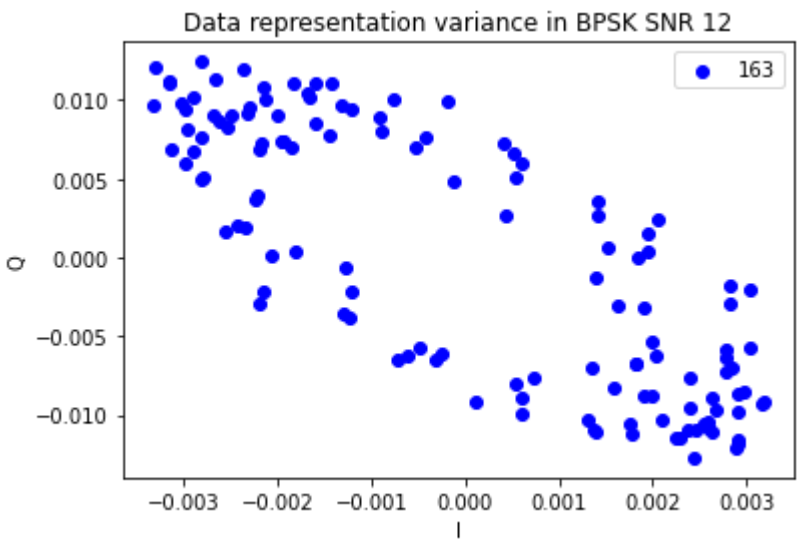
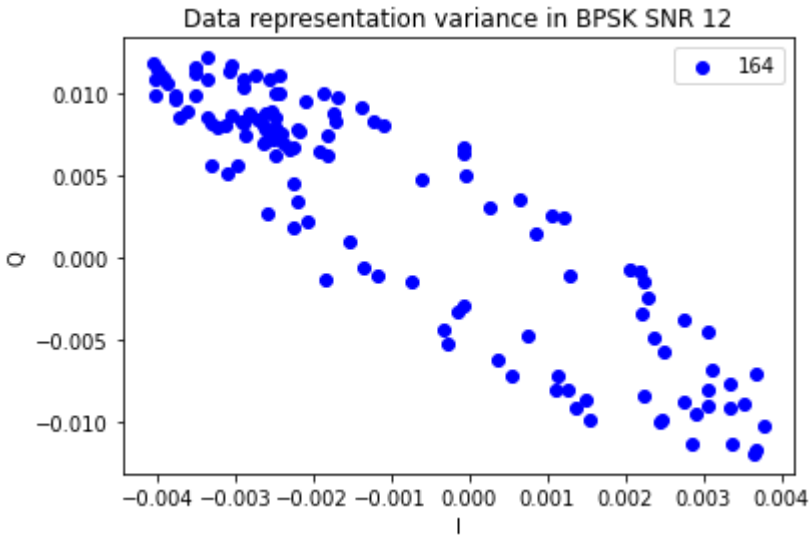
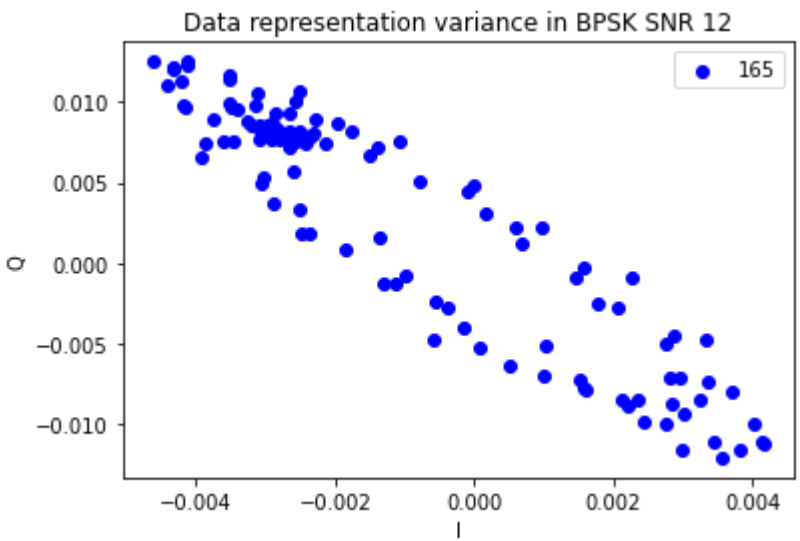
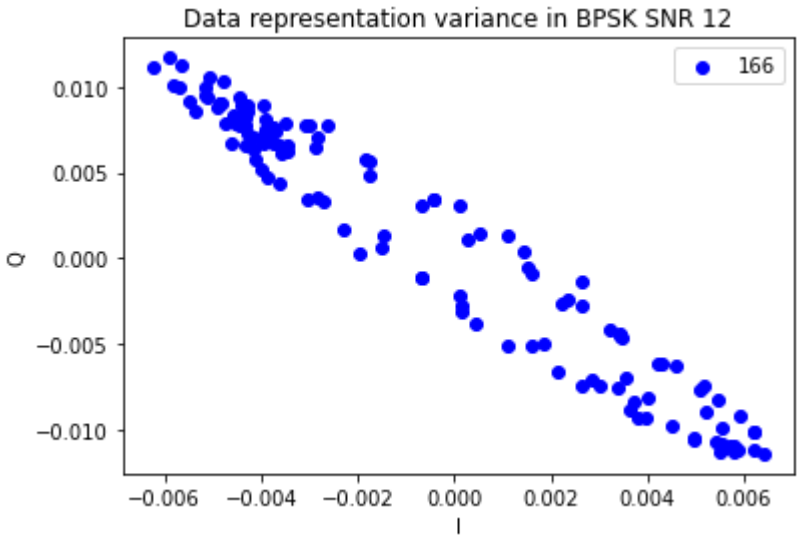
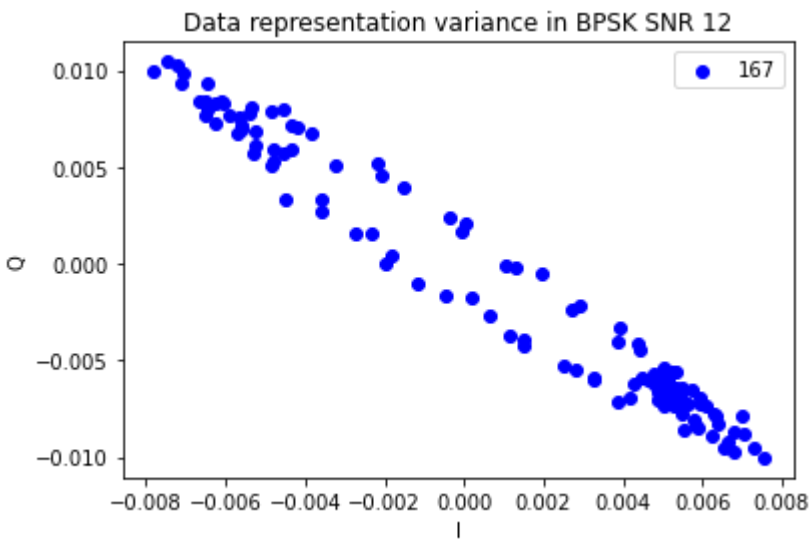
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
163
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
164
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I


Data representation variance in BPSK SNR 12
165
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I


Data representation variance in BPSK SNR 12
166
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
167
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.006
−0.004
−0.002
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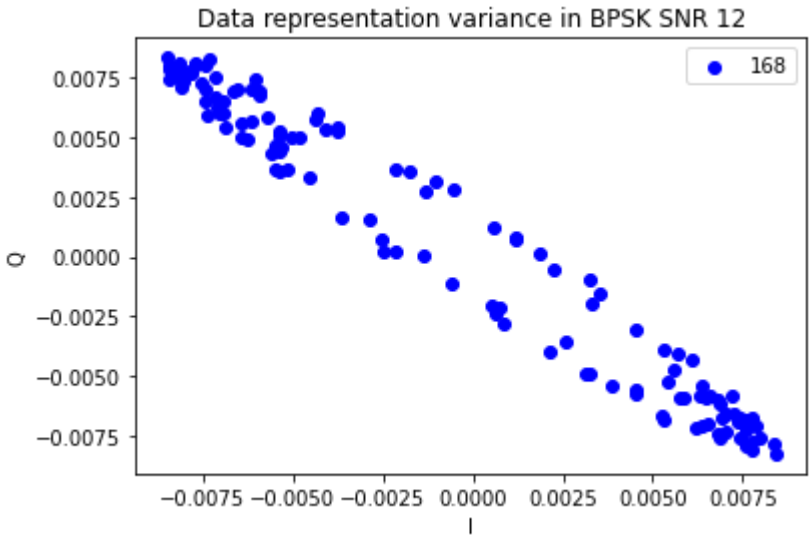
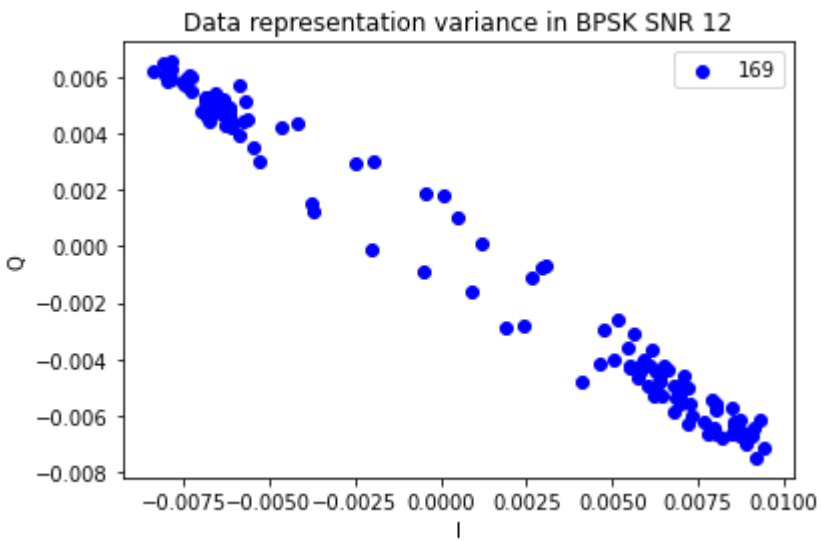
0.002
0.004
0.006
0.008
I


Data representation variance in BPSK SNR 12
168
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
169
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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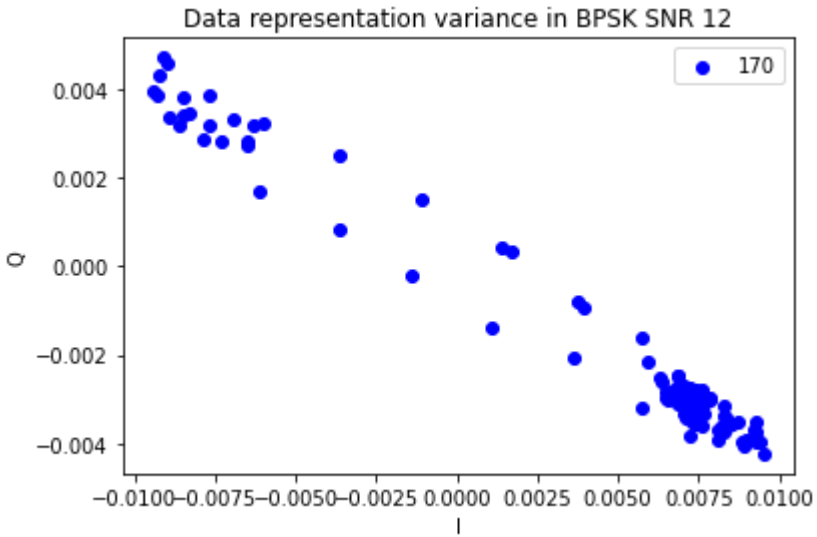
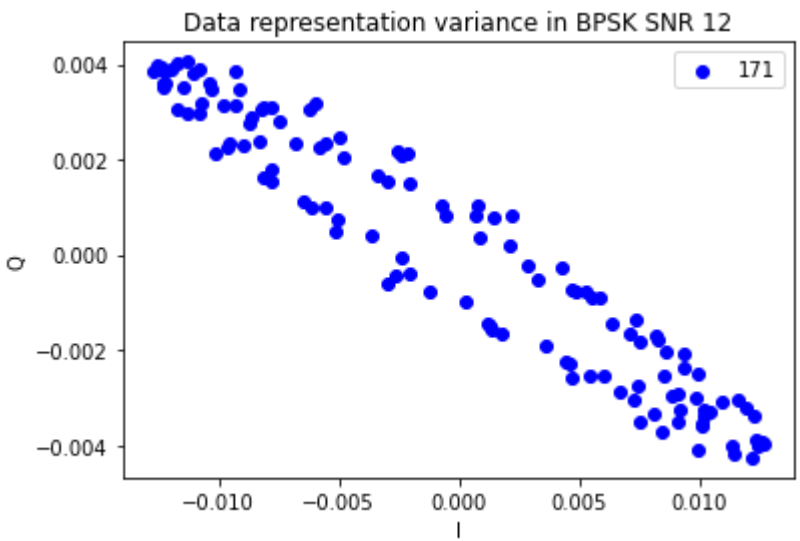
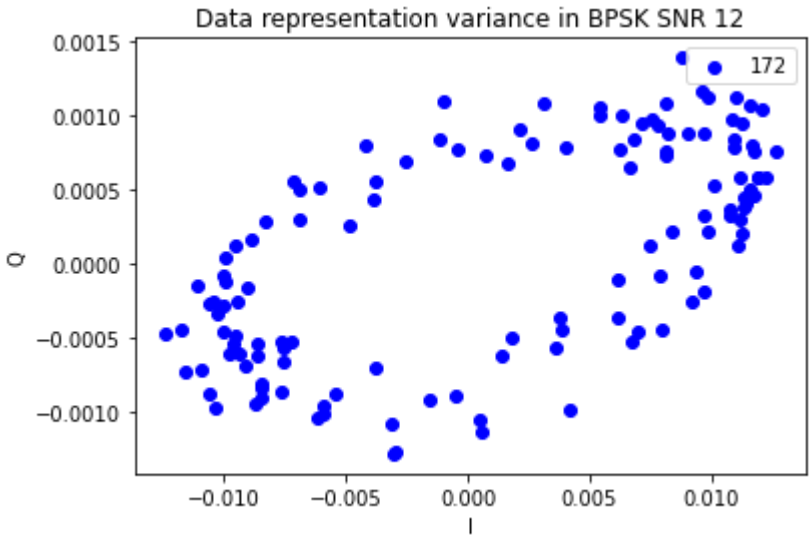

Data representation variance in BPSK SNR 12
170
0.004
0.002
0.000
−0.002
−0.004
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
171
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010 −0.005 0.000 0.005 0.010
I


Data representation variance in BPSK SNR 12
172
0.0015
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0.0005
0.0000
−0.0005
−0.0010
Q
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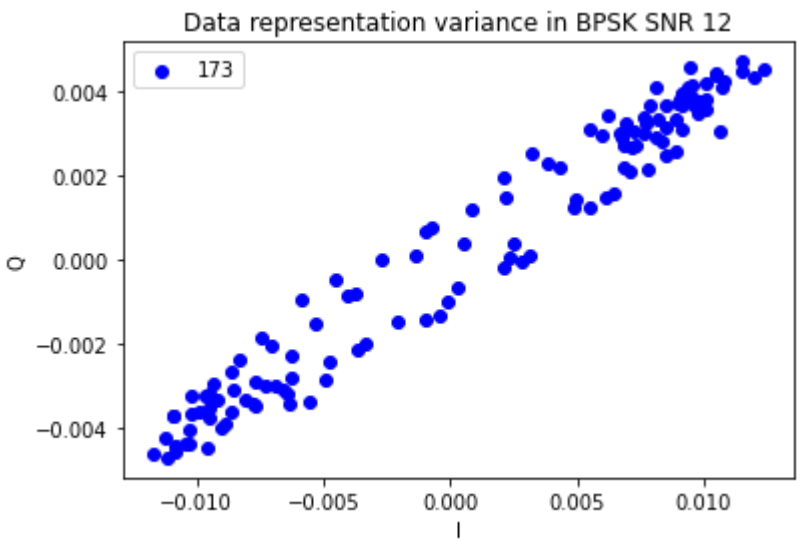
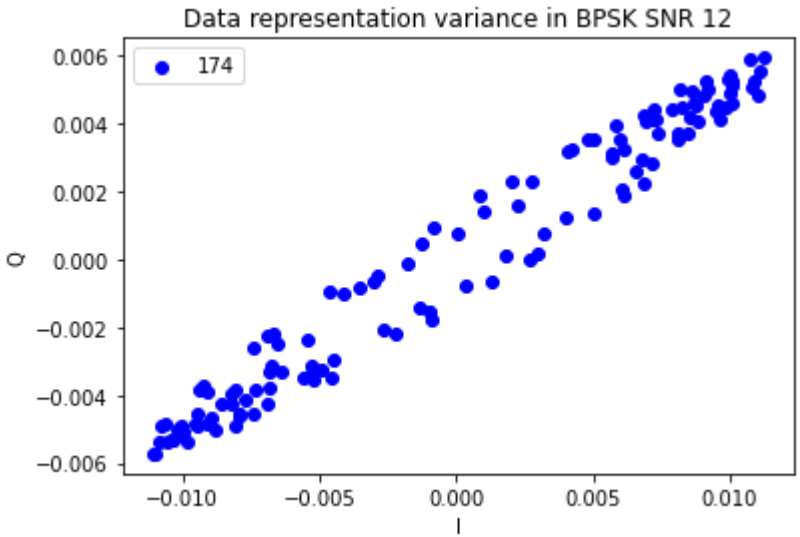
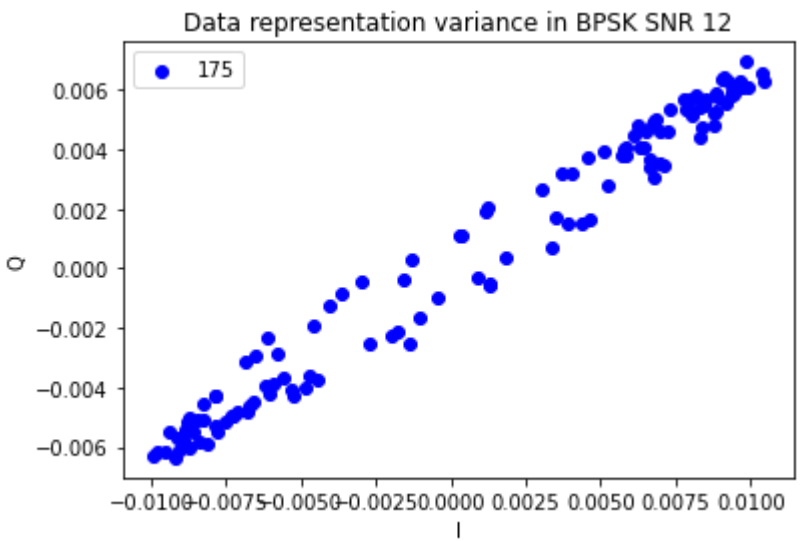
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
173
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
174
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
175
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
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−0.0075
−0.0050
−0.0025
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0.0025
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0.0075
0.0100
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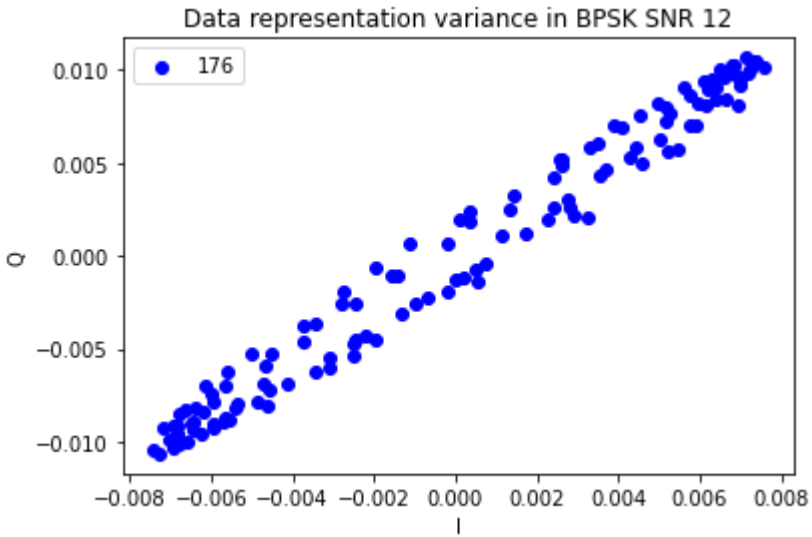
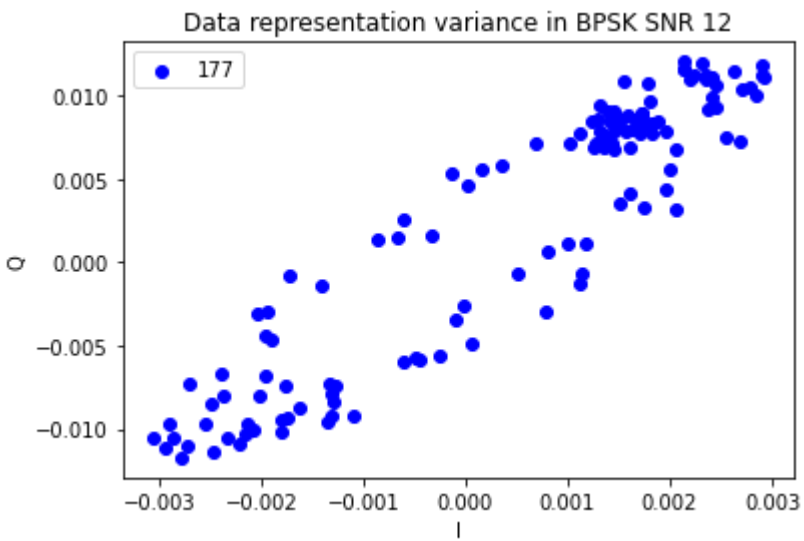
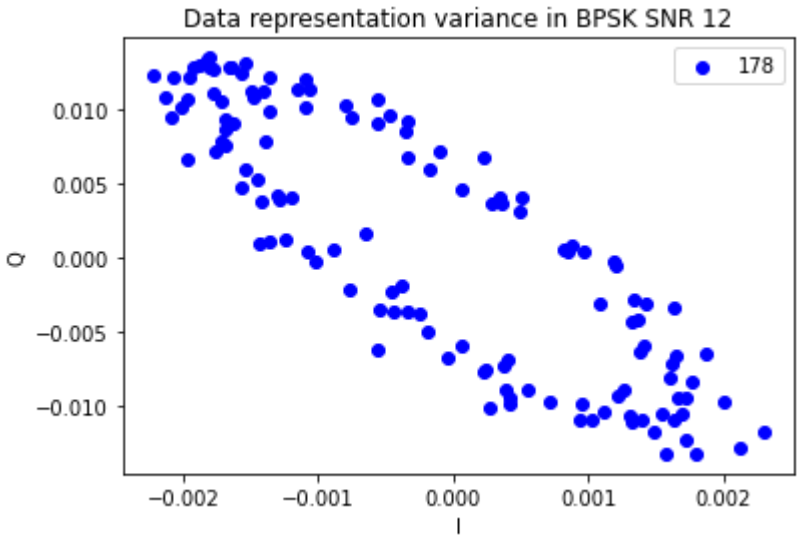
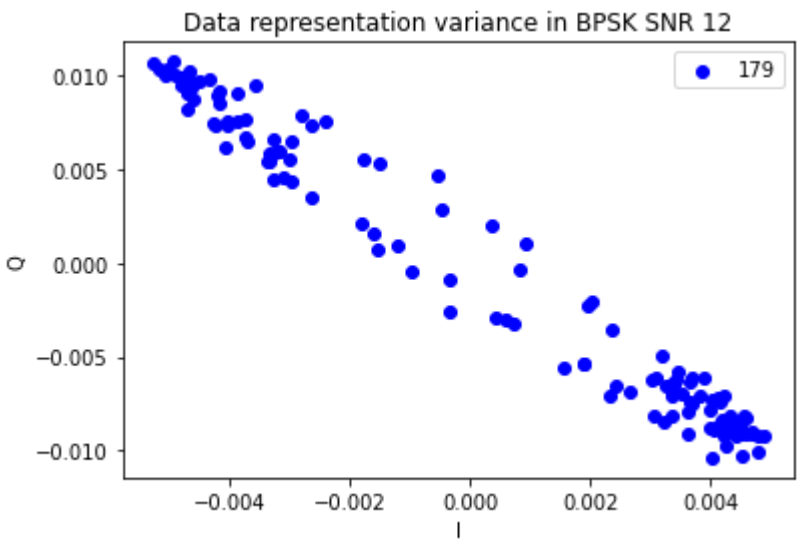
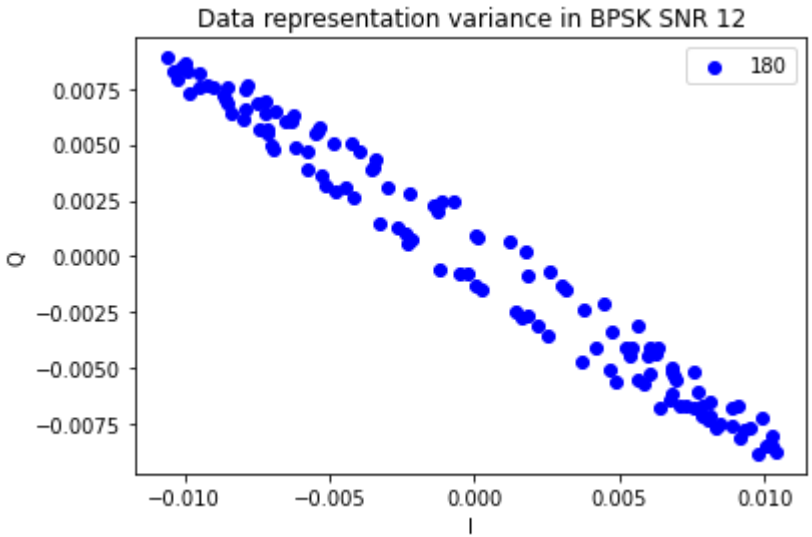
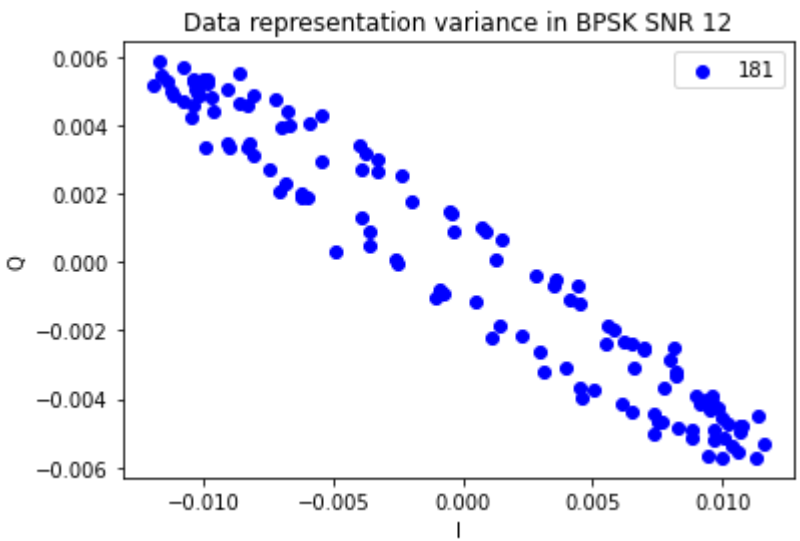

Data representation variance in BPSK SNR 12
176
0.010
0.005
0.000
−0.005
−0.010
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

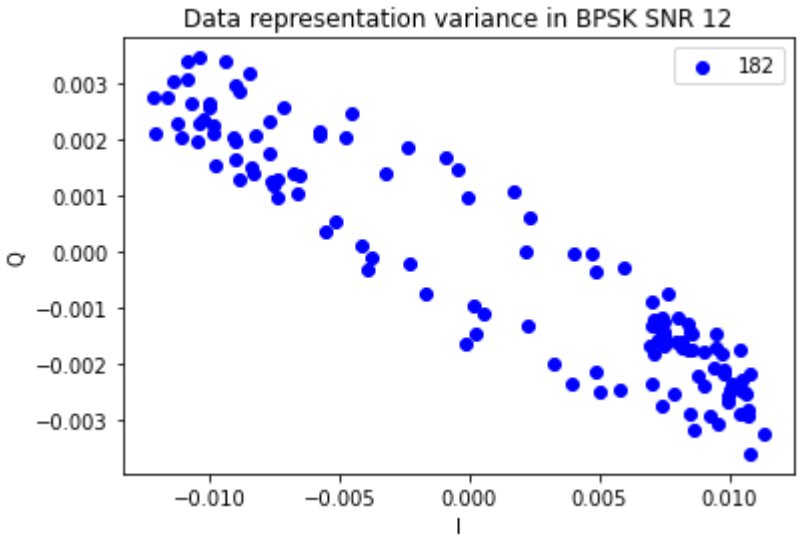

Data representation variance in BPSK SNR 12
177
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002 0.003
I


Data representation variance in BPSK SNR 12
178
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
179
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
180
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
181
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
182
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0.002
0.001
0.000
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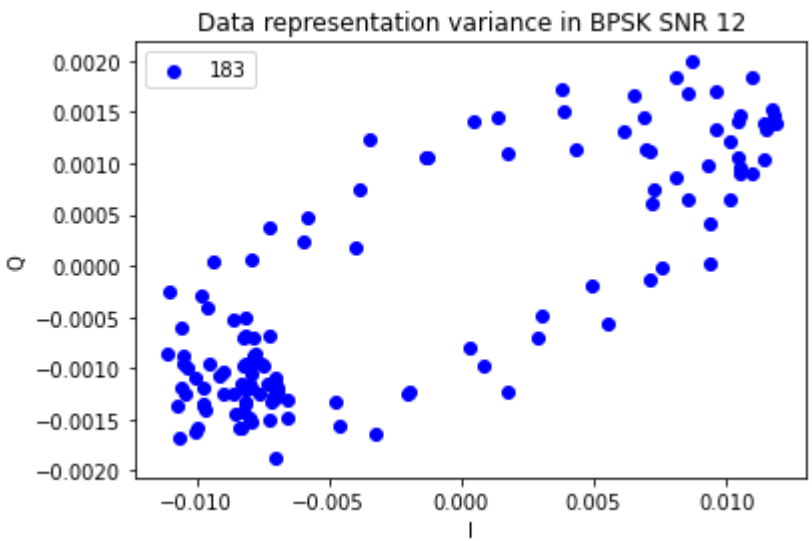
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
183
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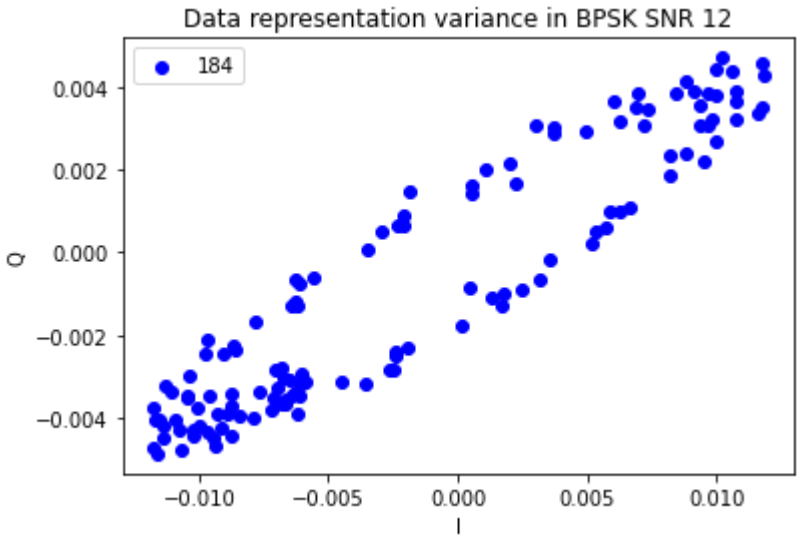
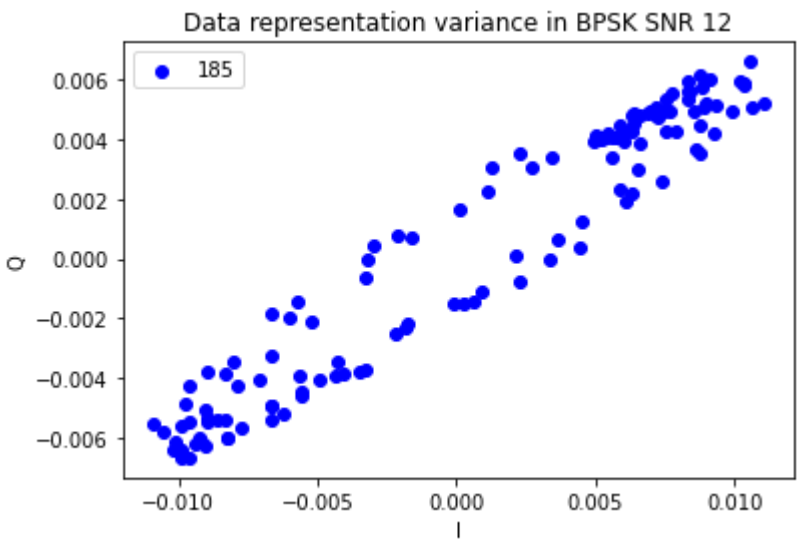
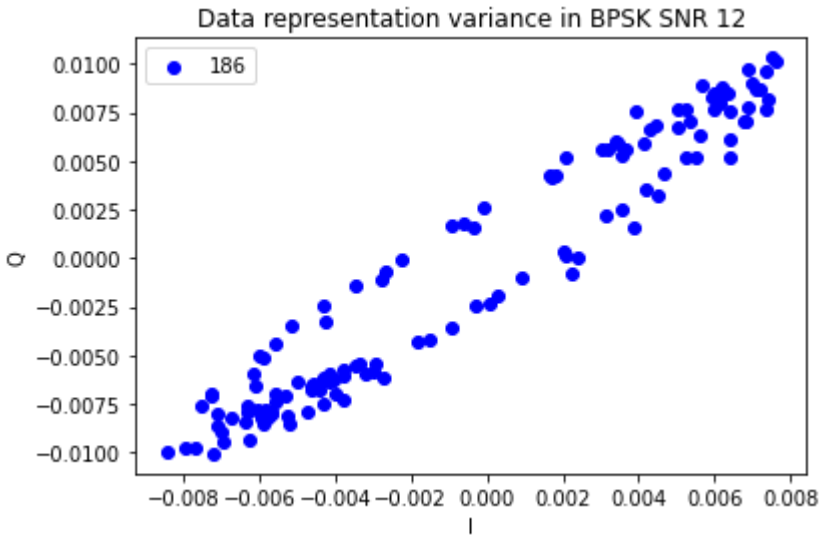
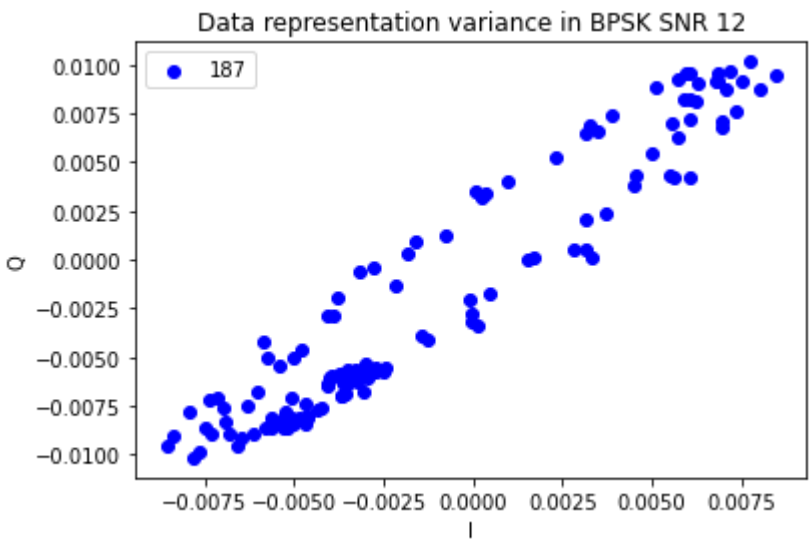
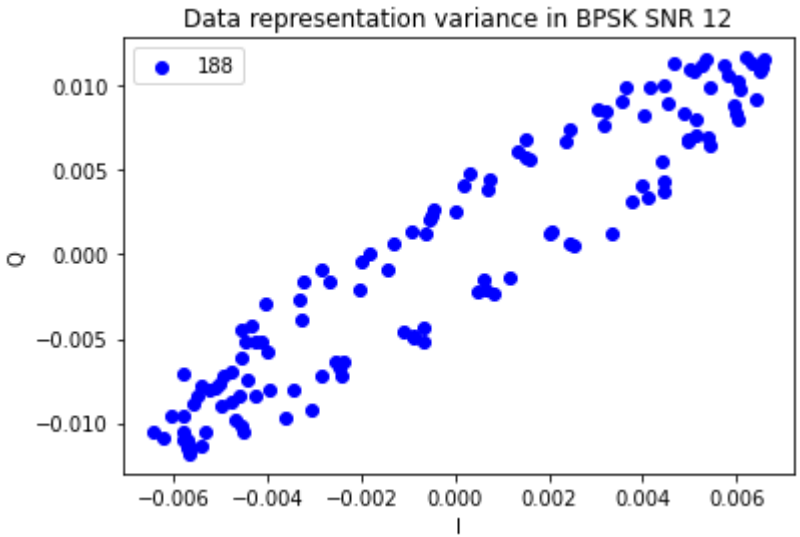
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
−0.0020
Q
−0.010
−0.005
0.000
0.005
0.010
I

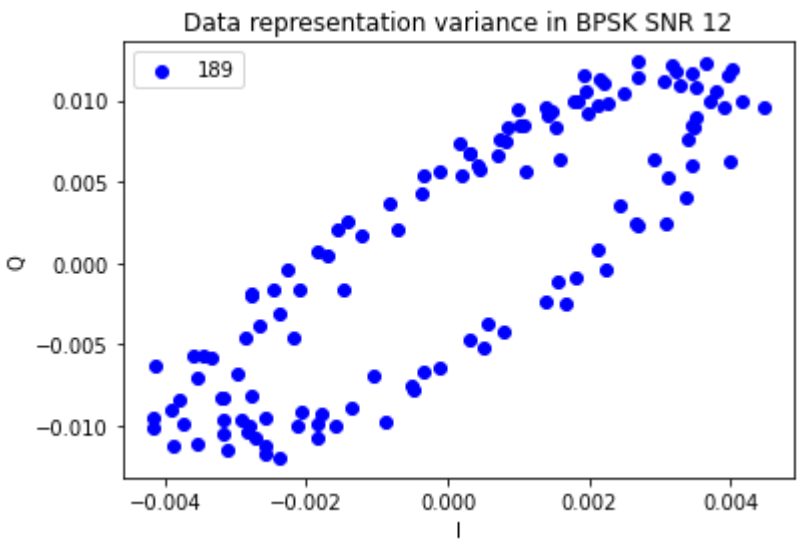

Data representation variance in BPSK SNR 12
184
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

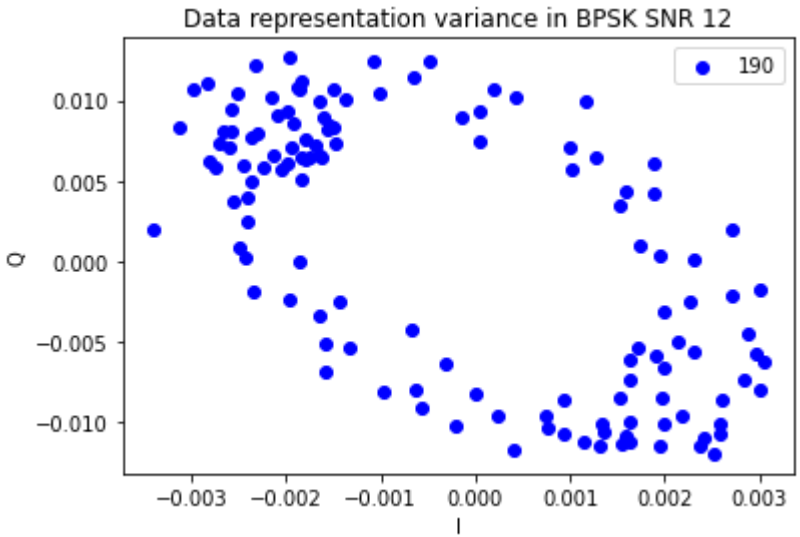

Data representation variance in BPSK SNR 12
185
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

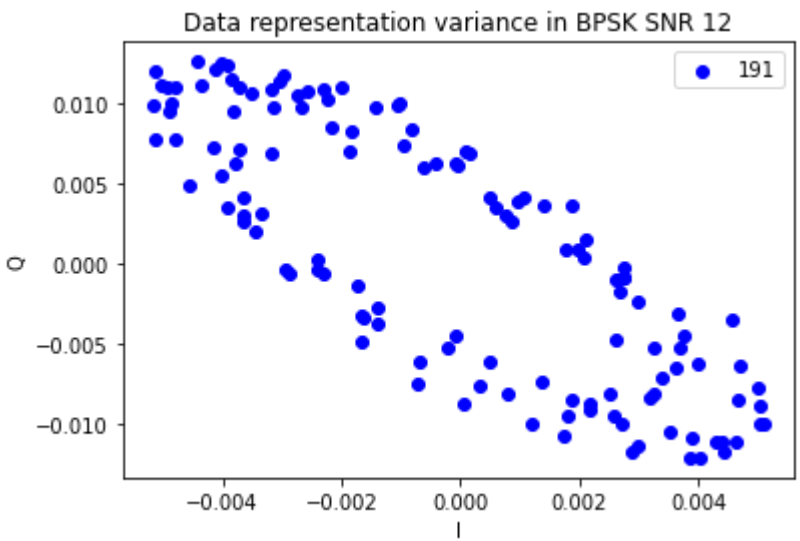

Data representation variance in BPSK SNR 12
186
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

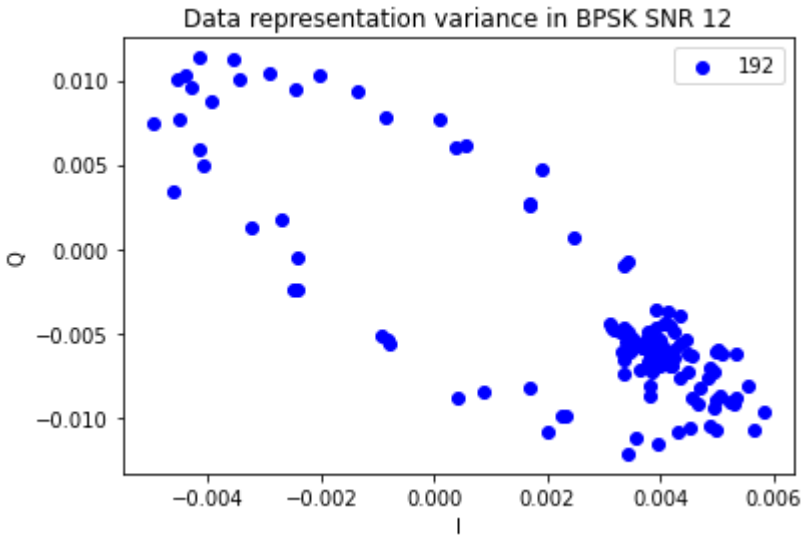

Data representation variance in BPSK SNR 12
187
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

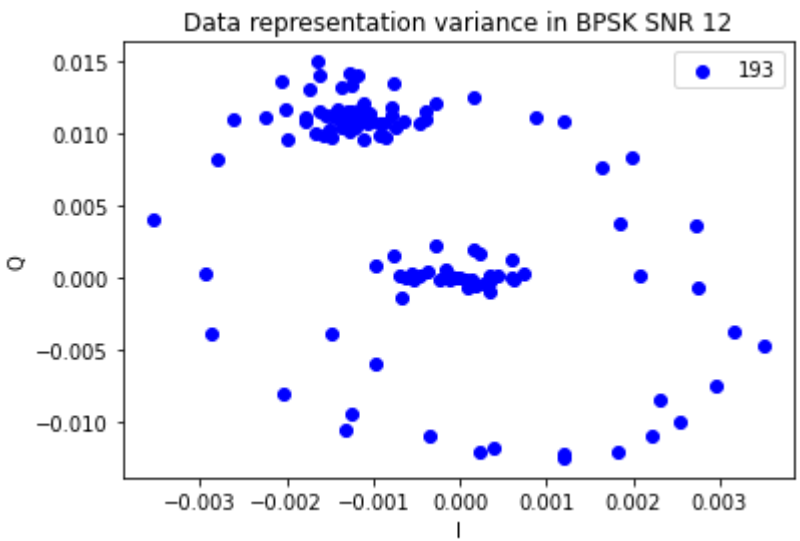

Data representation variance in BPSK SNR 12
188
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

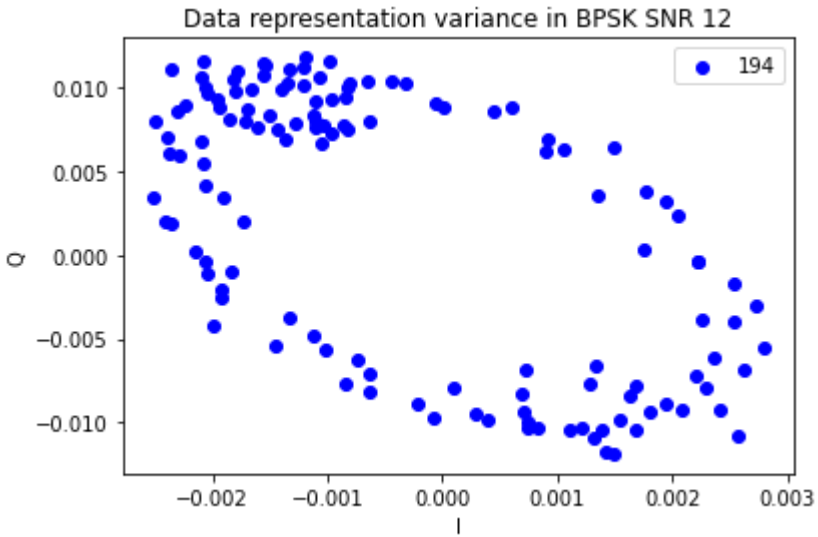

Data representation variance in BPSK SNR 12
189
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

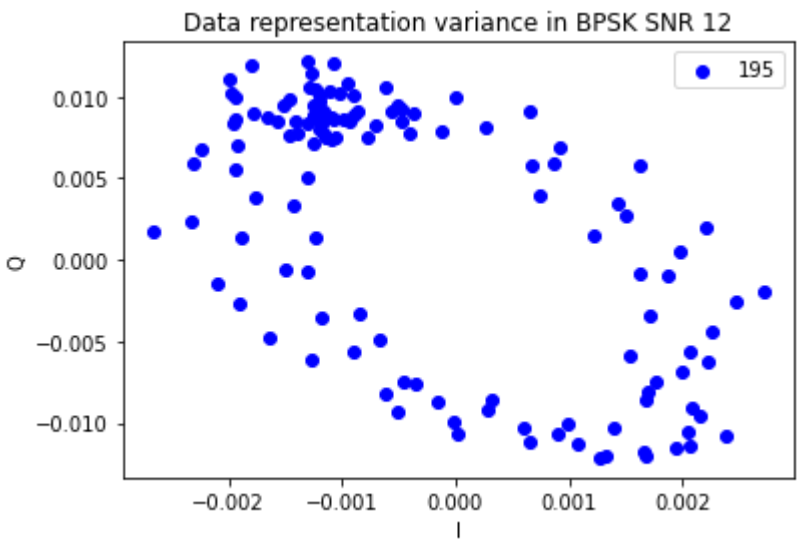

Data representation variance in BPSK SNR 12
190
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

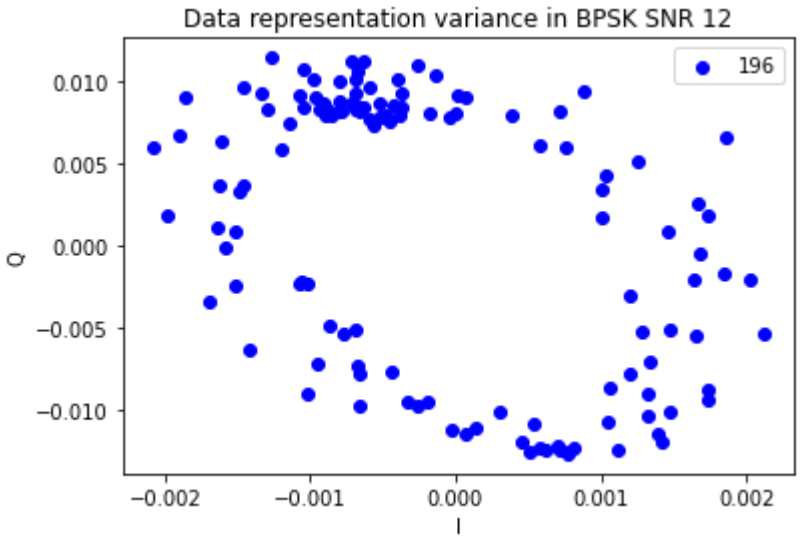

Data representation variance in BPSK SNR 12
191
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

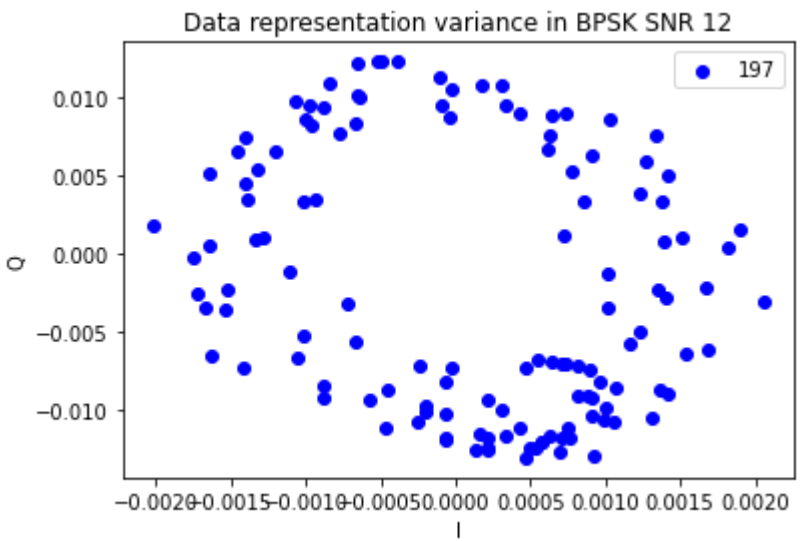

Data representation variance in BPSK SNR 12
192
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
193
0.015
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
194
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
195
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
196
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
197
0.010
0.005
0.000
−0.005
−0.010
Q
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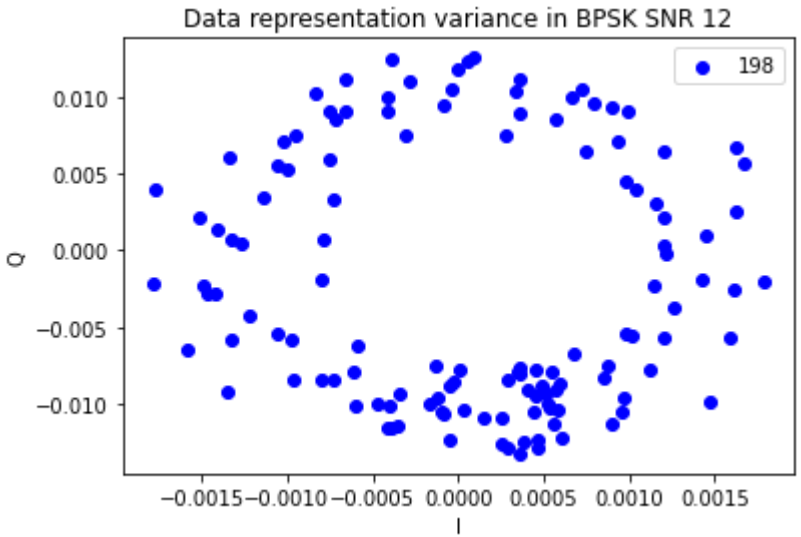
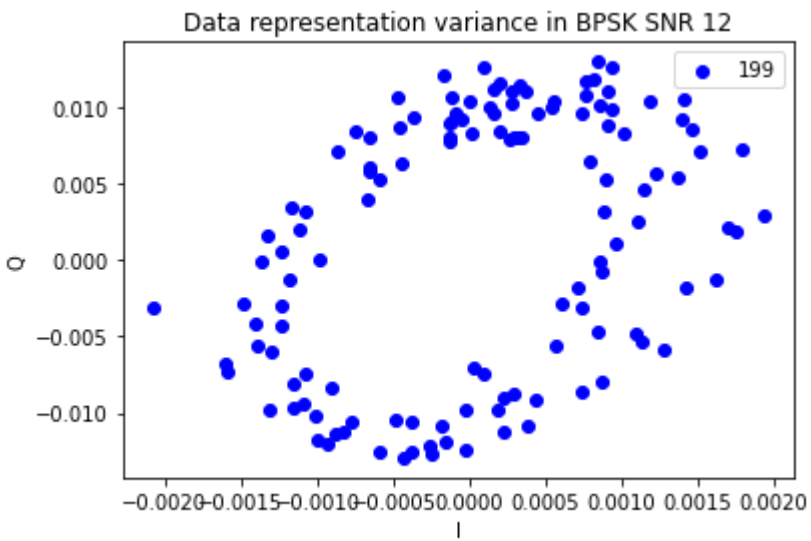
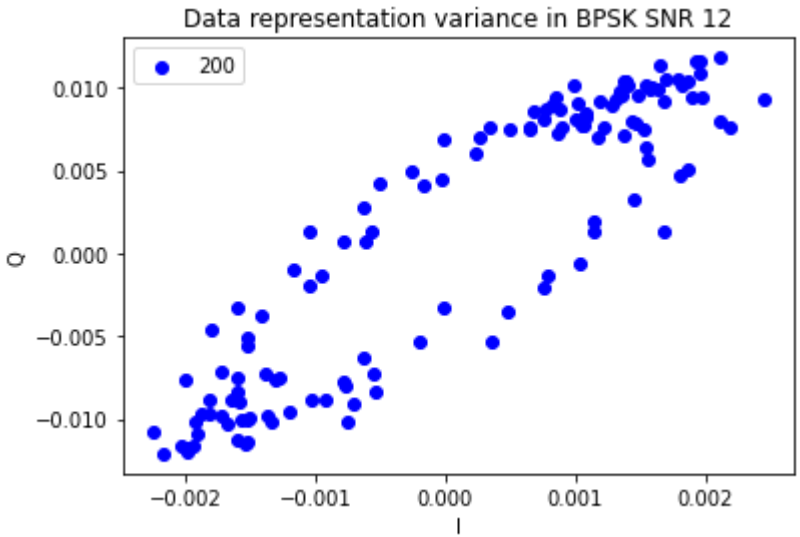
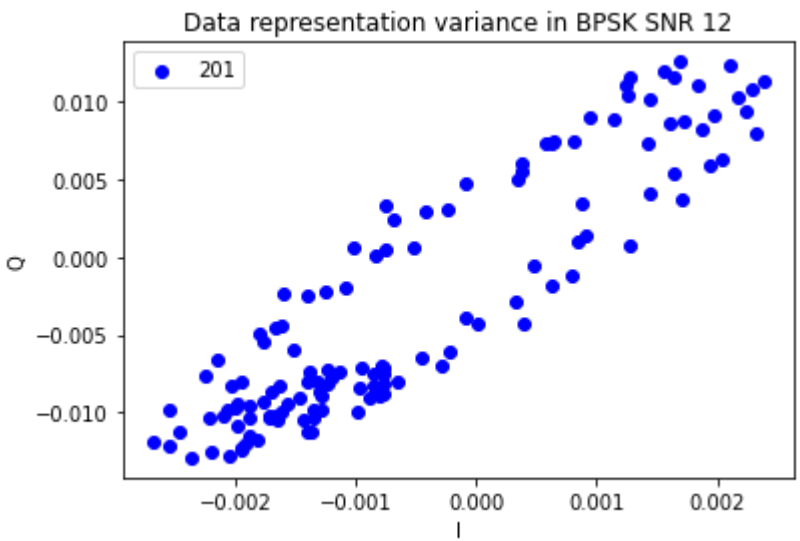
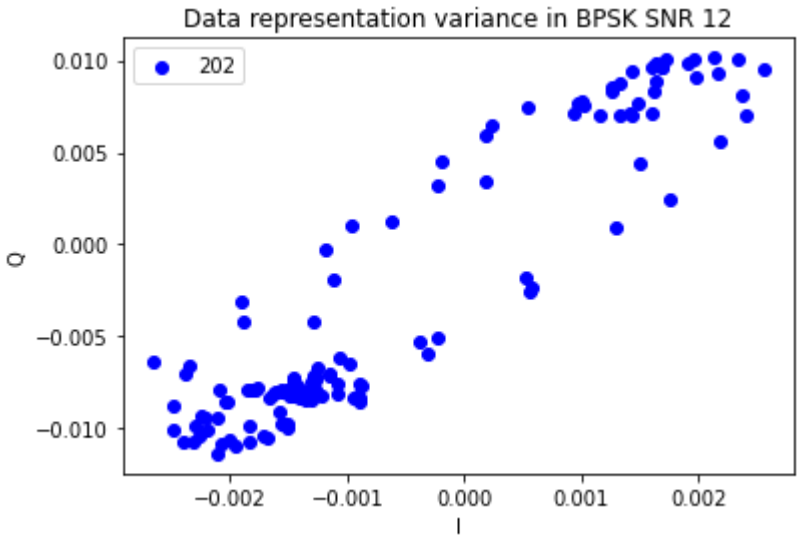
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
0.0020
I

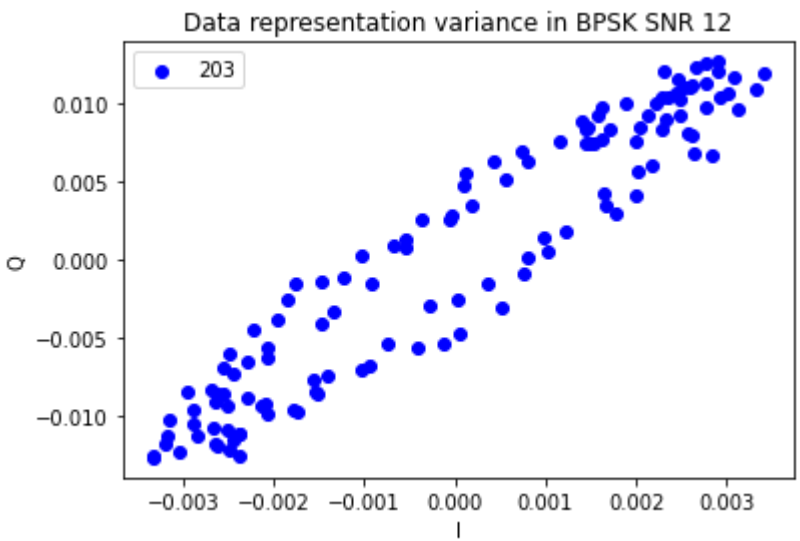

Data representation variance in BPSK SNR 12
198
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
I

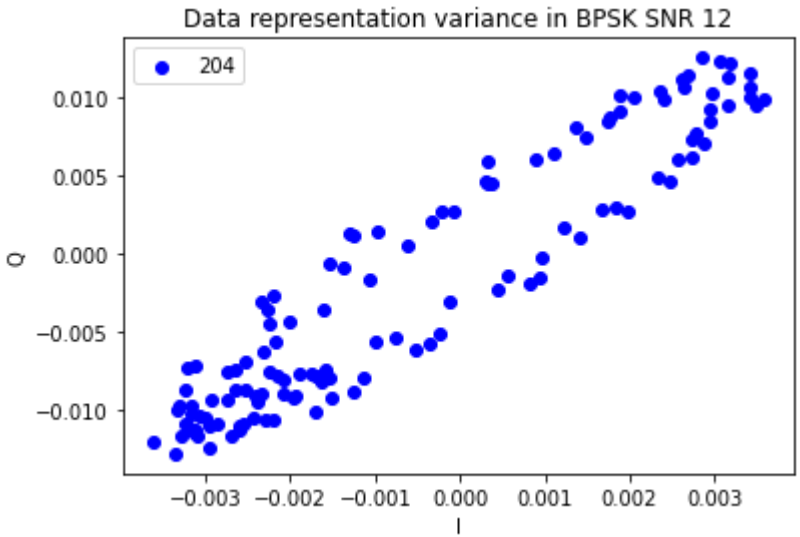

Data representation variance in BPSK SNR 12
199
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
I

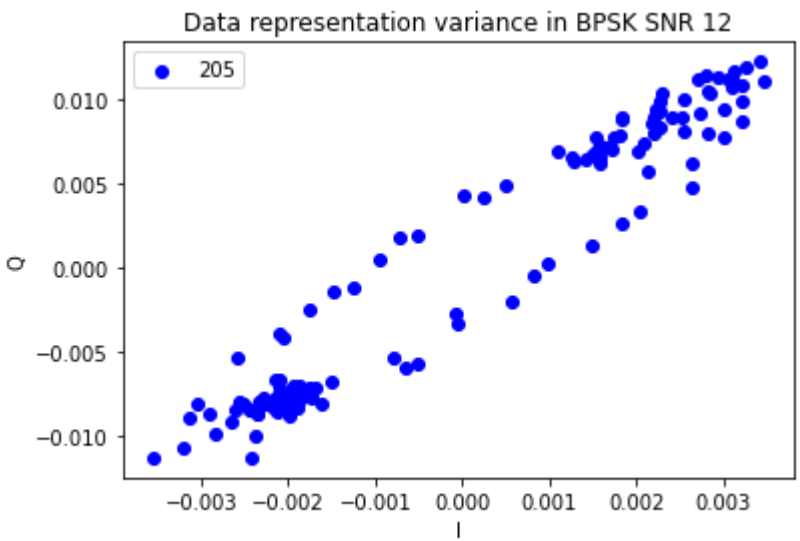

Data representation variance in BPSK SNR 12
200
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

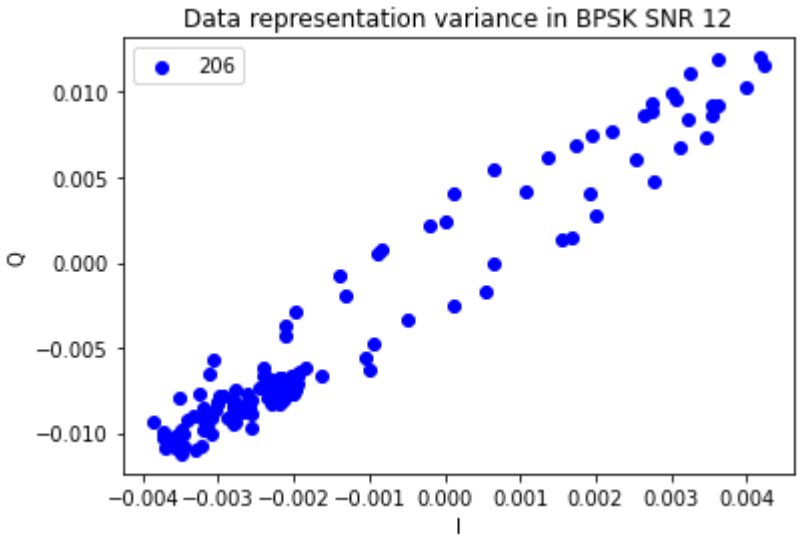

Data representation variance in BPSK SNR 12
201
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

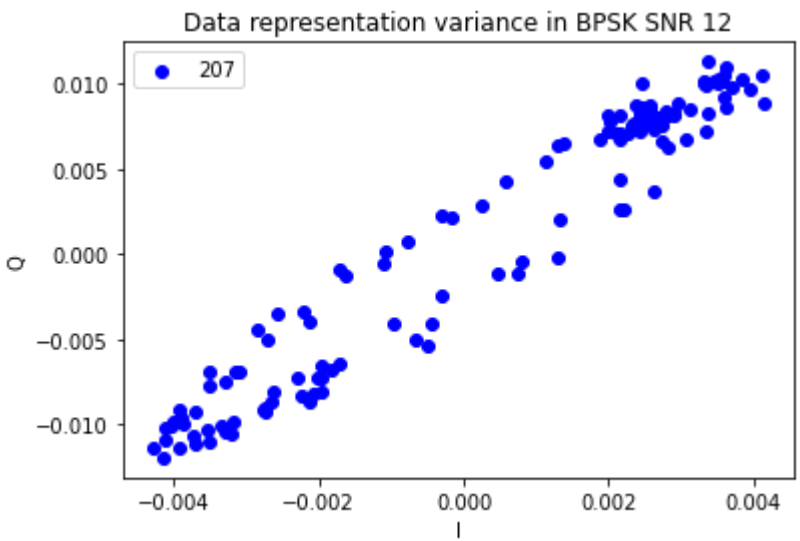

Data representation variance in BPSK SNR 12
202
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

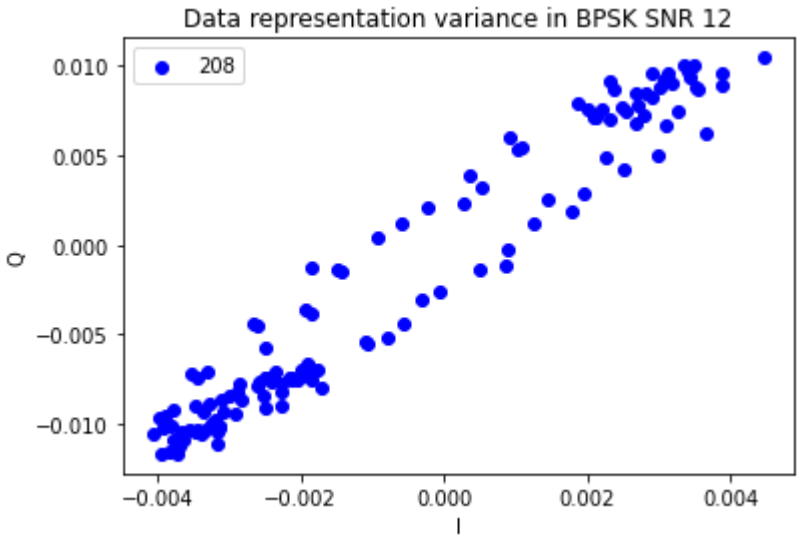

Data representation variance in BPSK SNR 12
203
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

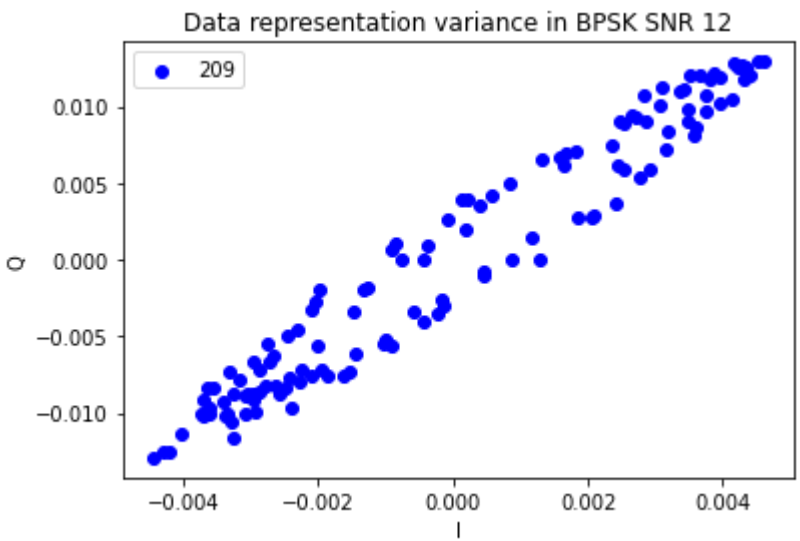

Data representation variance in BPSK SNR 12
204
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

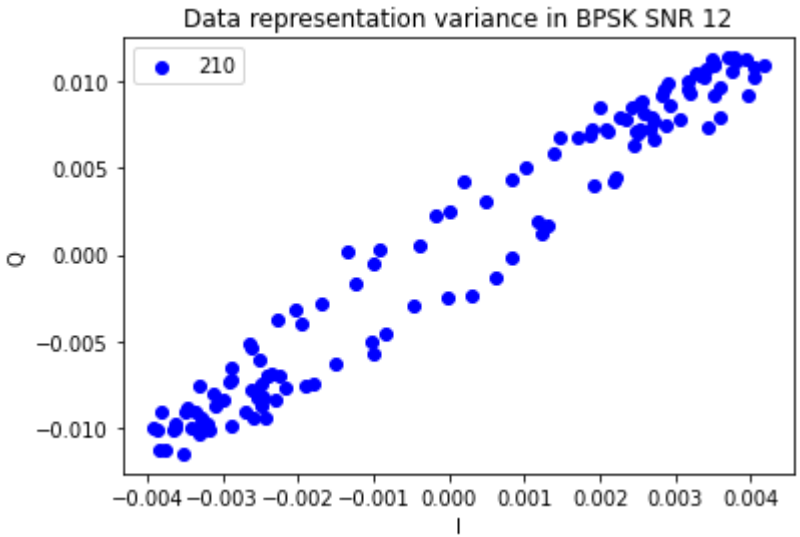

Data representation variance in BPSK SNR 12
205
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

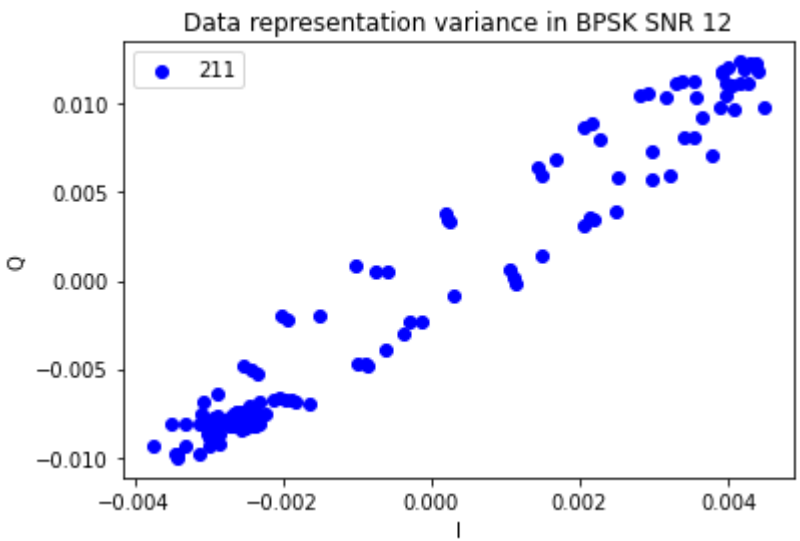

Data representation variance in BPSK SNR 12
206
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

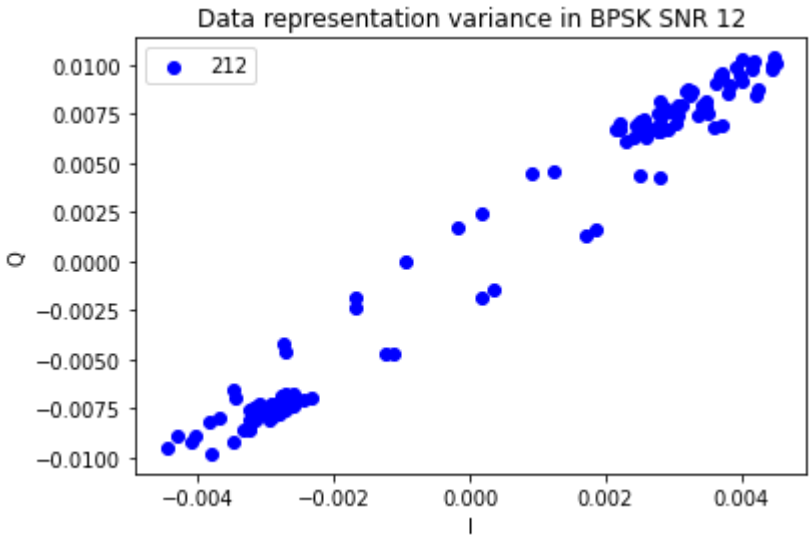

Data representation variance in BPSK SNR 12
207
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I

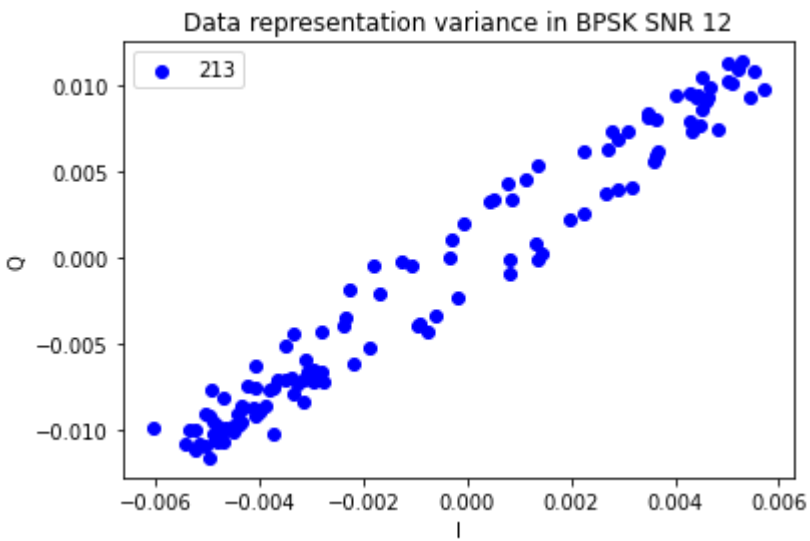

Data representation variance in BPSK SNR 12
208
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

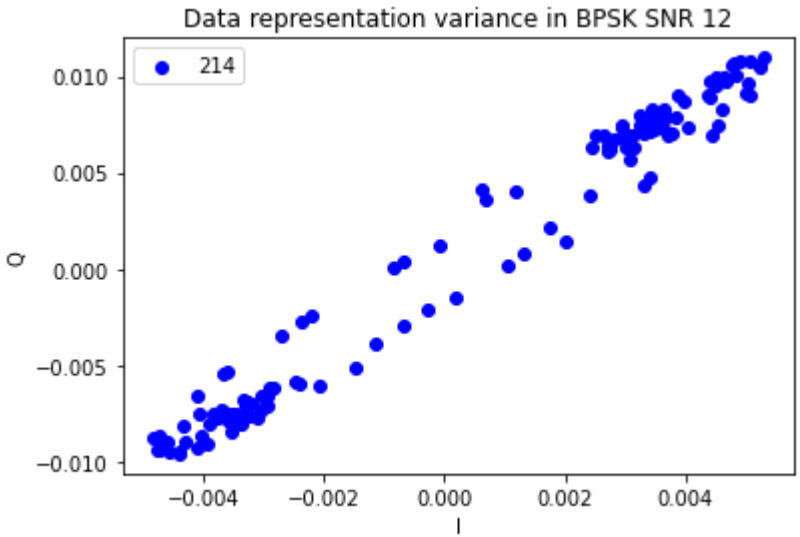

Data representation variance in BPSK SNR 12
209
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

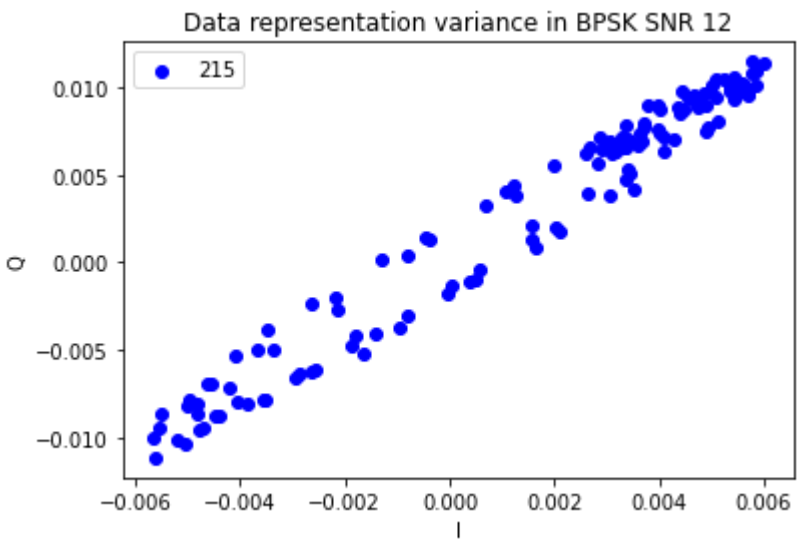

Data representation variance in BPSK SNR 12
210
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I


Data representation variance in BPSK SNR 12
211
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I


Data representation variance in BPSK SNR 12
212
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
213
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
214
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
215
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
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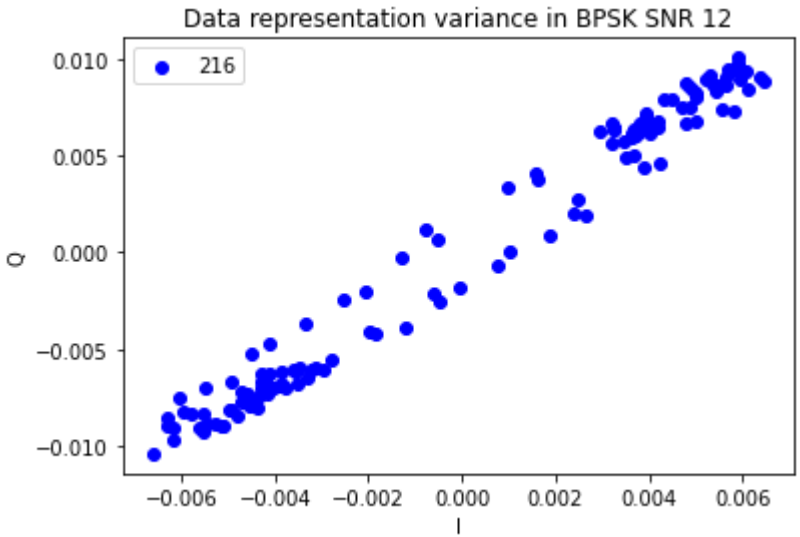
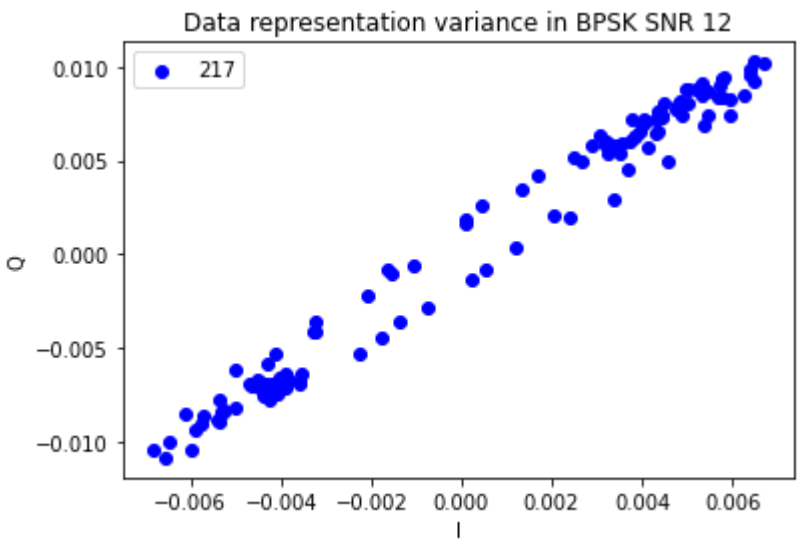
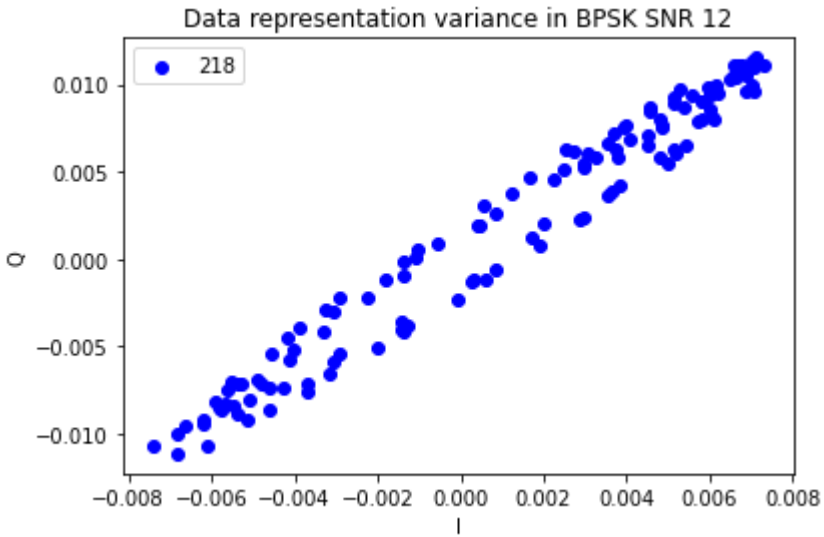
I


Data representation variance in BPSK SNR 12
216
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
217
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
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0.010
0.005
0.000
−0.005
−0.010
Q
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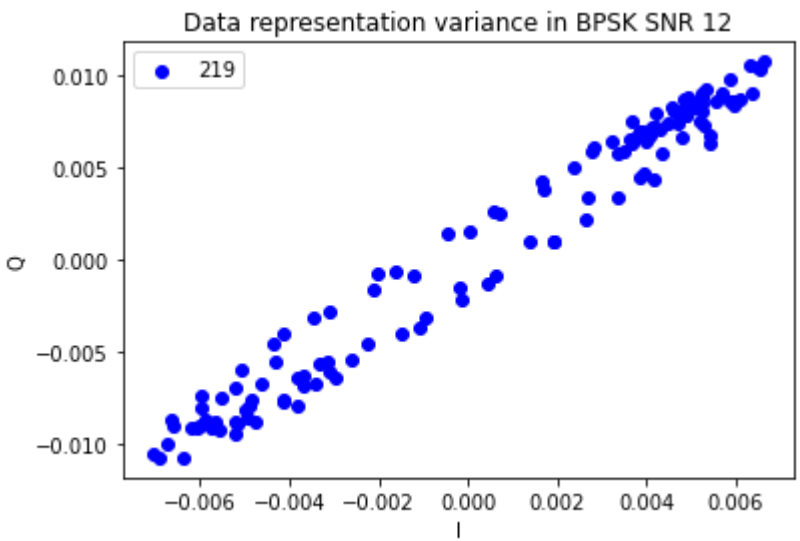
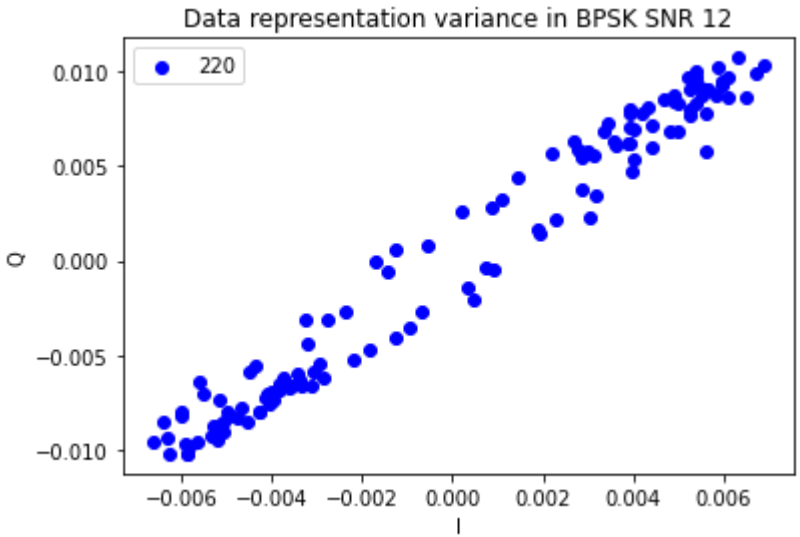
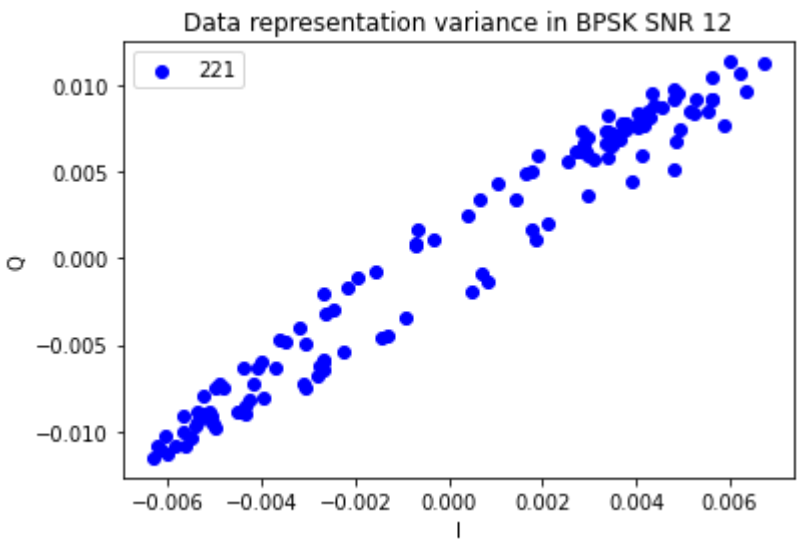
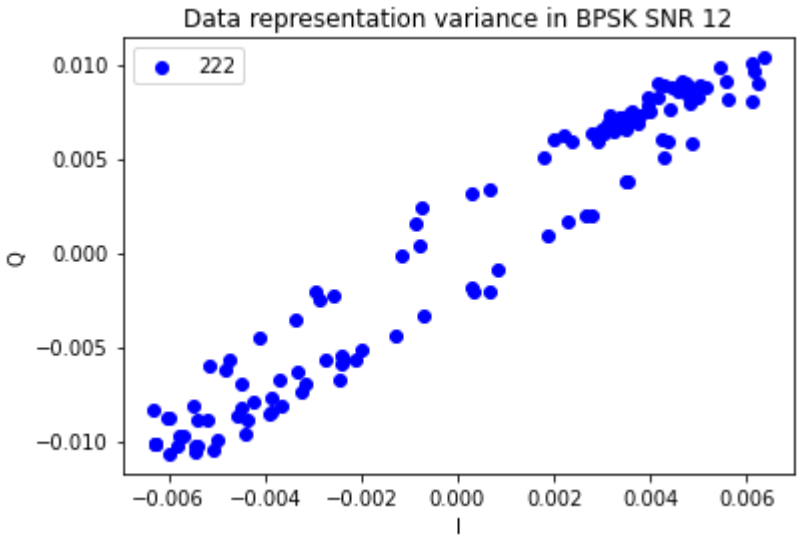
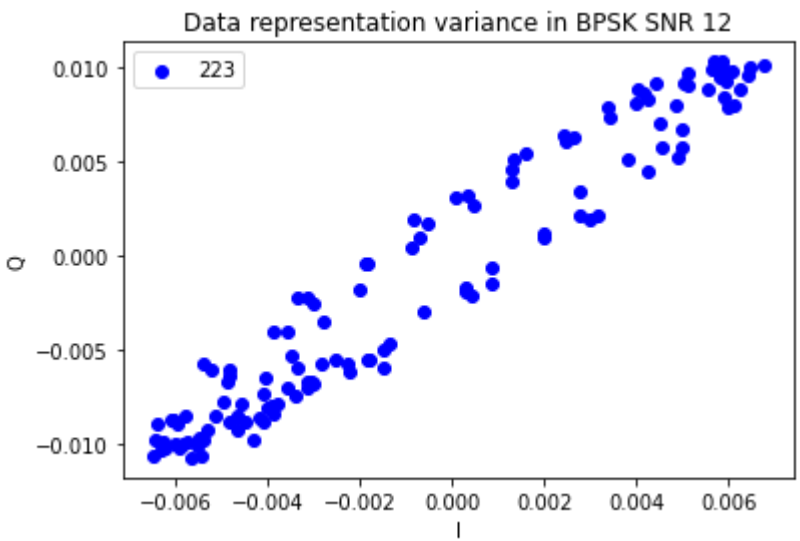
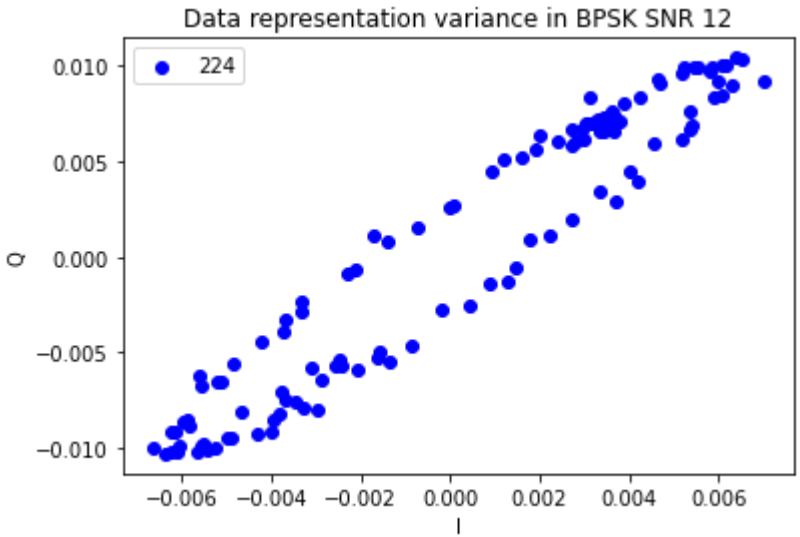

Data representation variance in BPSK SNR 12
219
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I

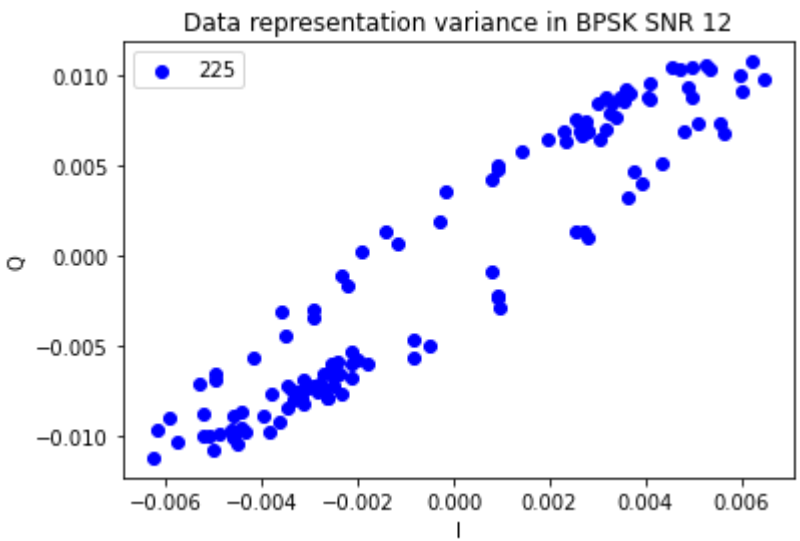

Data representation variance in BPSK SNR 12
220
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

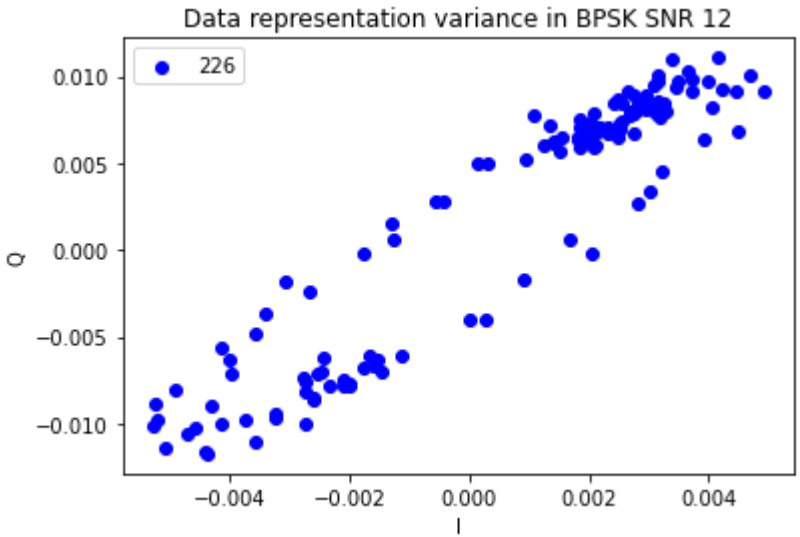

Data representation variance in BPSK SNR 12
221
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

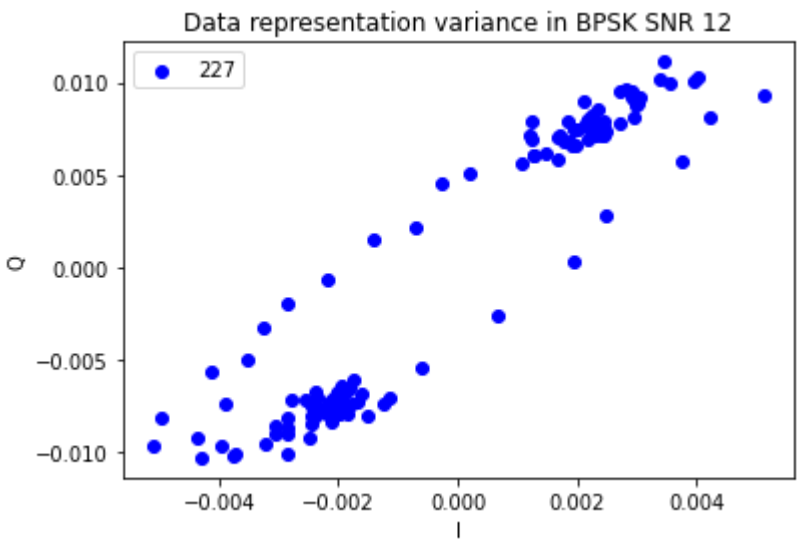

Data representation variance in BPSK SNR 12
222
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

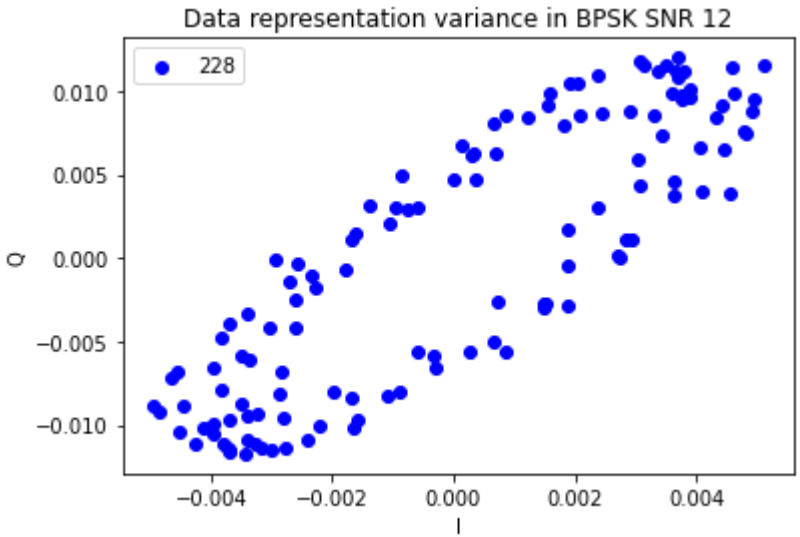

Data representation variance in BPSK SNR 12
223
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
224
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
225
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
226
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
227
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
228
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
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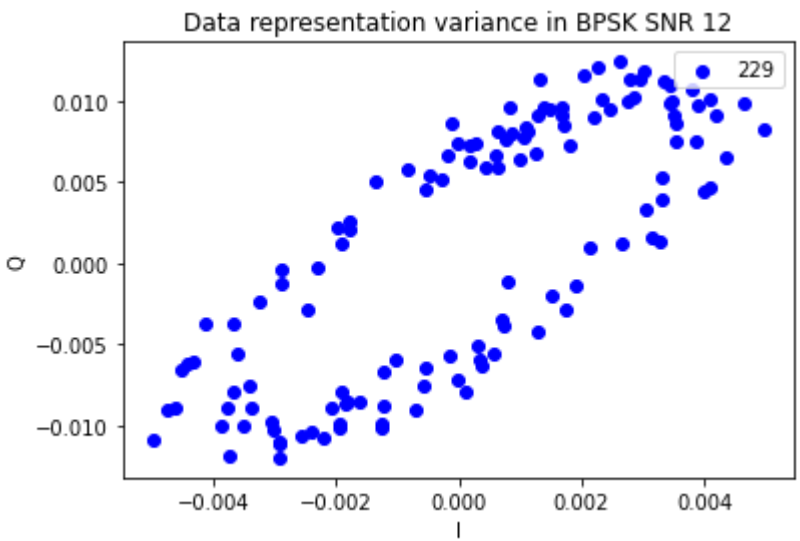
Data representation variance in BPSK SNR 12
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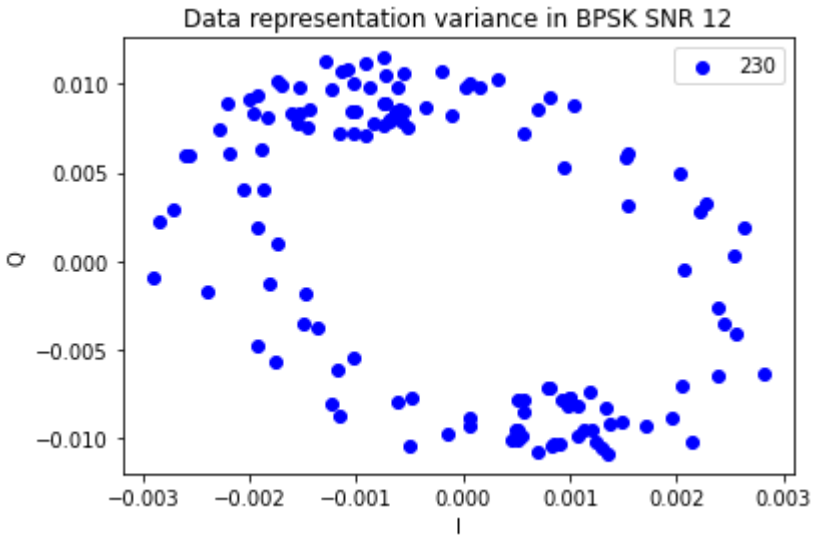
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
230
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
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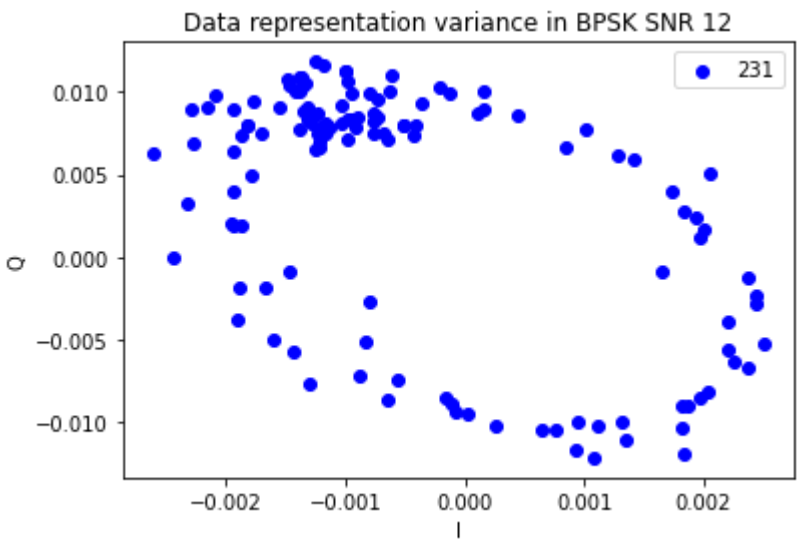
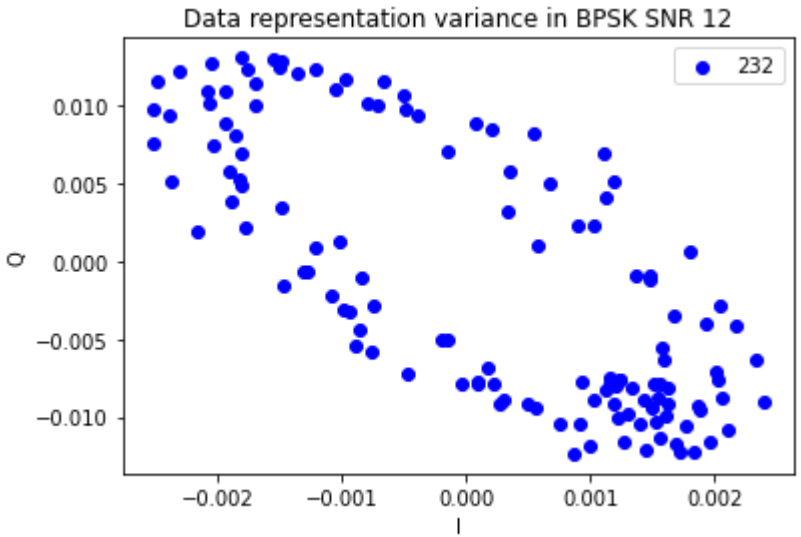

Data representation variance in BPSK SNR 12
231
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
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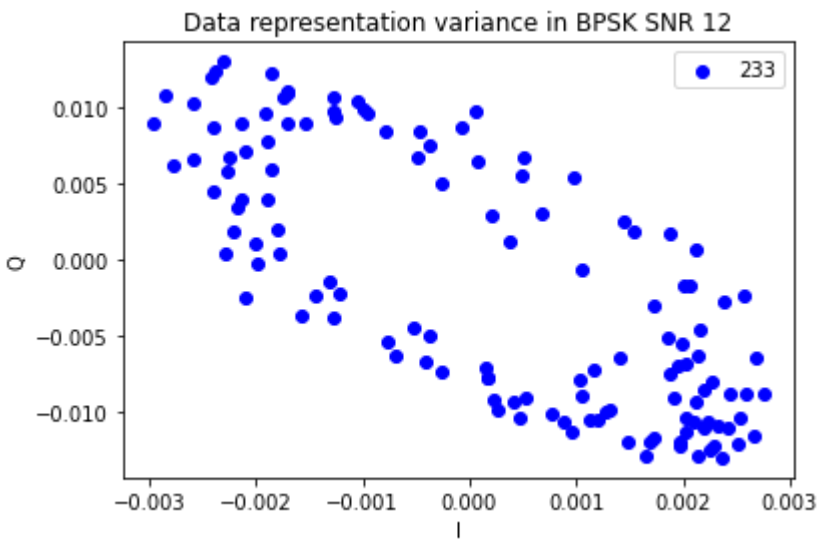
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
233
0.010
0.005
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−0.005
−0.010
Q
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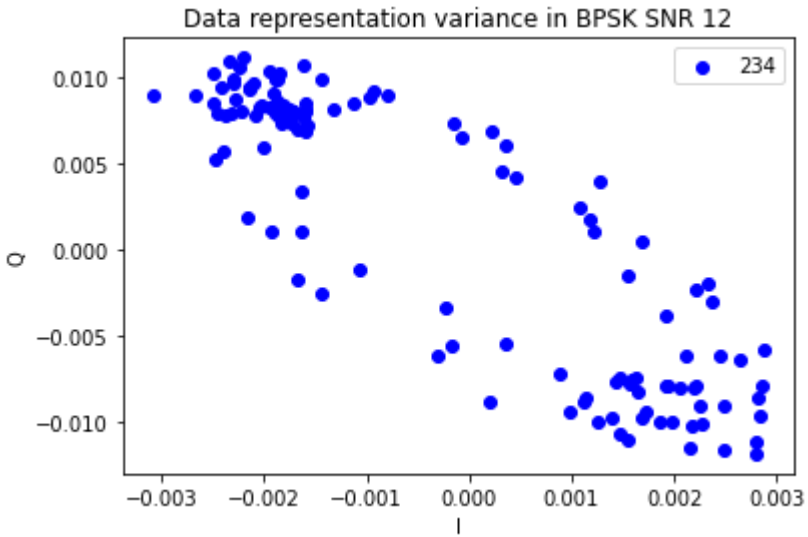
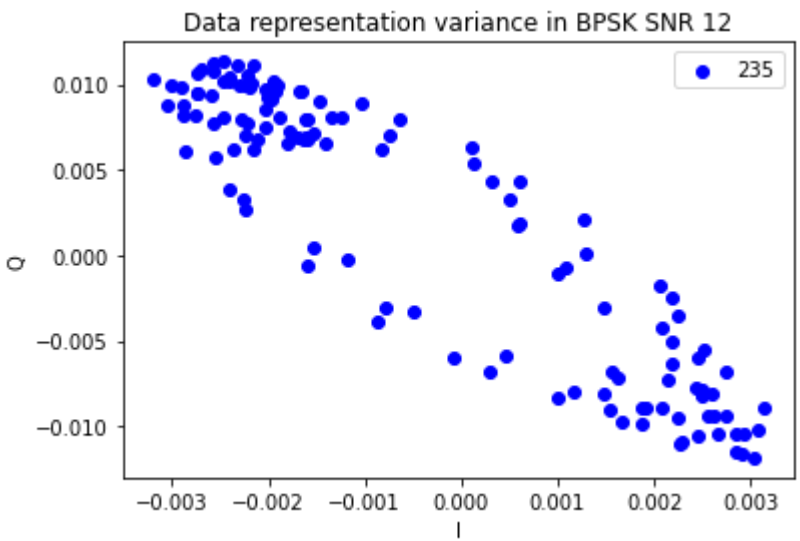
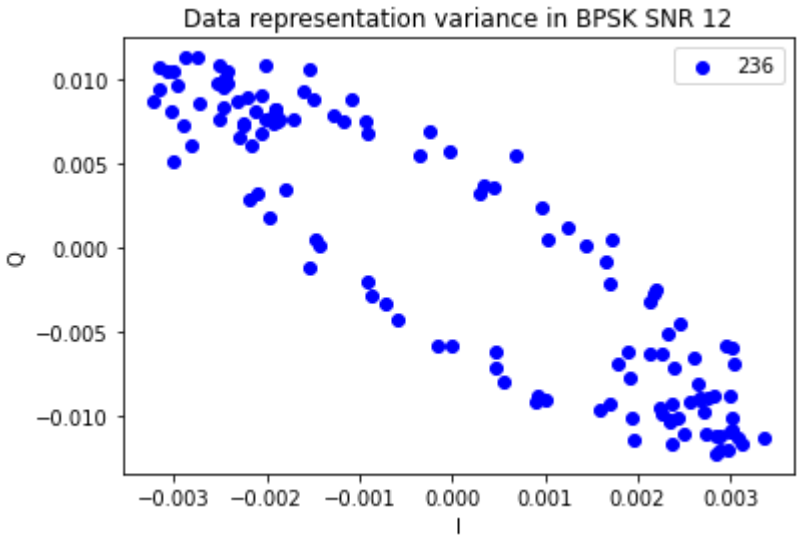
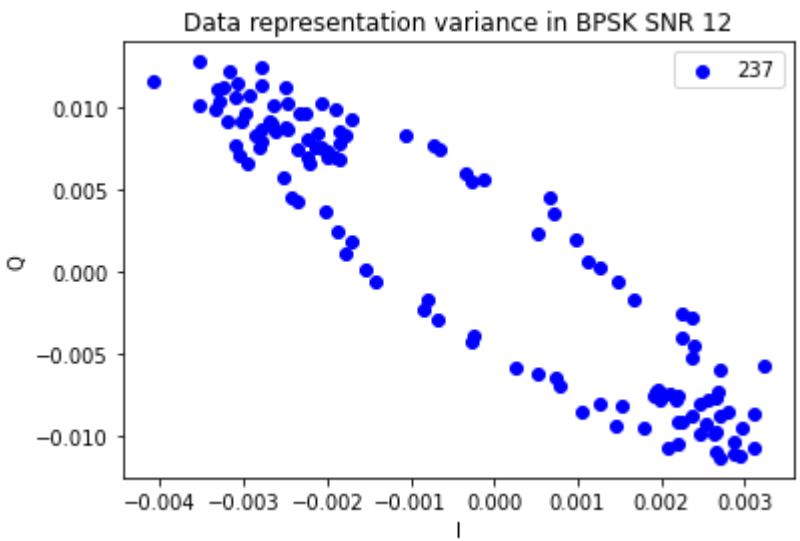
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
234
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
235
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
236
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
237
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.003
−0.002
−0.001
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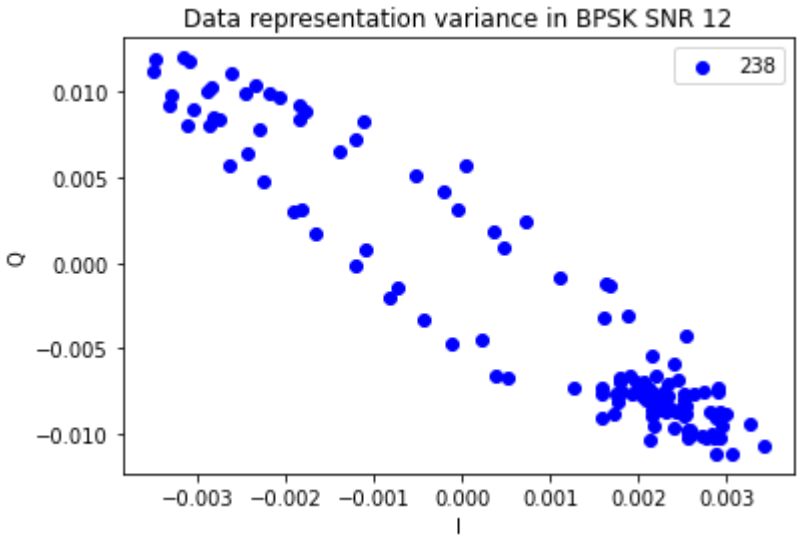
0.003
I


Data representation variance in BPSK SNR 12
238
0.010
0.005
0.000
−0.005
−0.010
Q
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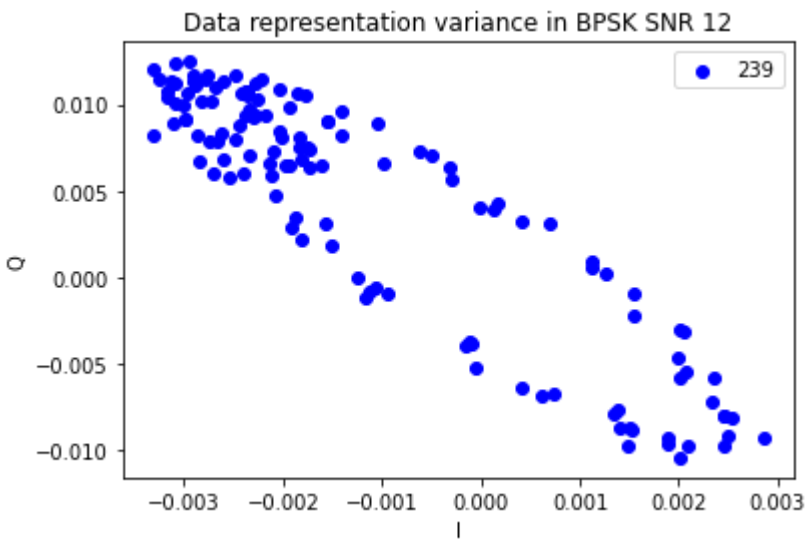
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
239
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
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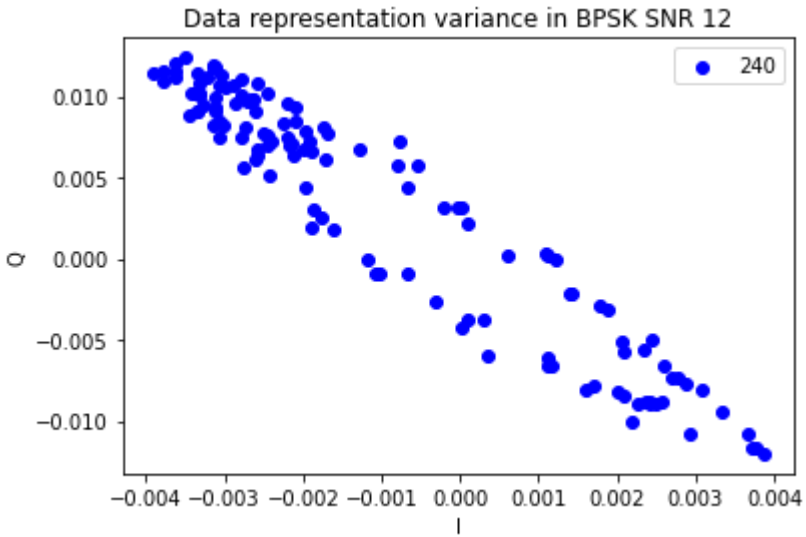
Data representation variance in BPSK SNR 12
240
0.010
0.005
0.000
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−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
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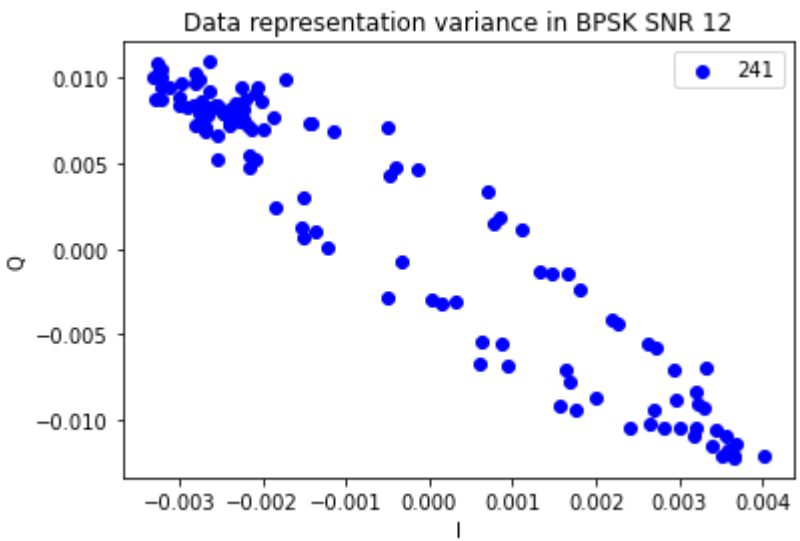
Data representation variance in BPSK SNR 12
241
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0.005
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−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
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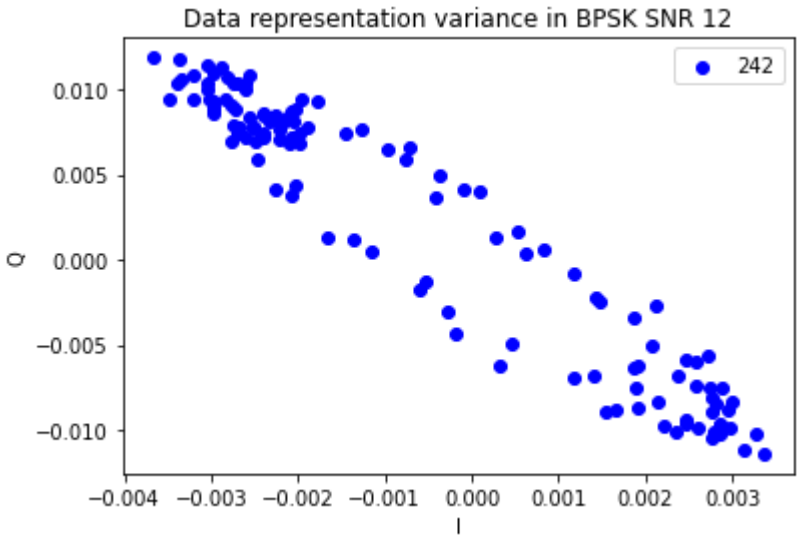
Data representation variance in BPSK SNR 12
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−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003
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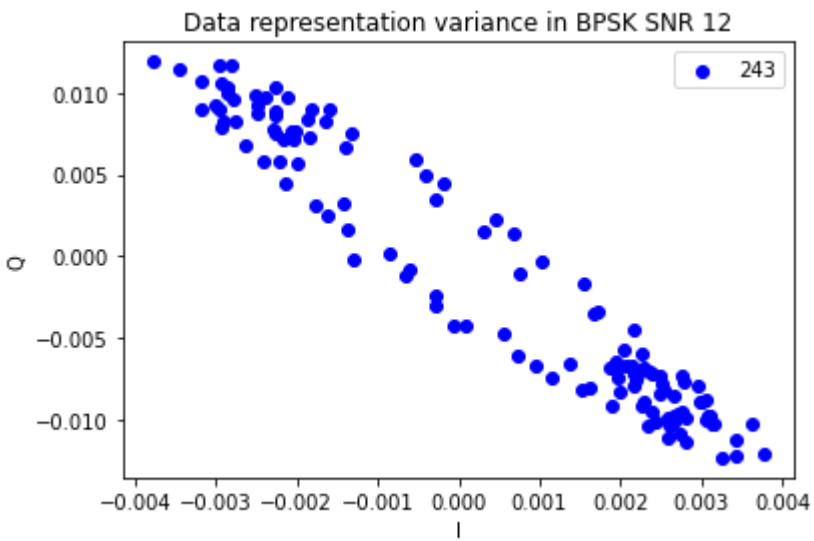
Data representation variance in BPSK SNR 12
243
0.010
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0.000
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−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
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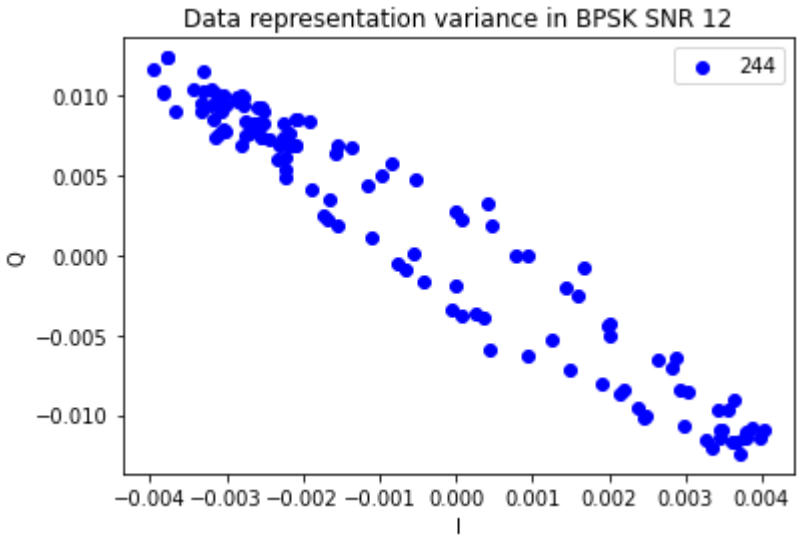
Data representation variance in BPSK SNR 12
244
0.010
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0.000
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−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
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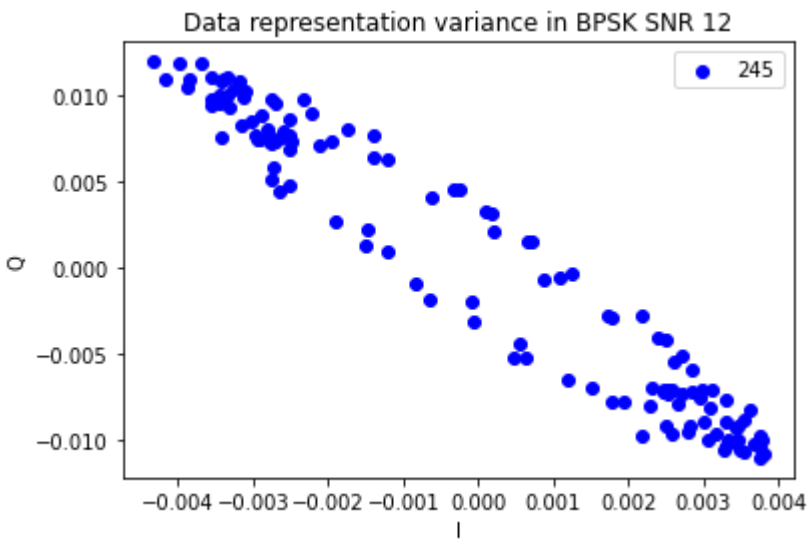
Data representation variance in BPSK SNR 12
245
0.010
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0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
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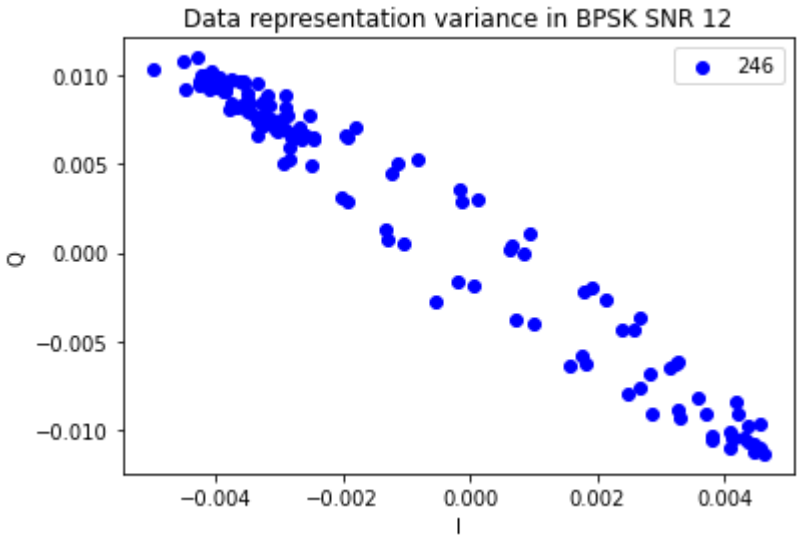
Data representation variance in BPSK SNR 12
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−0.005
−0.010
Q
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−0.002
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0.002
0.004
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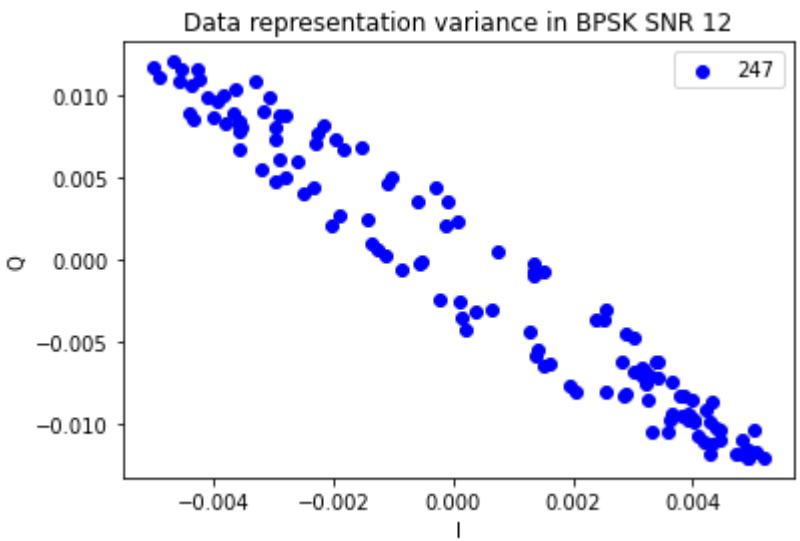
Data representation variance in BPSK SNR 12
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−0.005
−0.010
Q
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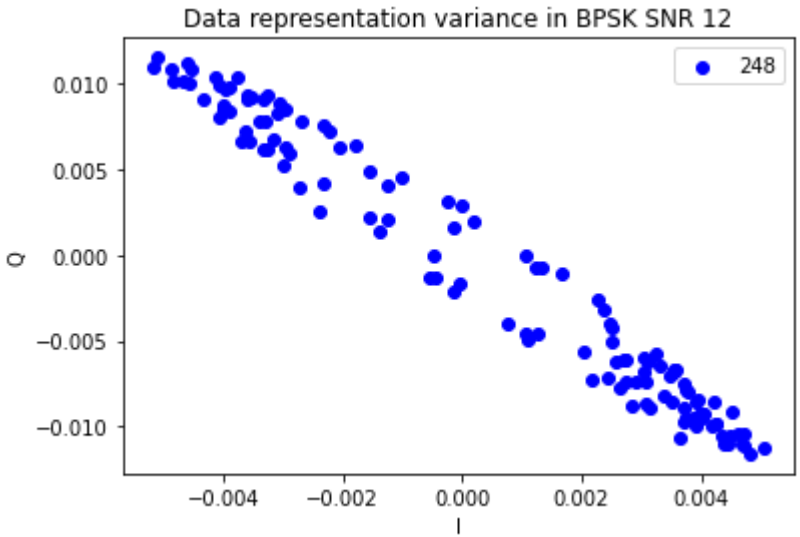
Data representation variance in BPSK SNR 12
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−0.010
Q
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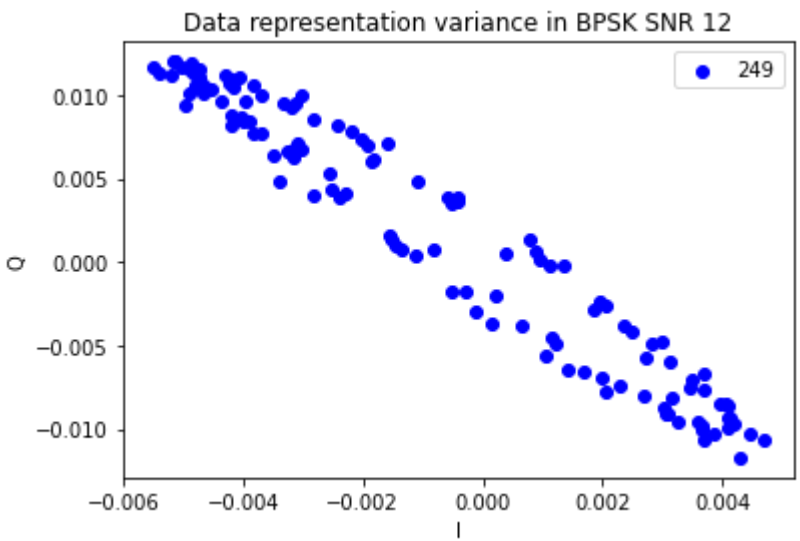
Data representation variance in BPSK SNR 12
249
0.010
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−0.010
Q
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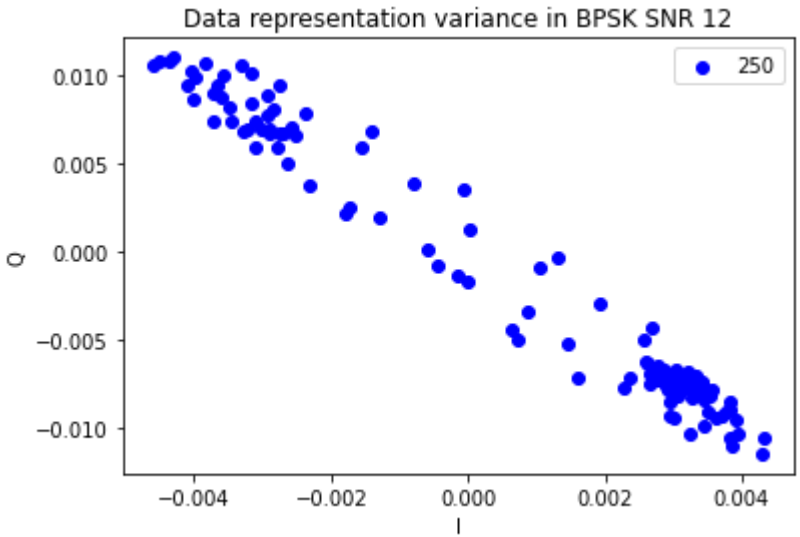
Data representation variance in BPSK SNR 12
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0.000
−0.005
−0.010
Q
−0.004
−0.002
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0.004
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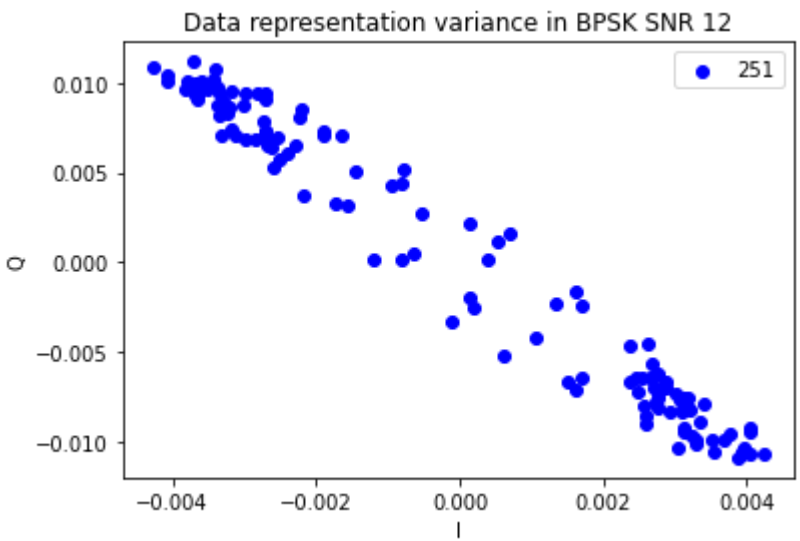
Data representation variance in BPSK SNR 12
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0.000
−0.005
−0.010
Q
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−0.002
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0.002
0.004
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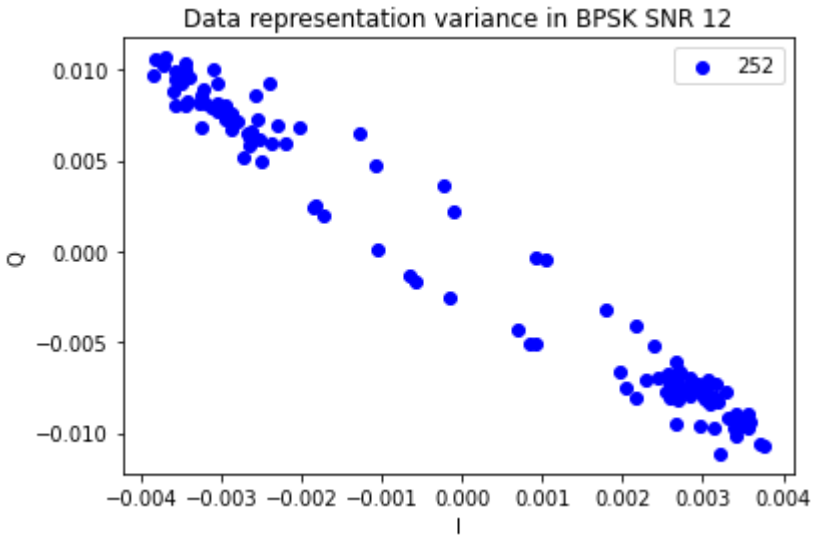
Data representation variance in BPSK SNR 12
252
0.010
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0.000
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−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
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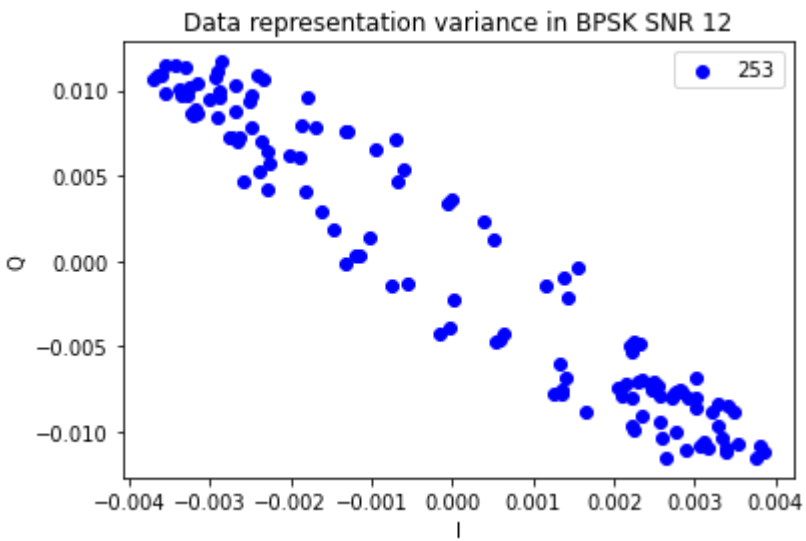
Data representation variance in BPSK SNR 12
253
0.010
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−0.010
Q
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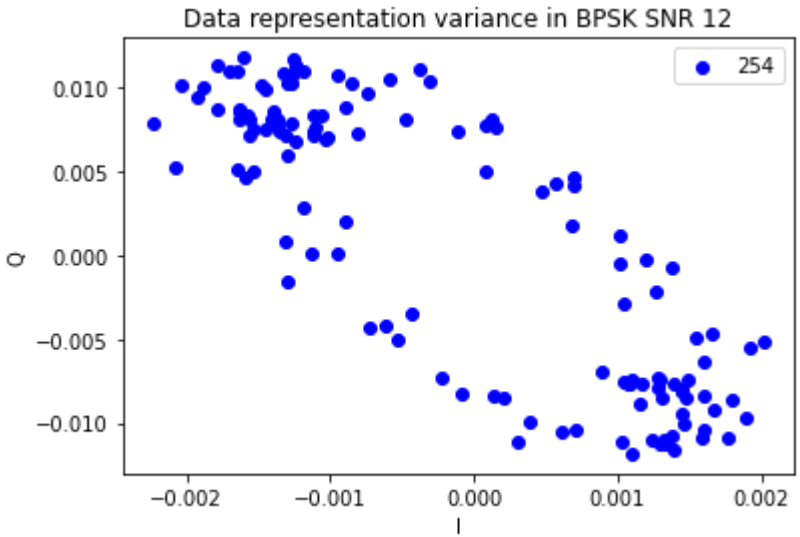
Data representation variance in BPSK SNR 12
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0.000
−0.005
−0.010
Q
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−0.001
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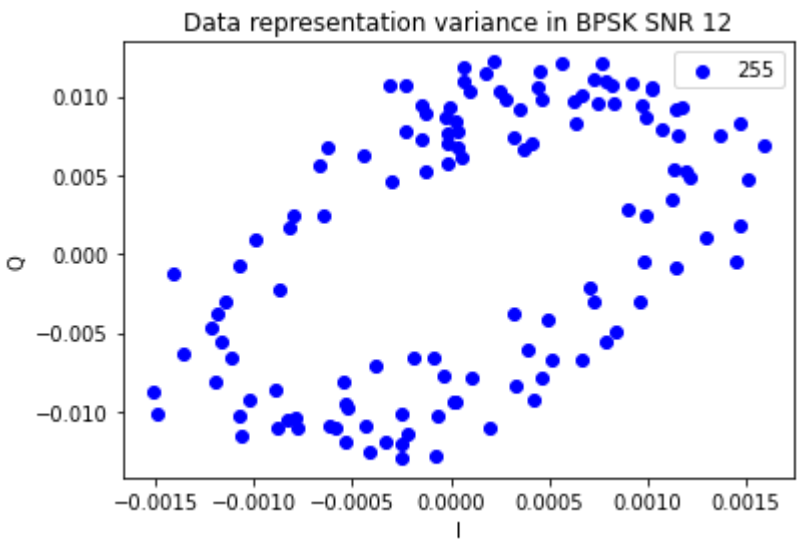
0.001
0.002
I


Data representation variance in BPSK SNR 12
255
0.010
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−0.005
−0.010
Q
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−0.0005
0.0000
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0.0010
0.0015
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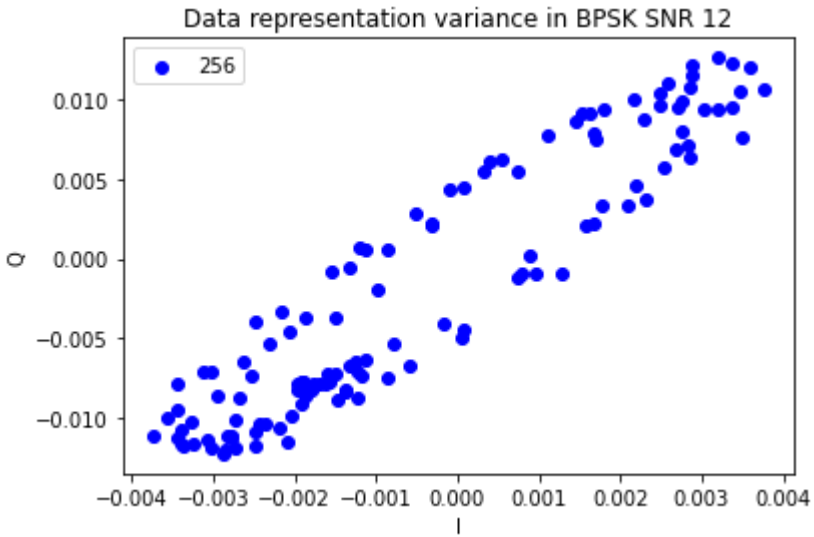
Data representation variance in BPSK SNR 12
256
0.010
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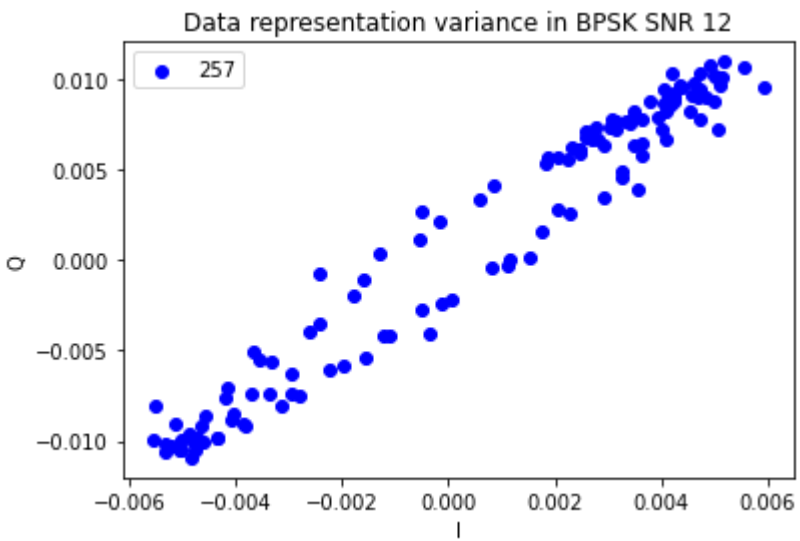
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I


Data representation variance in BPSK SNR 12
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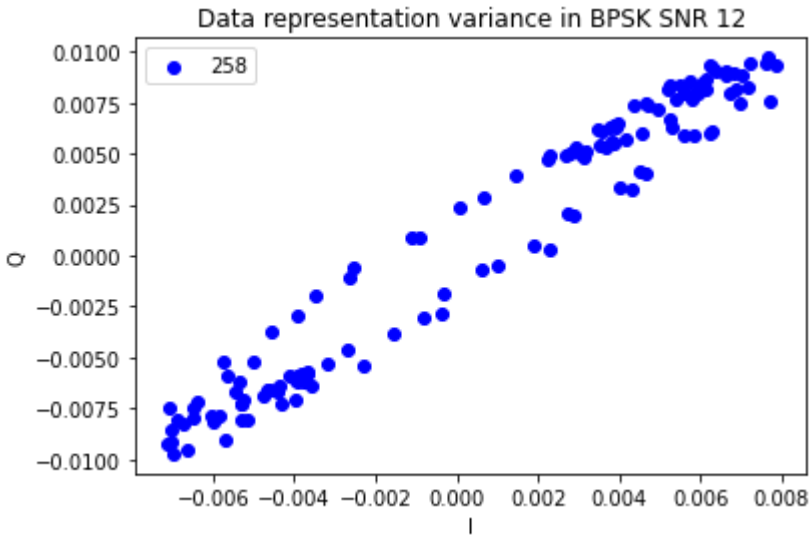
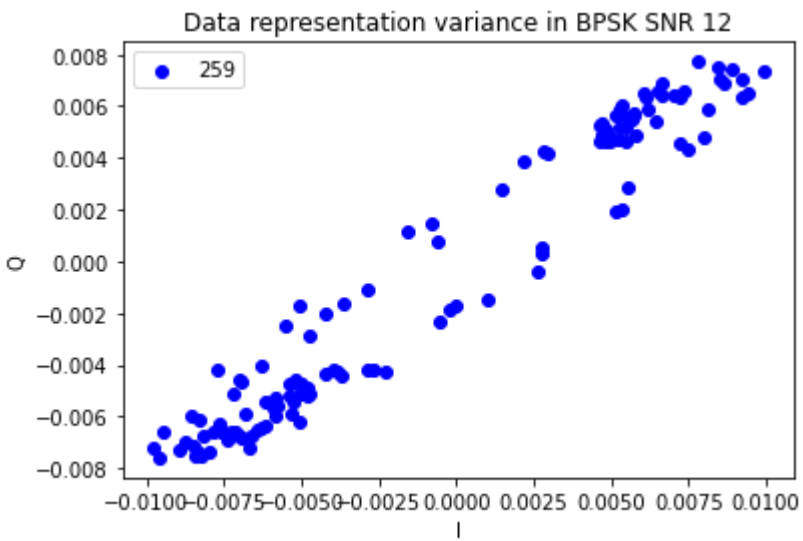
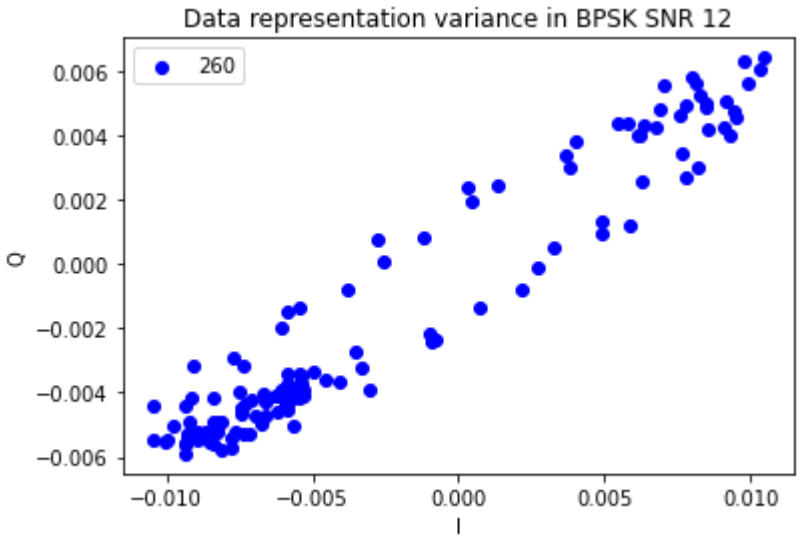
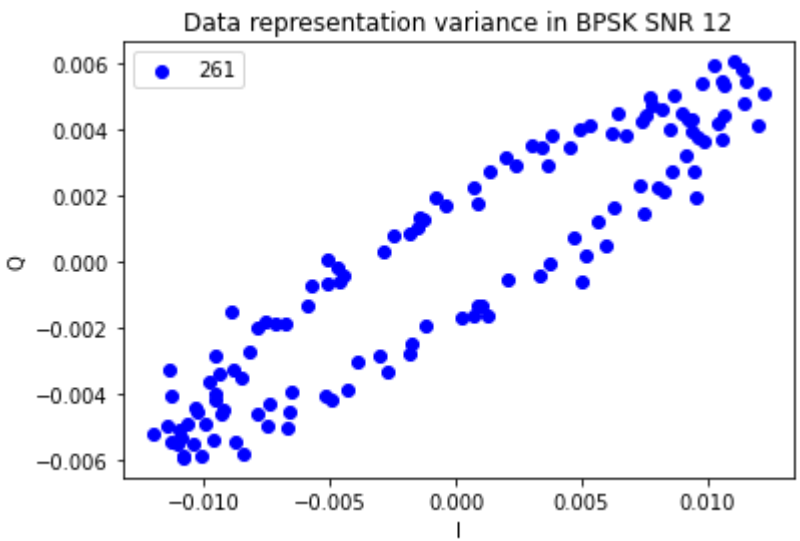
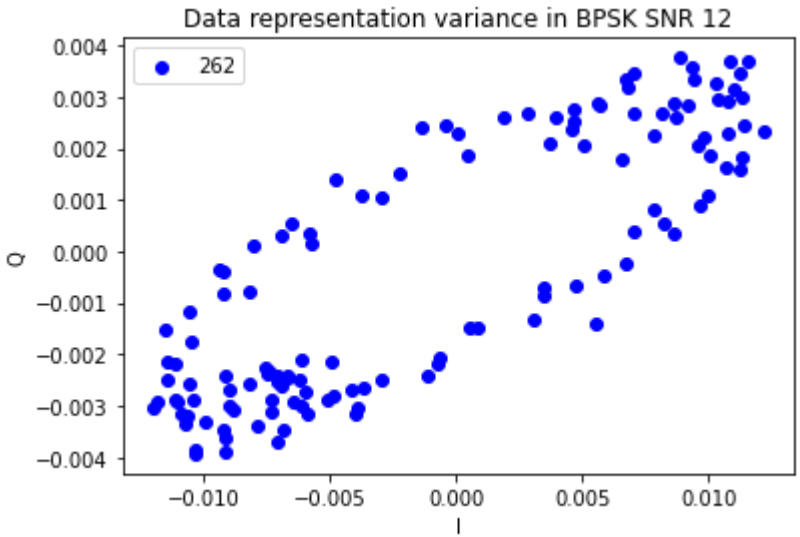
0.000
−0.005
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I

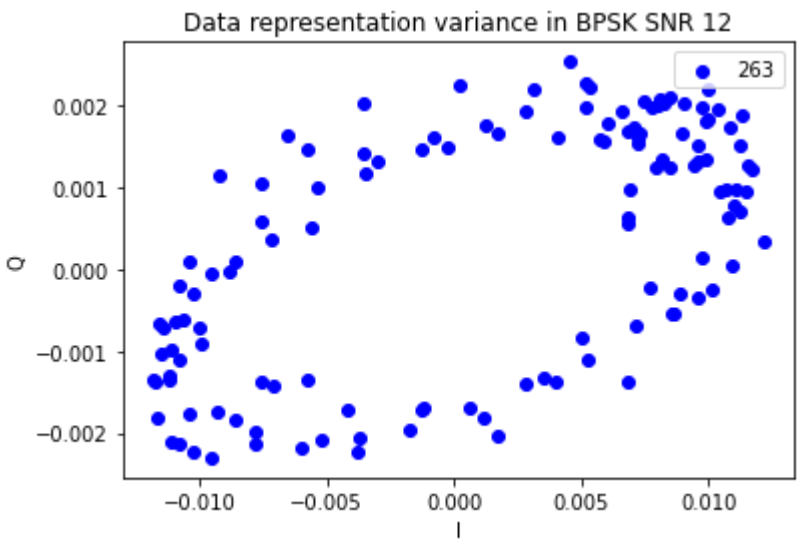

Data representation variance in BPSK SNR 12
258
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

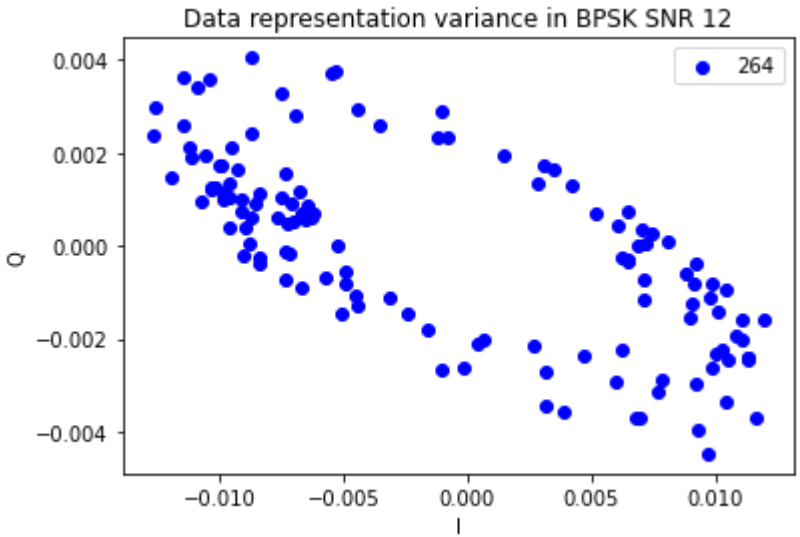

Data representation variance in BPSK SNR 12
259
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

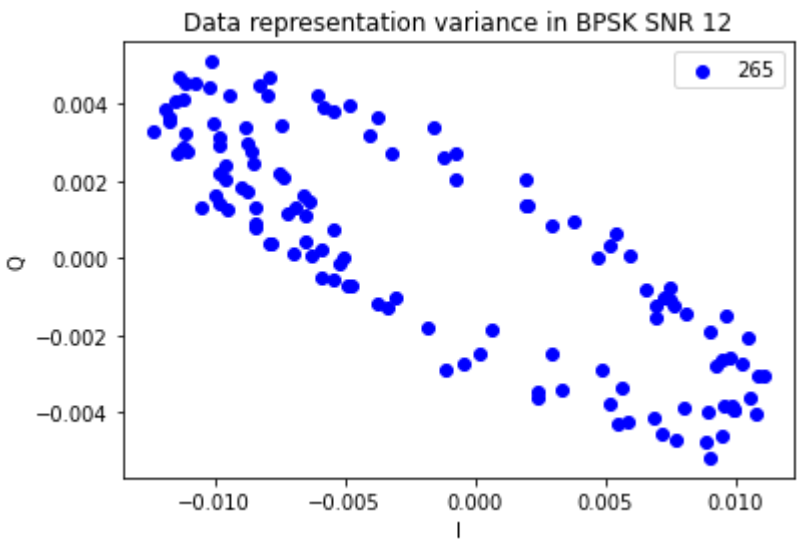

Data representation variance in BPSK SNR 12
260
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

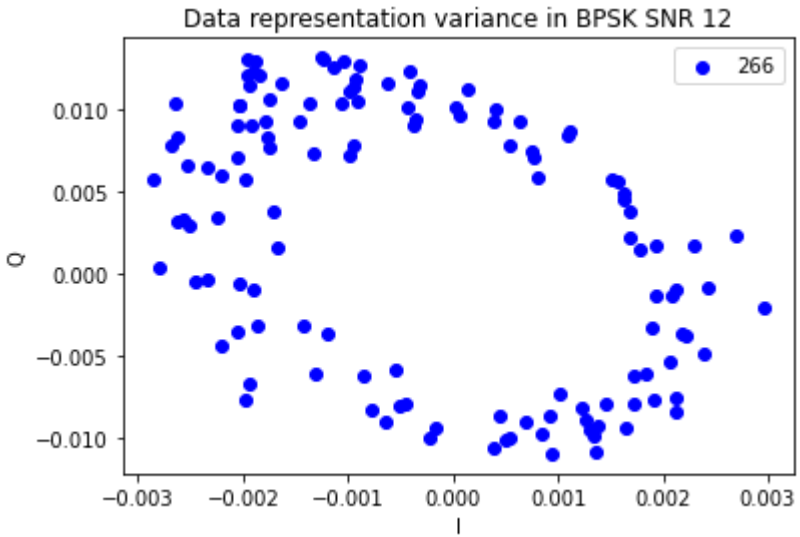

Data representation variance in BPSK SNR 12
261
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

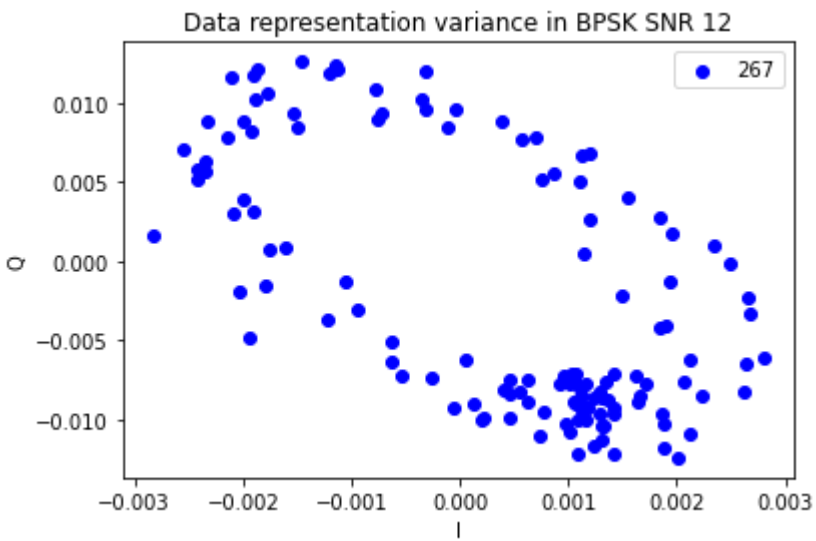

Data representation variance in BPSK SNR 12
262
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

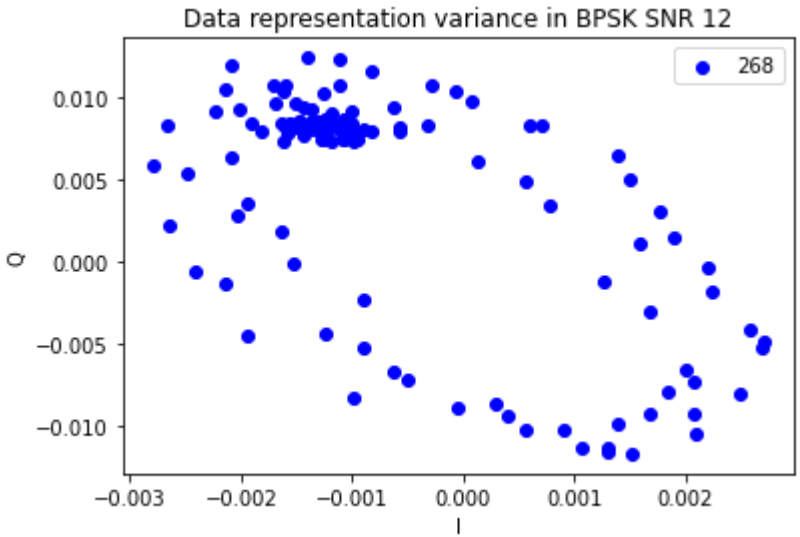

Data representation variance in BPSK SNR 12
263
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

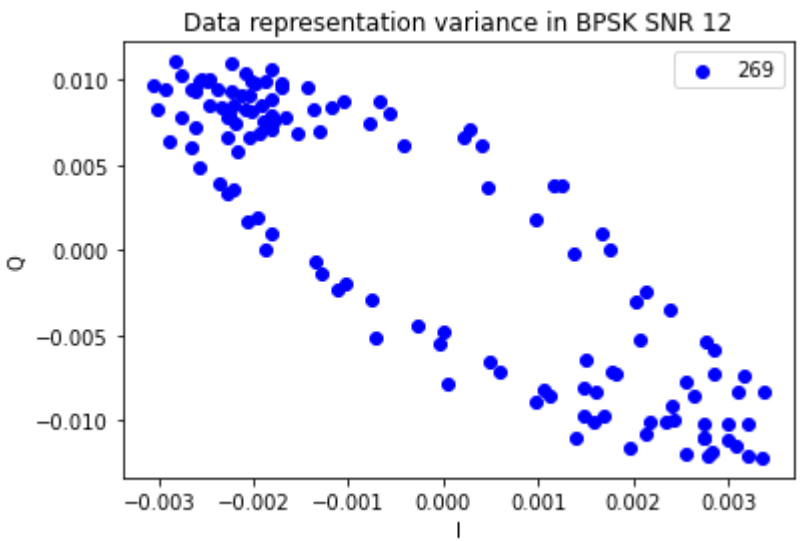

Data representation variance in BPSK SNR 12
264
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

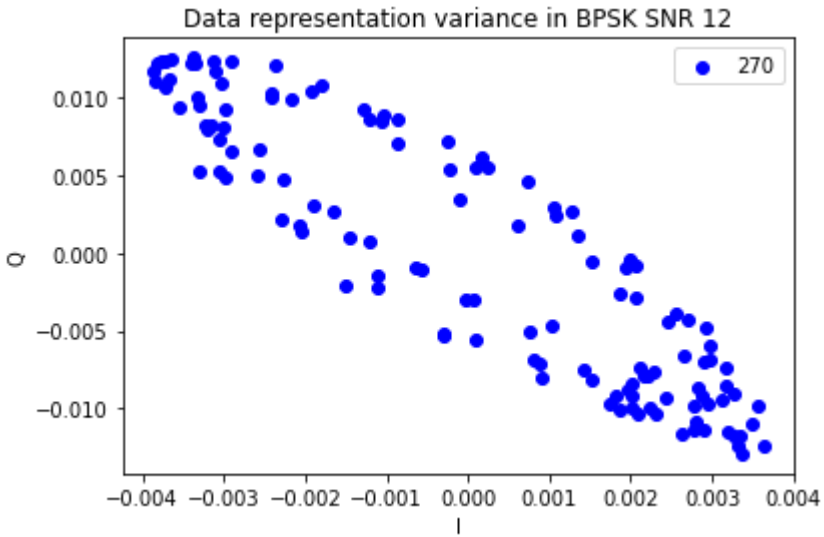

Data representation variance in BPSK SNR 12
265
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

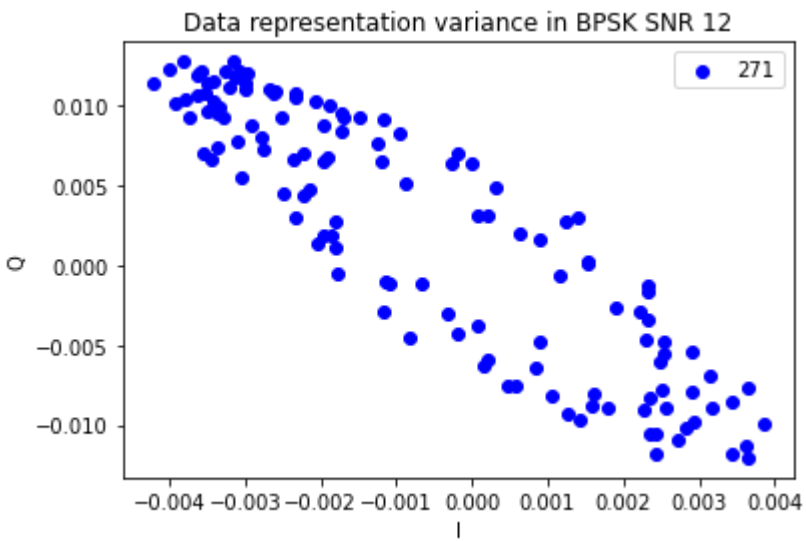

Data representation variance in BPSK SNR 12
266
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

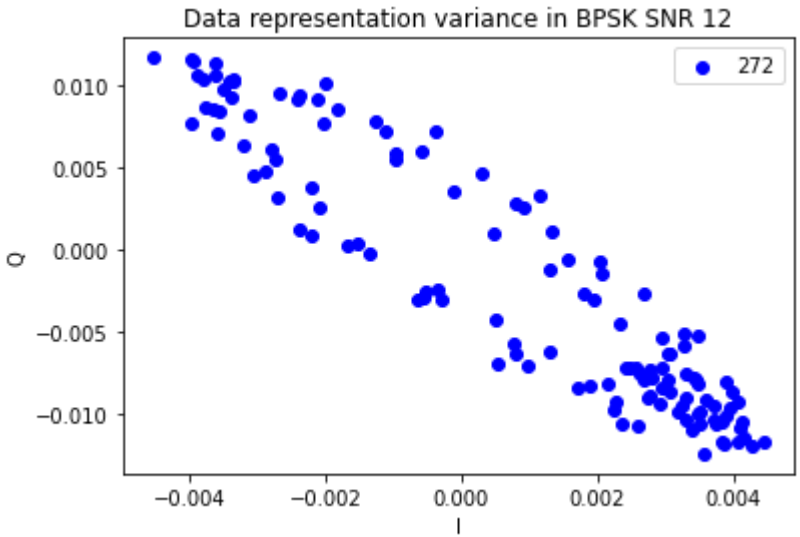

Data representation variance in BPSK SNR 12
267
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

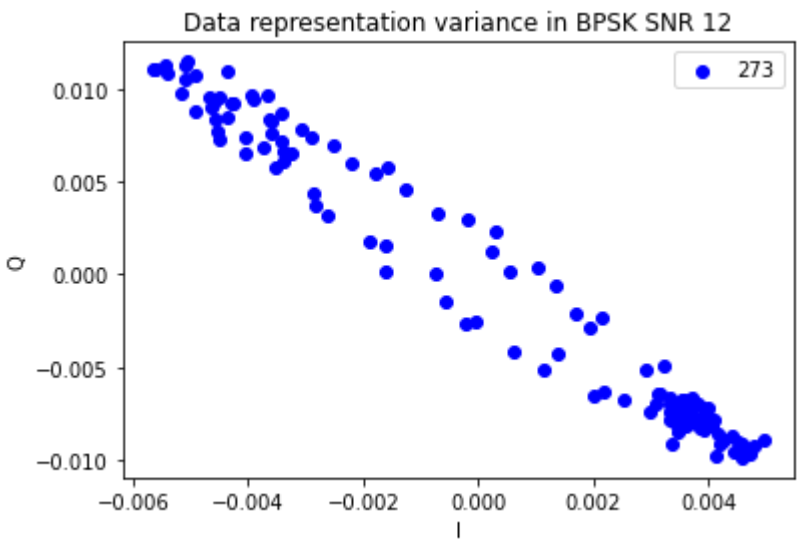

Data representation variance in BPSK SNR 12
268
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I

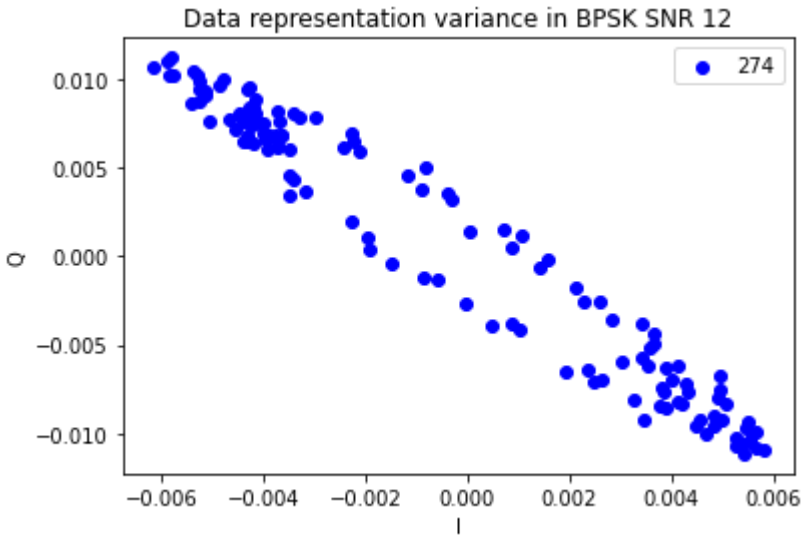

Data representation variance in BPSK SNR 12
269
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

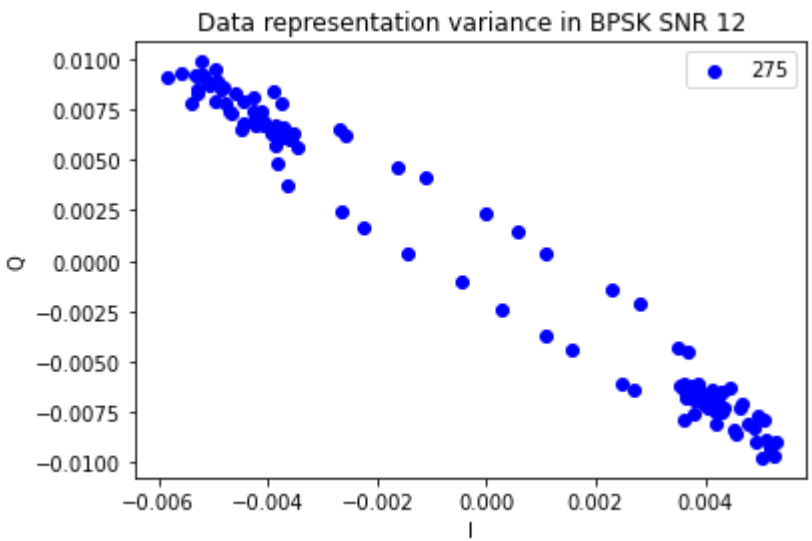

Data representation variance in BPSK SNR 12
270
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

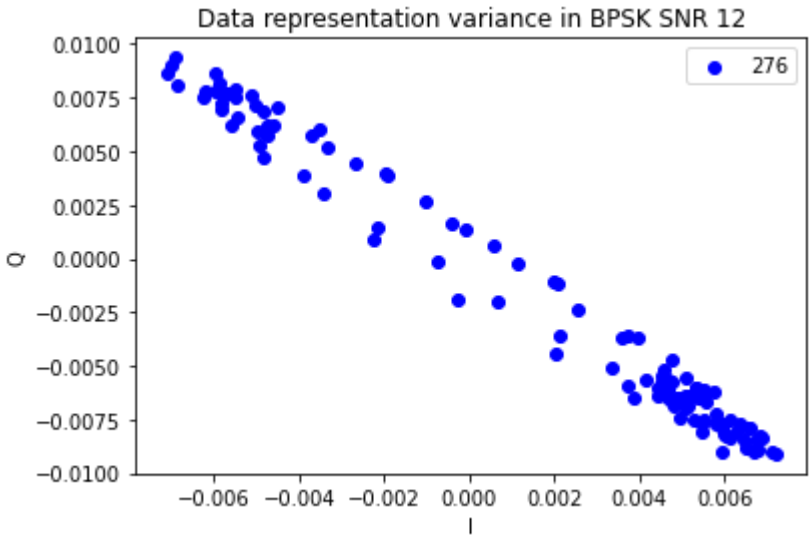

Data representation variance in BPSK SNR 12
271
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I

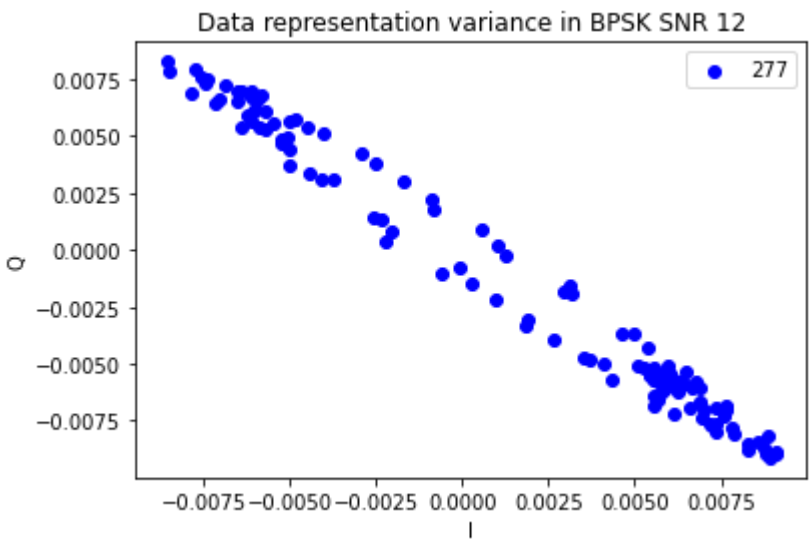

Data representation variance in BPSK SNR 12
272
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

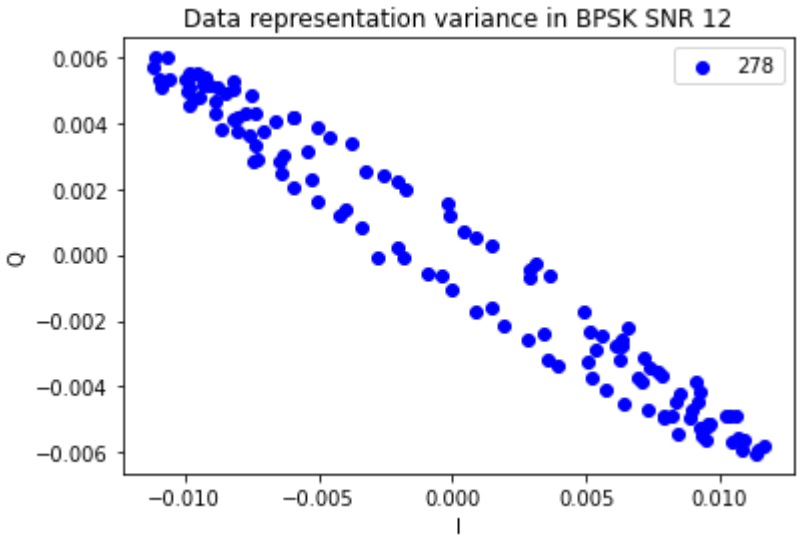

Data representation variance in BPSK SNR 12
273
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I

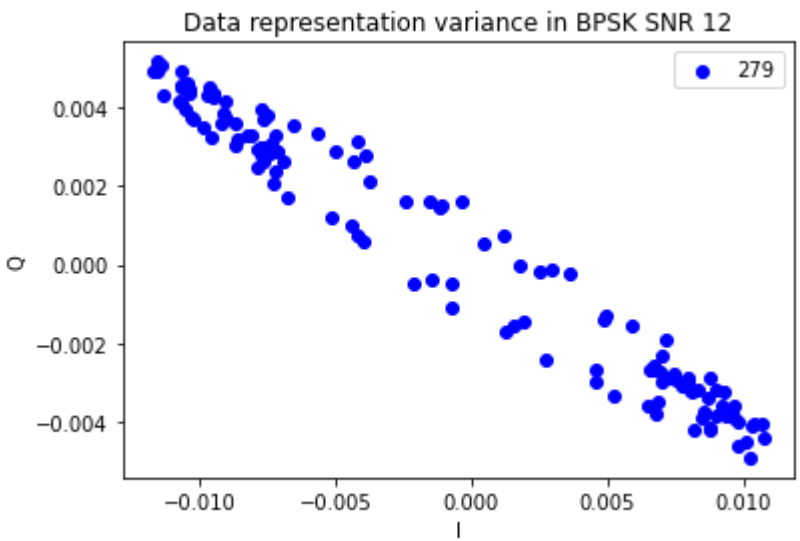

Data representation variance in BPSK SNR 12
274
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

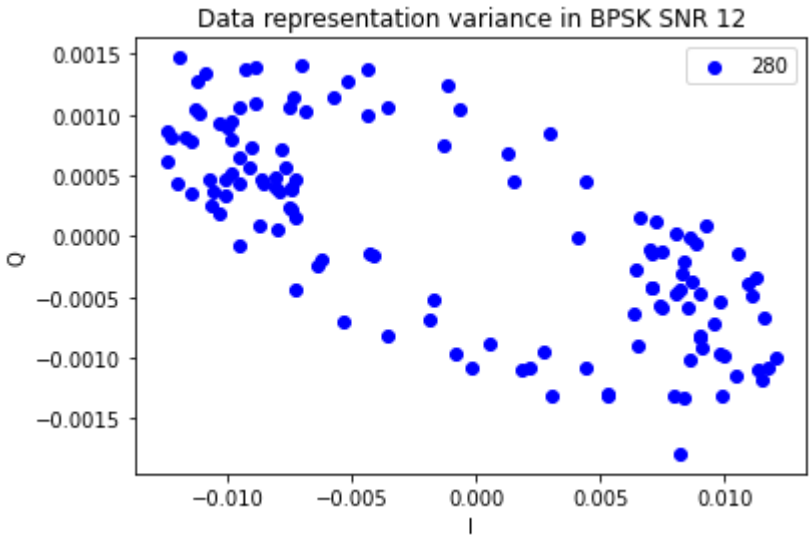

Data representation variance in BPSK SNR 12
275
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I

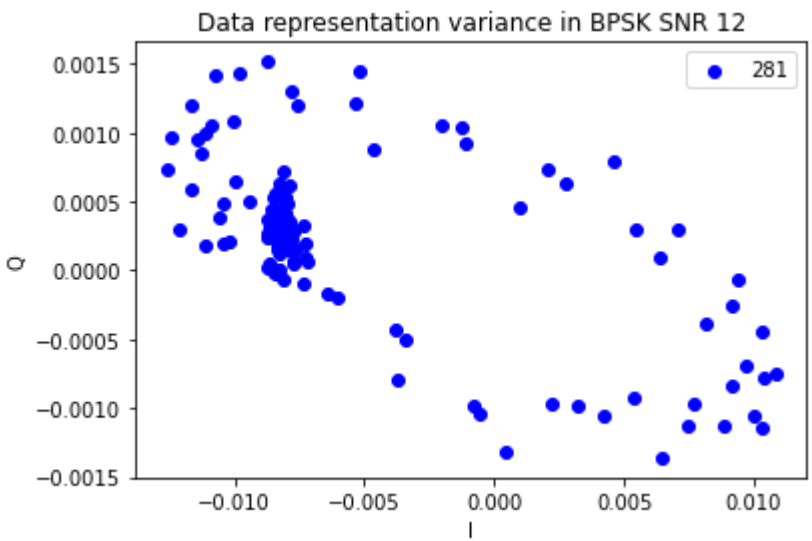

Data representation variance in BPSK SNR 12
276
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

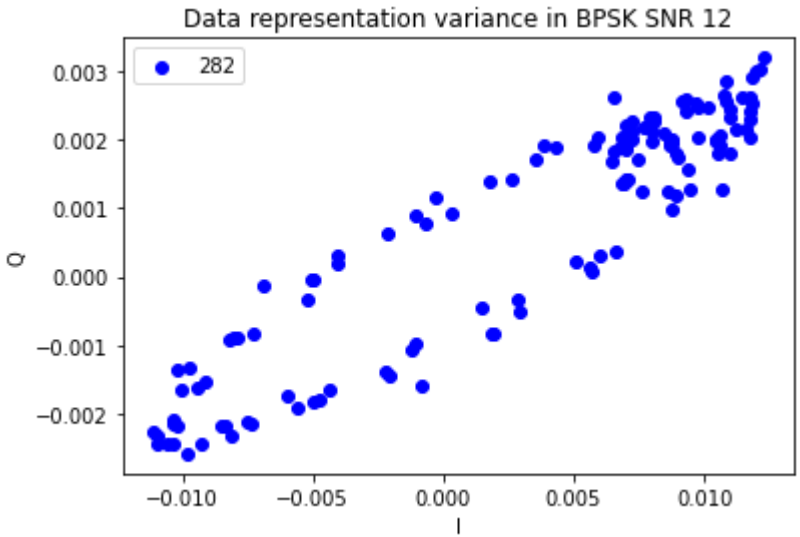

Data representation variance in BPSK SNR 12
277
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
I

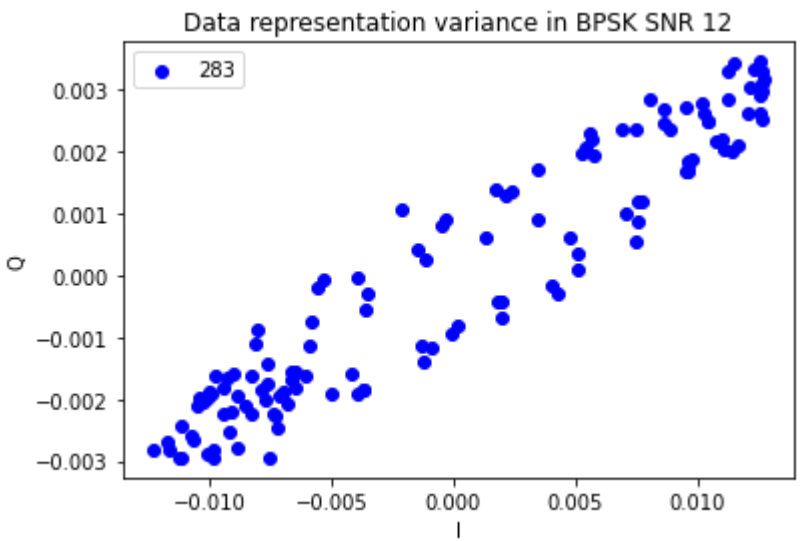

Data representation variance in BPSK SNR 12
278
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

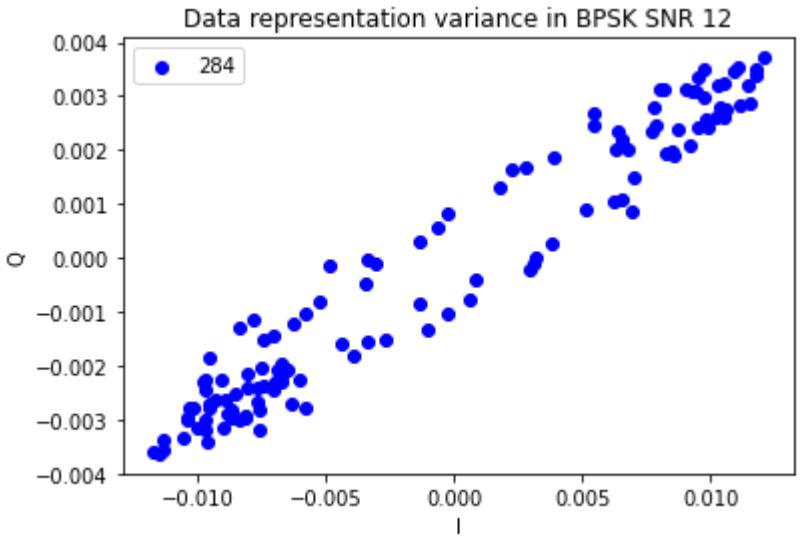

Data representation variance in BPSK SNR 12
279
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

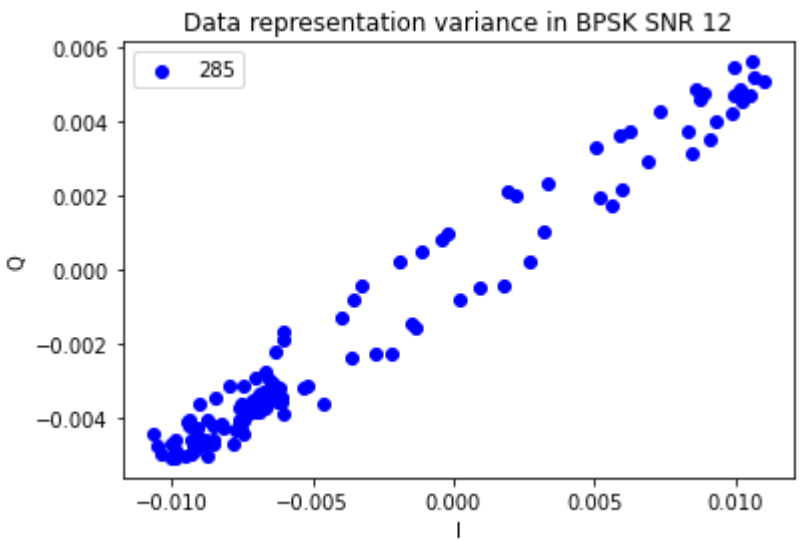

Data representation variance in BPSK SNR 12
280
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I

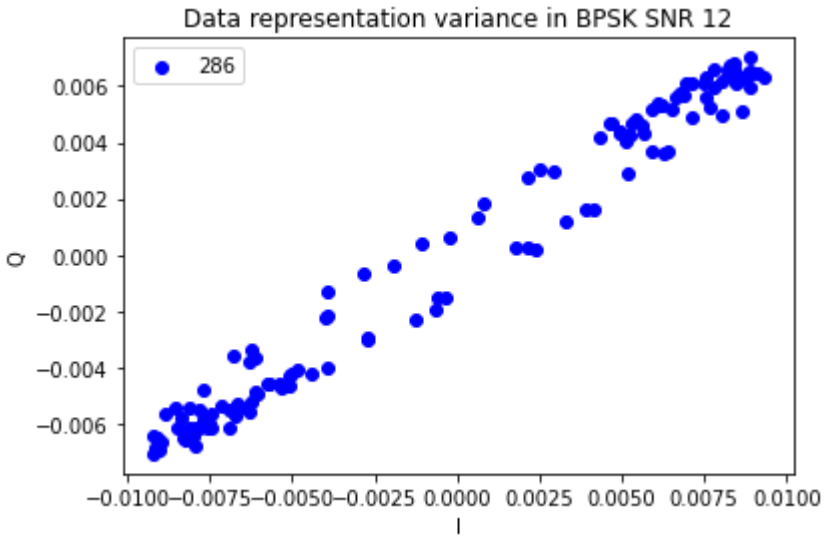

Data representation variance in BPSK SNR 12
281
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I

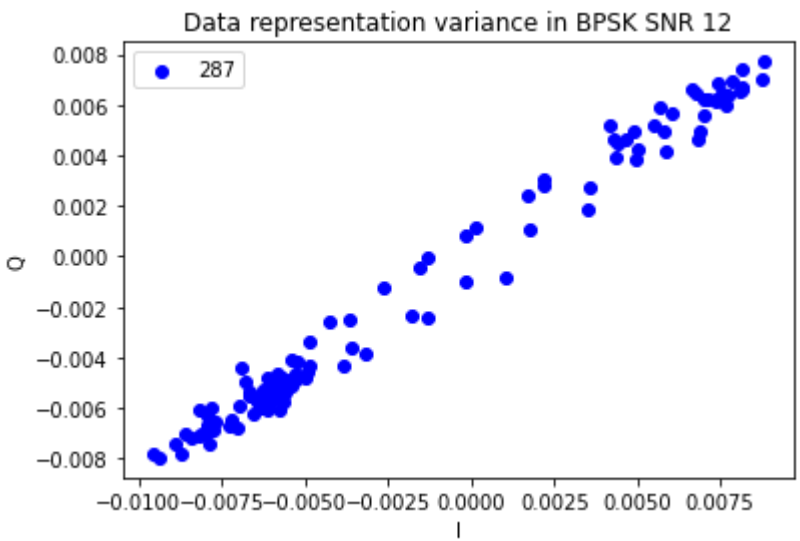

Data representation variance in BPSK SNR 12
282
0.003
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

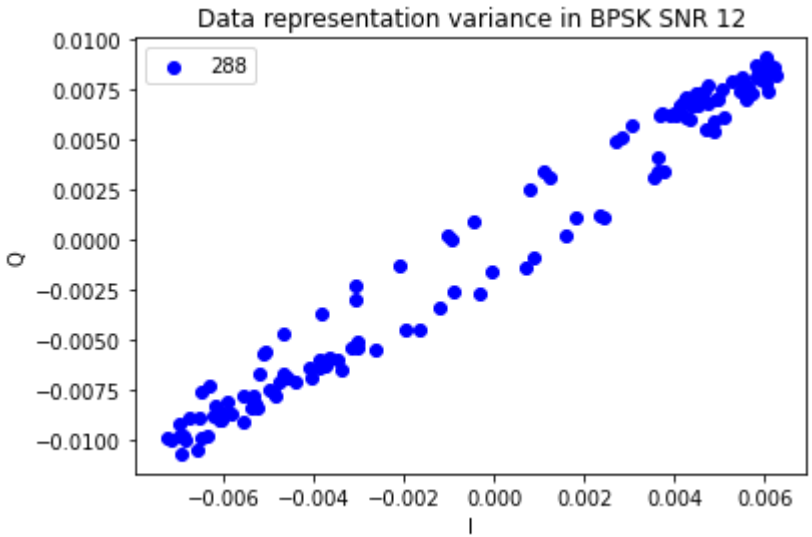

Data representation variance in BPSK SNR 12
283
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

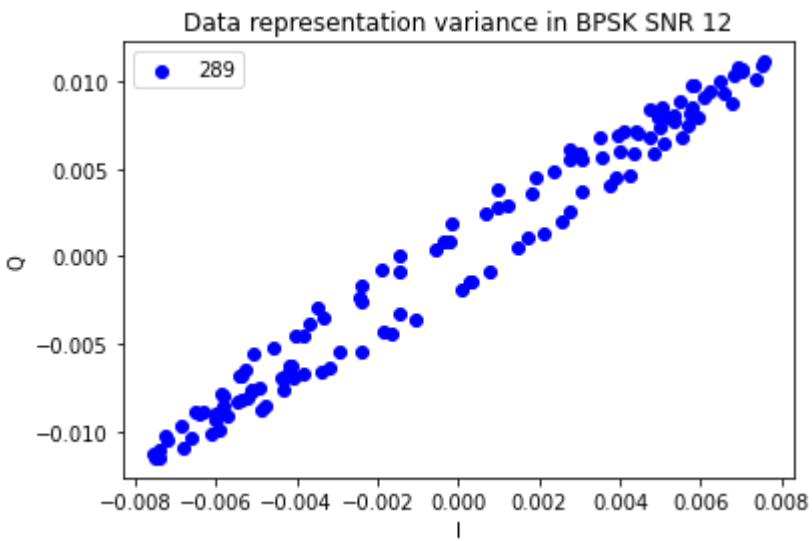

Data representation variance in BPSK SNR 12
284
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

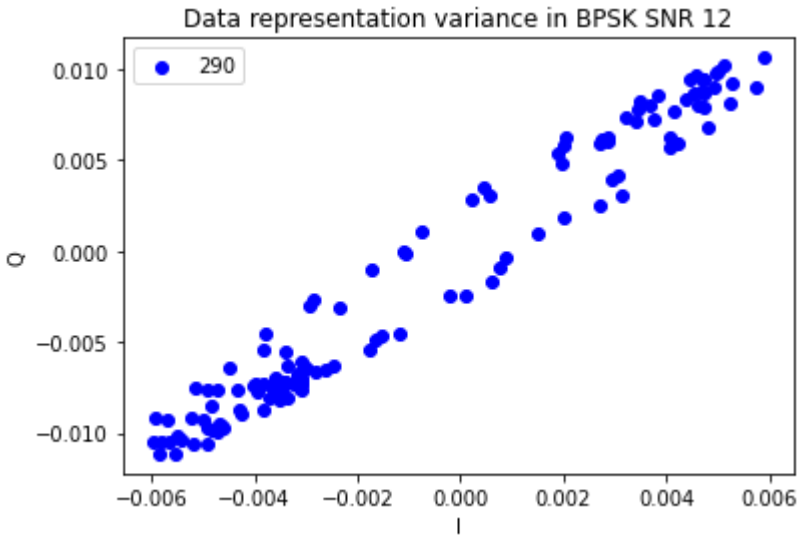

Data representation variance in BPSK SNR 12
285
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

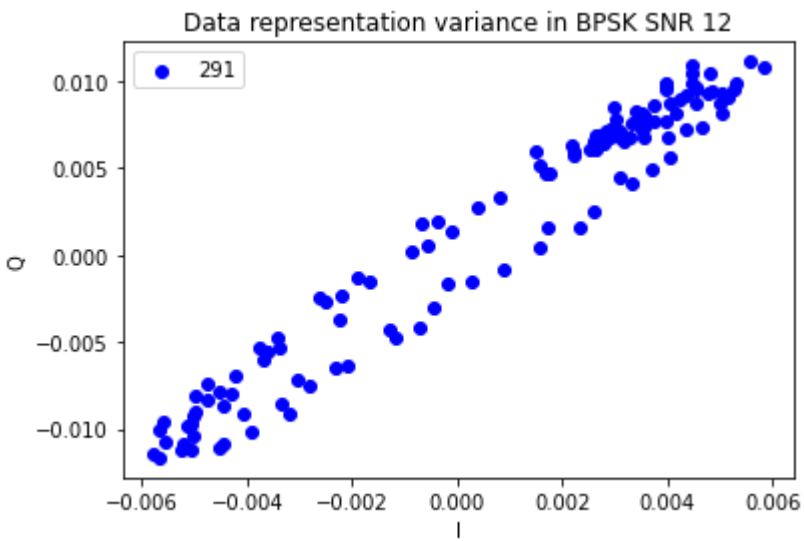

Data representation variance in BPSK SNR 12
286
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

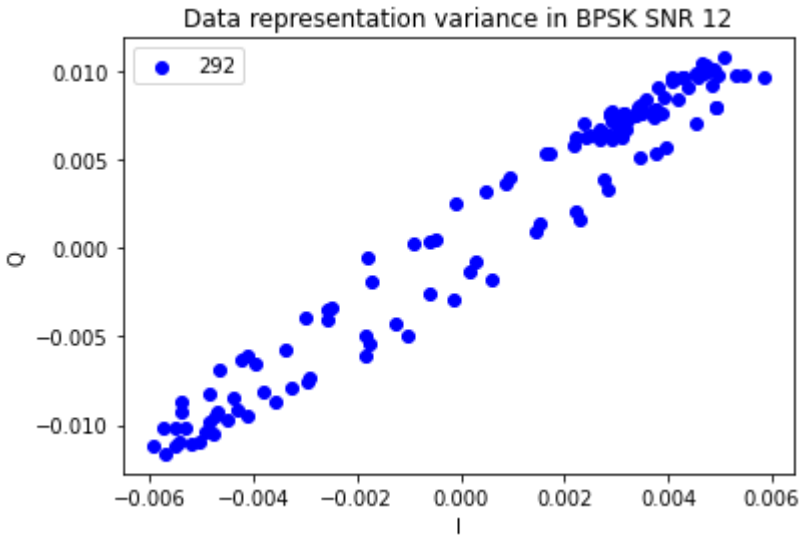

Data representation variance in BPSK SNR 12
287
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

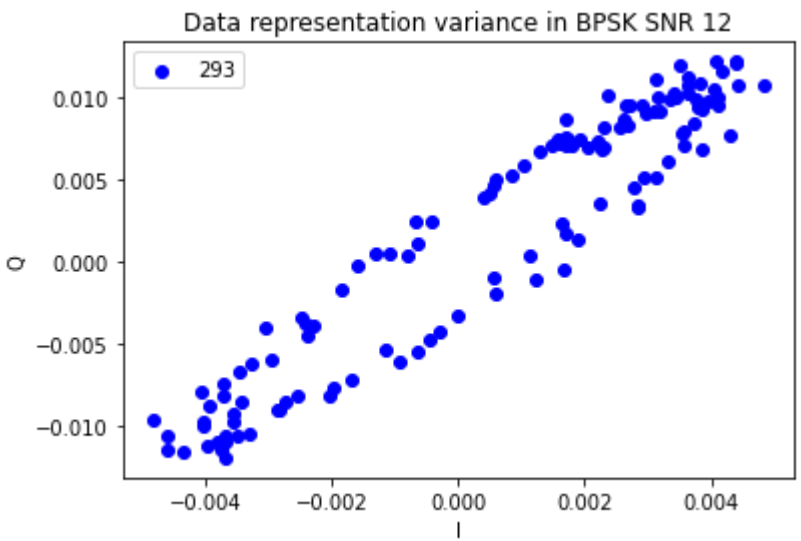

Data representation variance in BPSK SNR 12
288
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

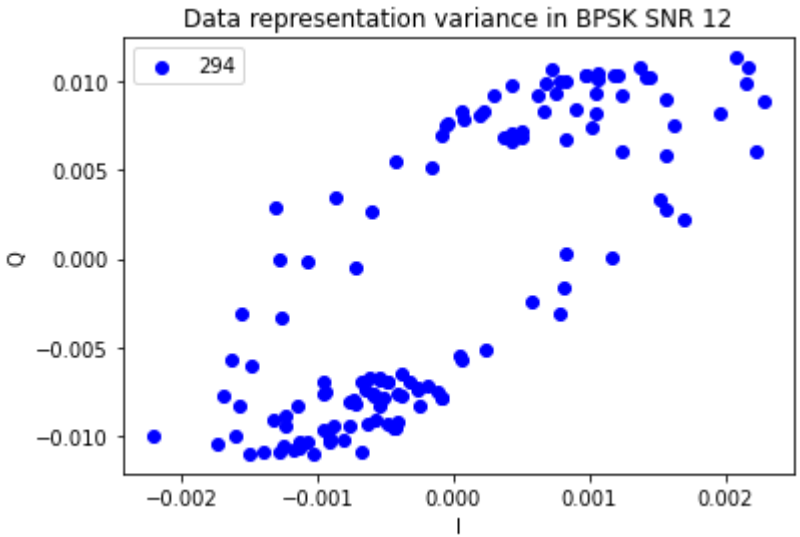

Data representation variance in BPSK SNR 12
289
0.010
0.005
0.000
−0.005
−0.010
Q
−0.008
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I

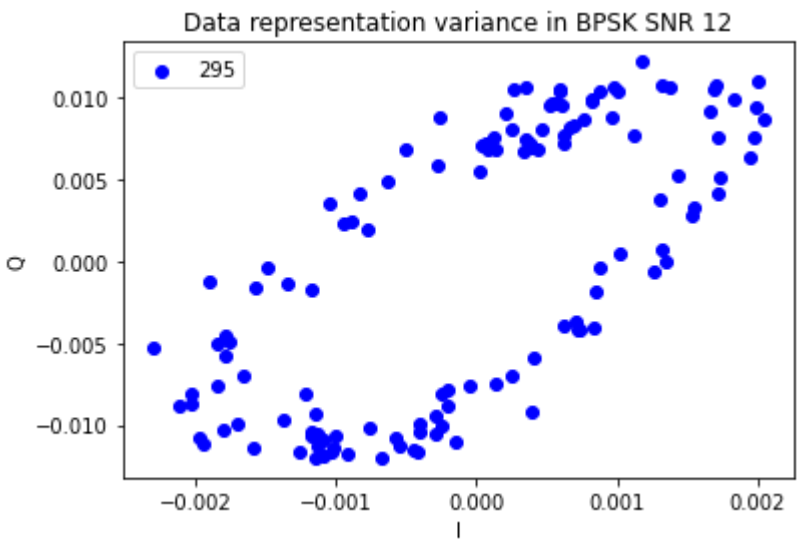

Data representation variance in BPSK SNR 12
290
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

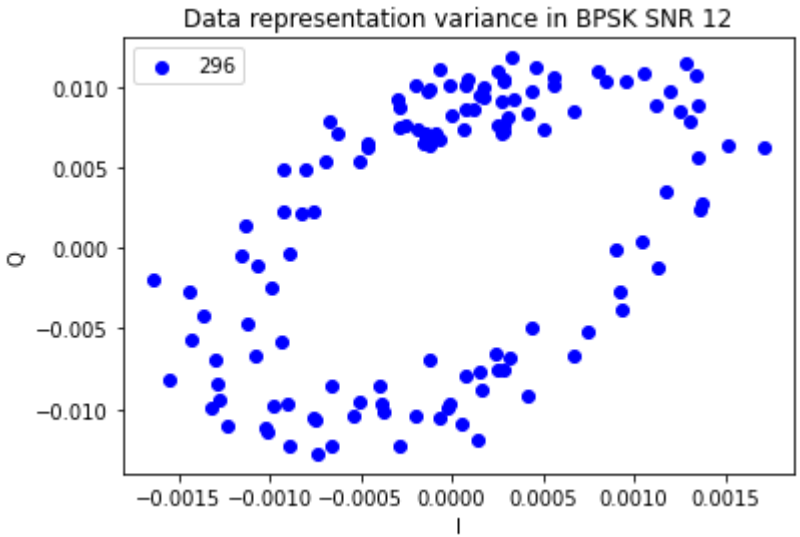

Data representation variance in BPSK SNR 12
291
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

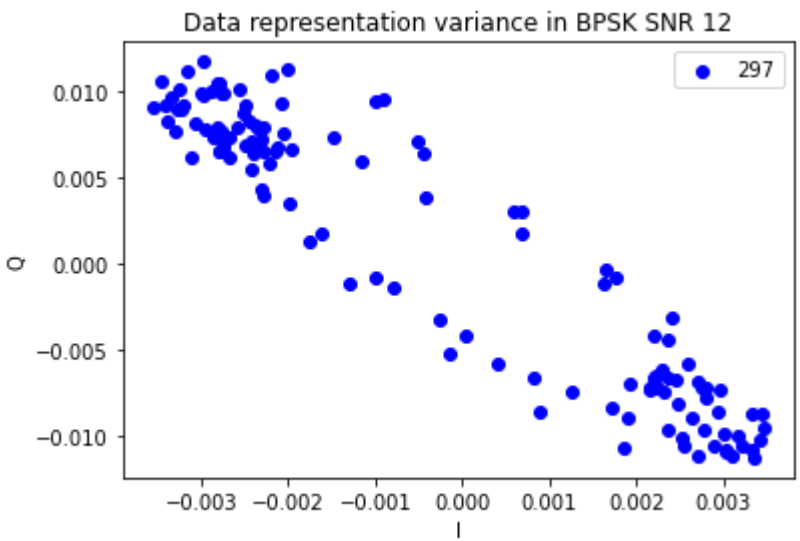

Data representation variance in BPSK SNR 12
292
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

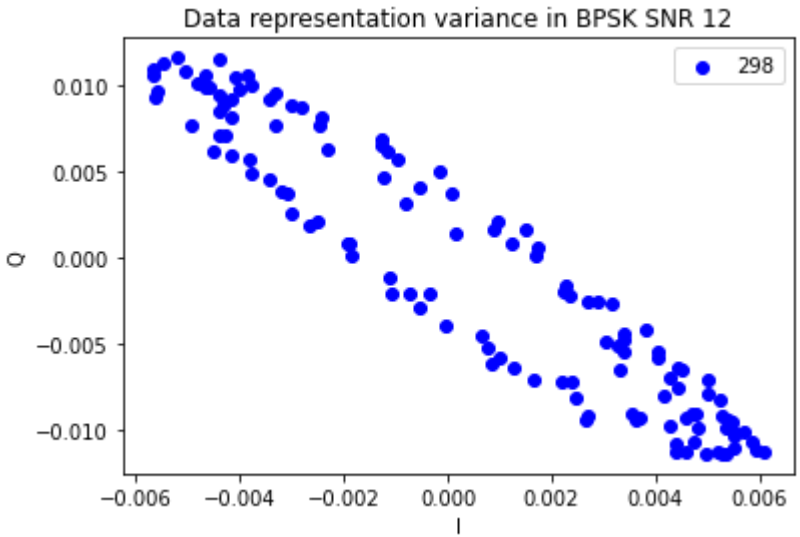

Data representation variance in BPSK SNR 12
293
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

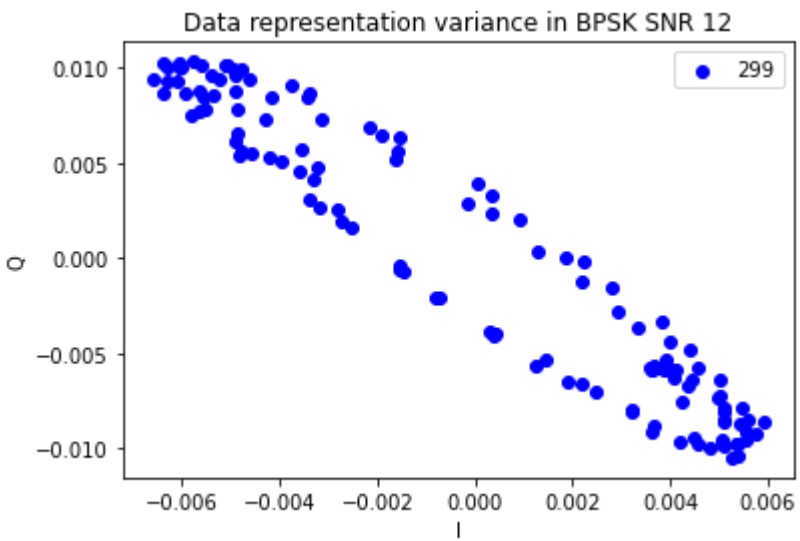

Data representation variance in BPSK SNR 12
294
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

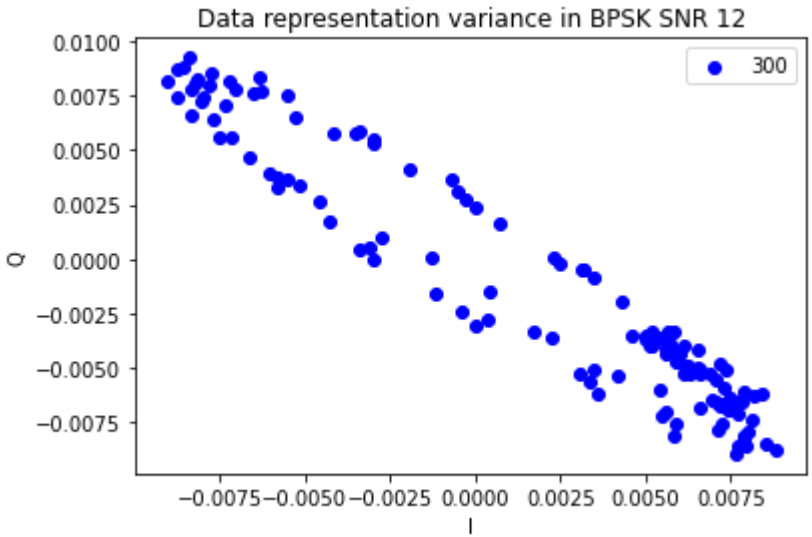

Data representation variance in BPSK SNR 12
295
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

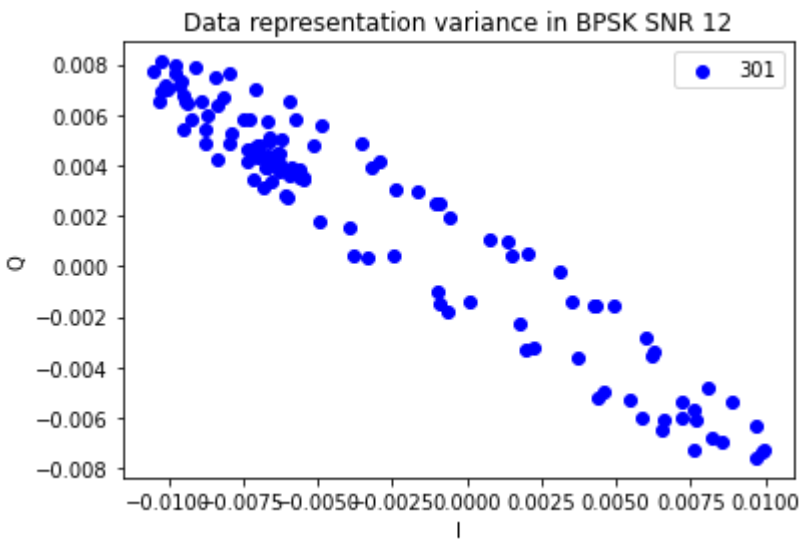

Data representation variance in BPSK SNR 12
296
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
I


Data representation variance in BPSK SNR 12
297
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002 0.003
I


Data representation variance in BPSK SNR 12
298
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
299
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
300
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
301
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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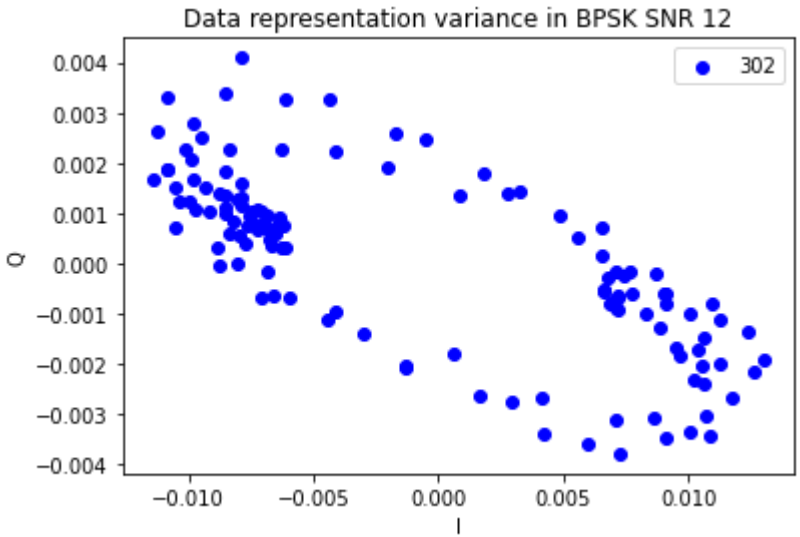
Data representation variance in BPSK SNR 12
302
0.004
0.003
0.002
0.001
0.000
−0.001
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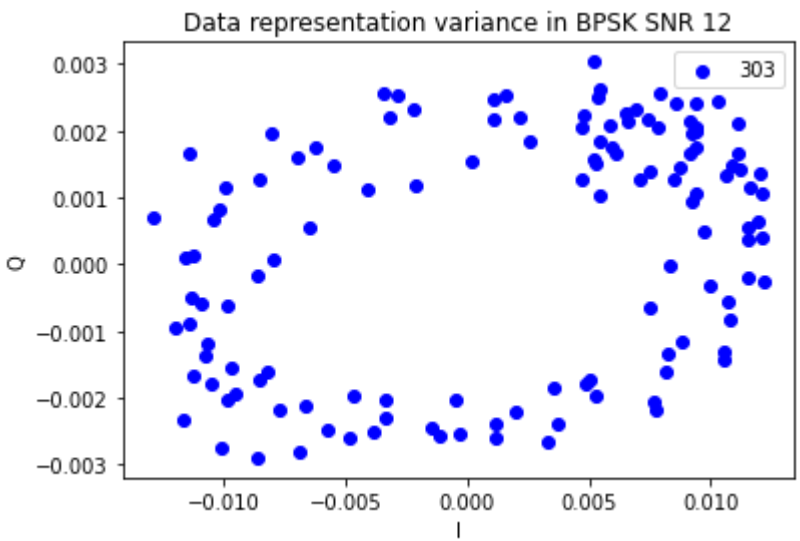
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
303
0.003
0.002
0.001
0.000
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−0.002
−0.003
Q
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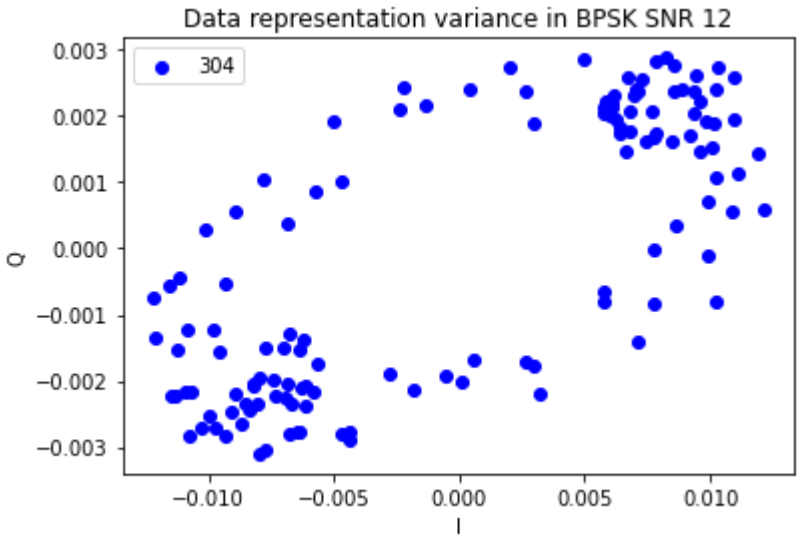
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
304
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
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0.005
0.010
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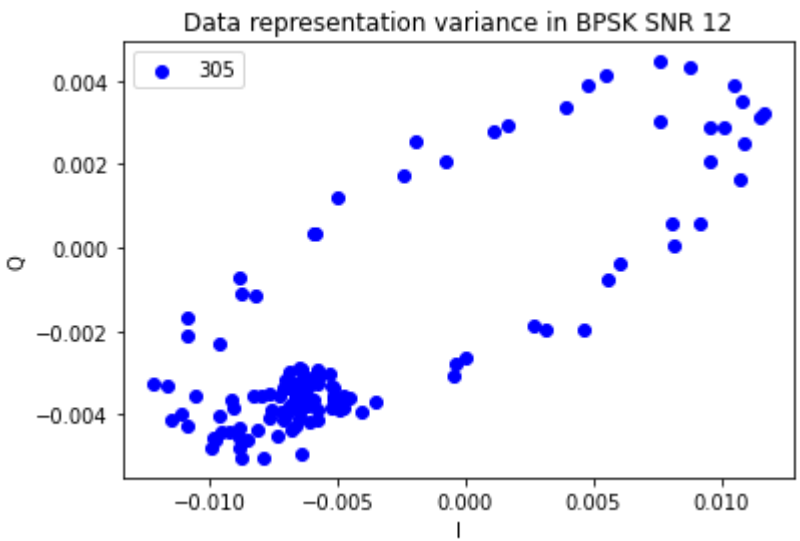
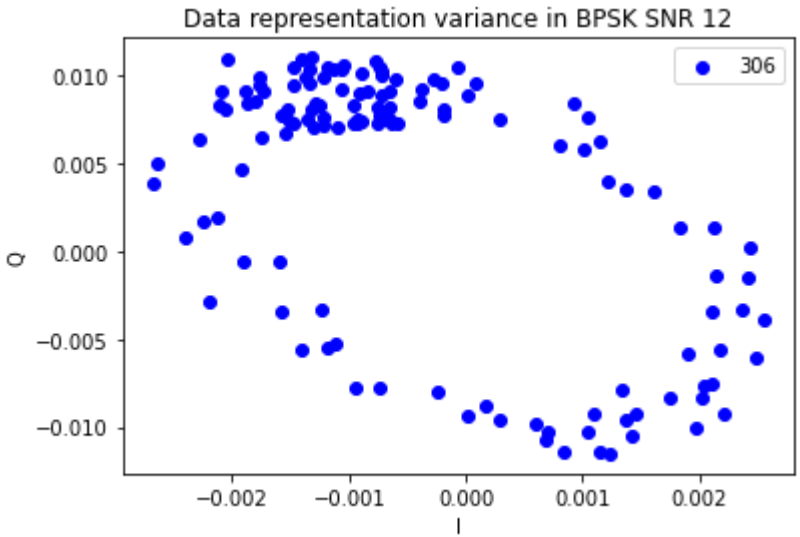

Data representation variance in BPSK SNR 12
305
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
306
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0.005
0.000
−0.005
−0.010
Q
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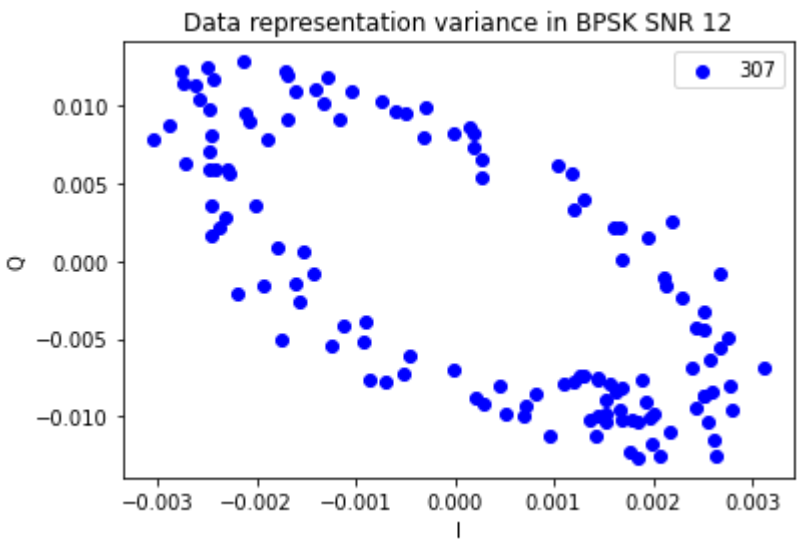
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
307
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
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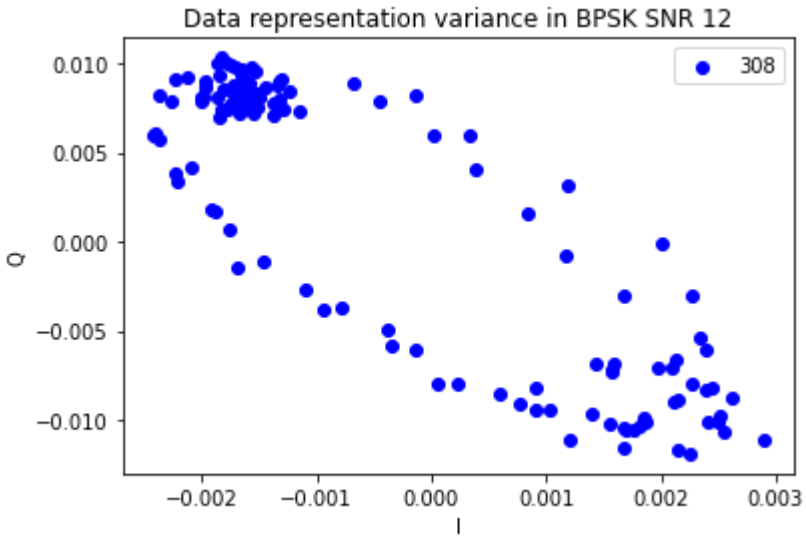
Data representation variance in BPSK SNR 12
308
0.010
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−0.005
−0.010
Q
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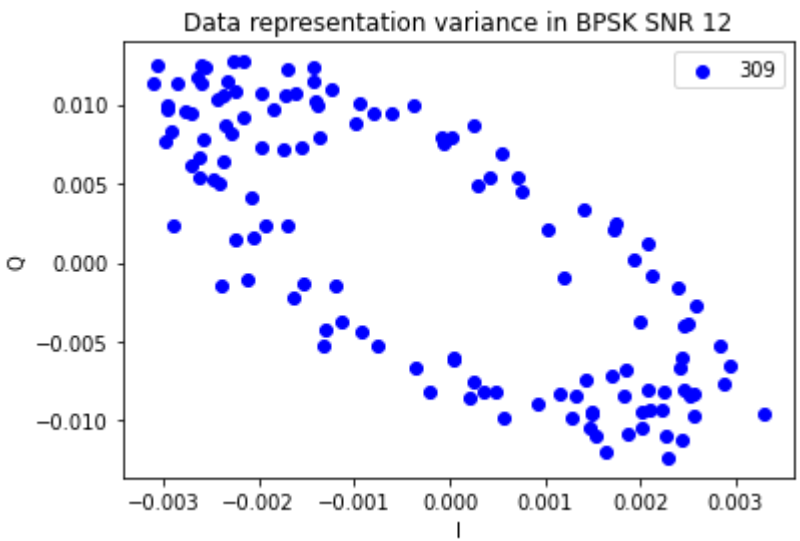
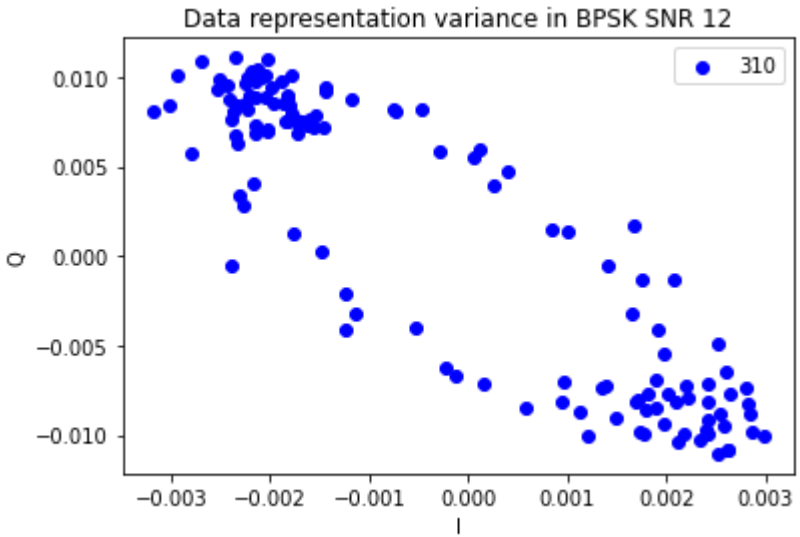
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
309
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
310
0.010
0.005
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−0.005
−0.010
Q
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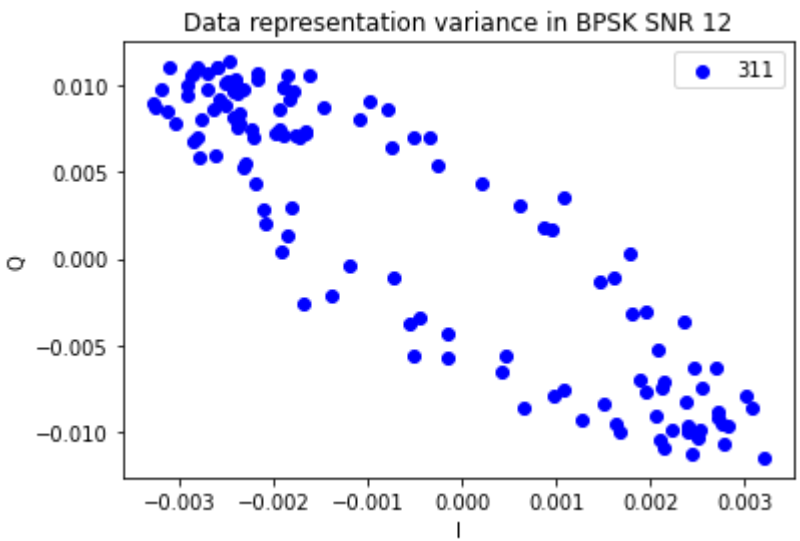
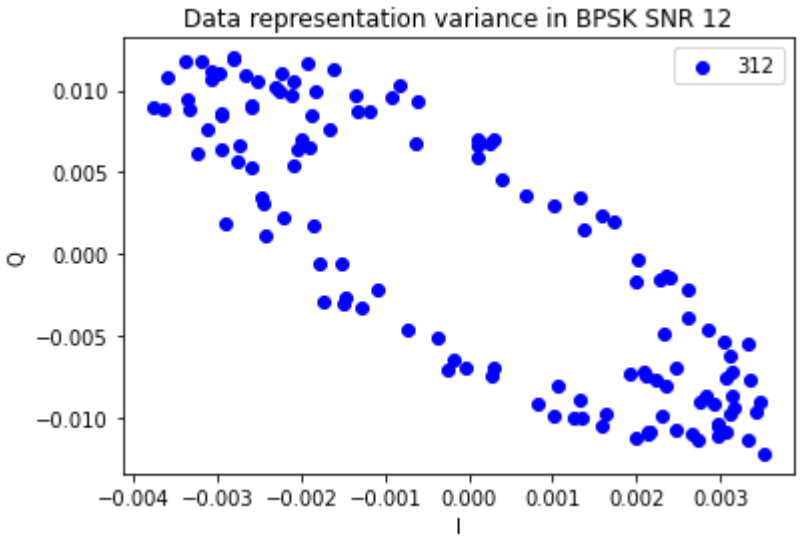
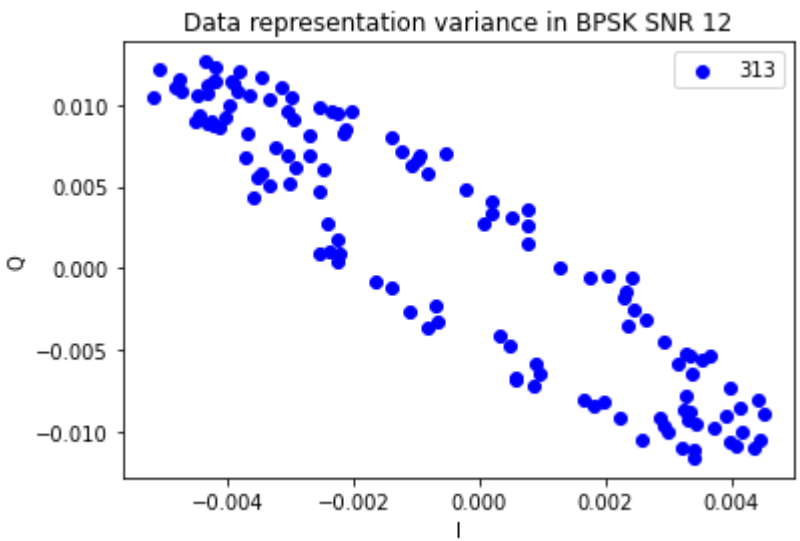
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
311
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
312
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
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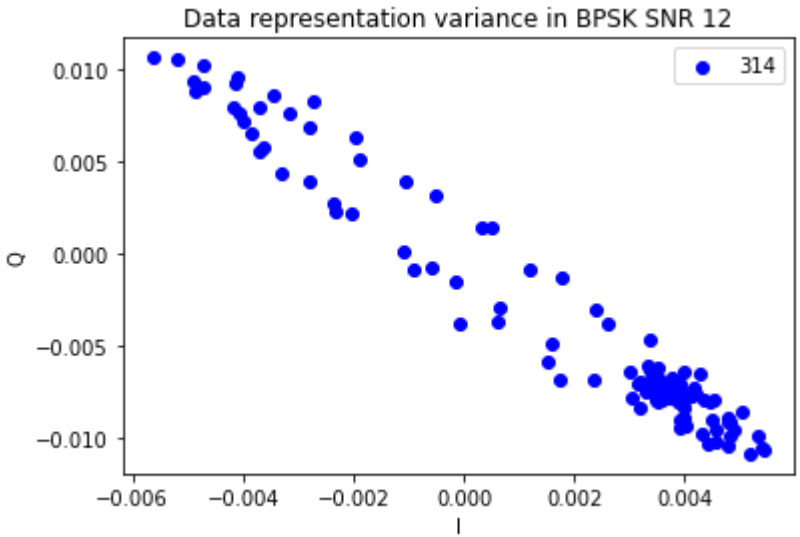
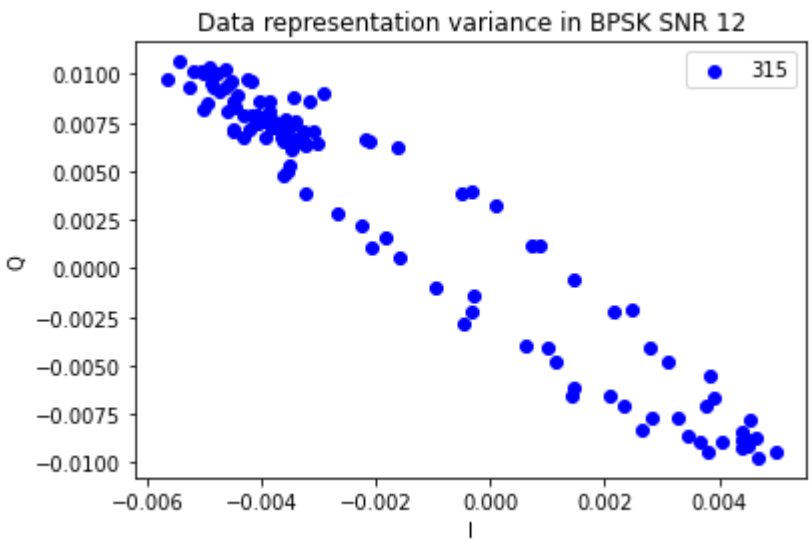
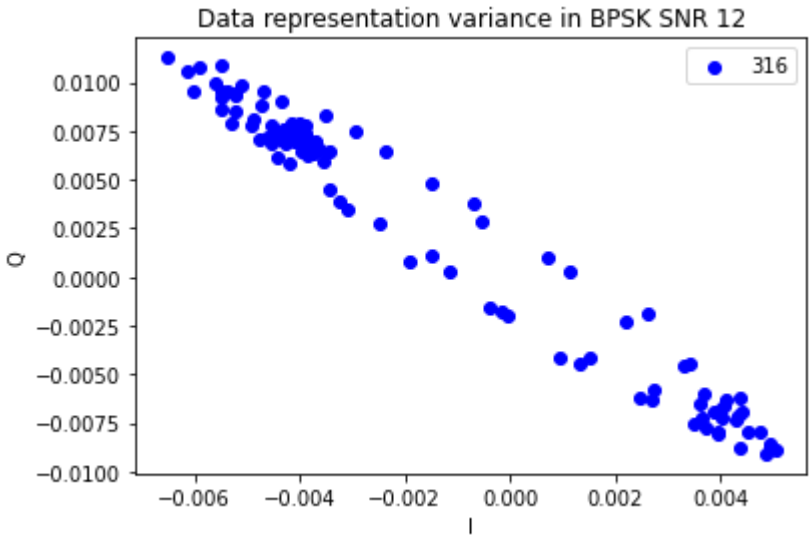
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
314
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
315
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
316
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
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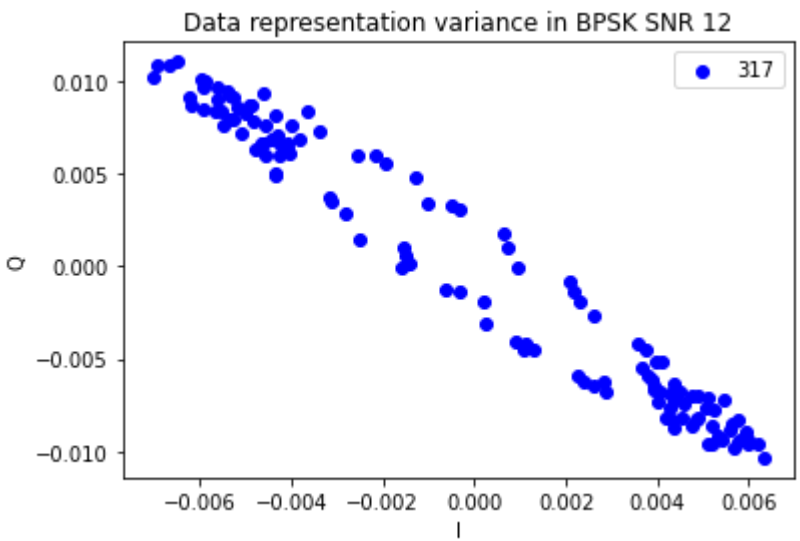
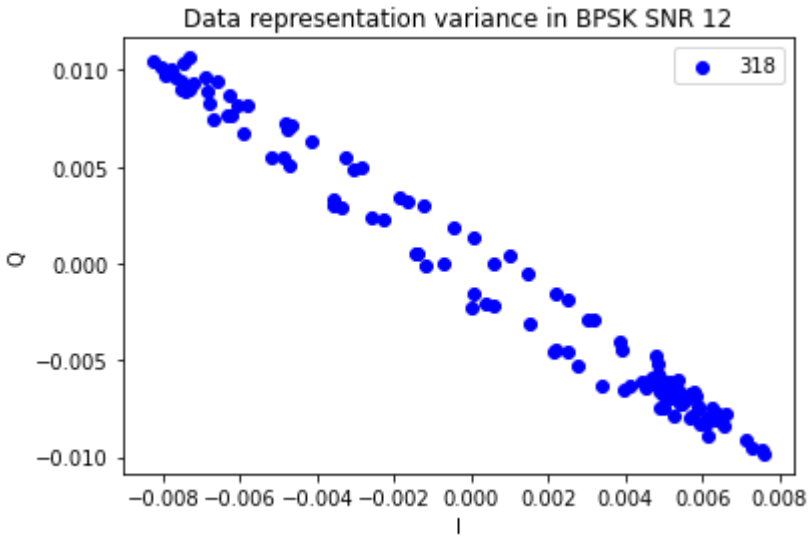
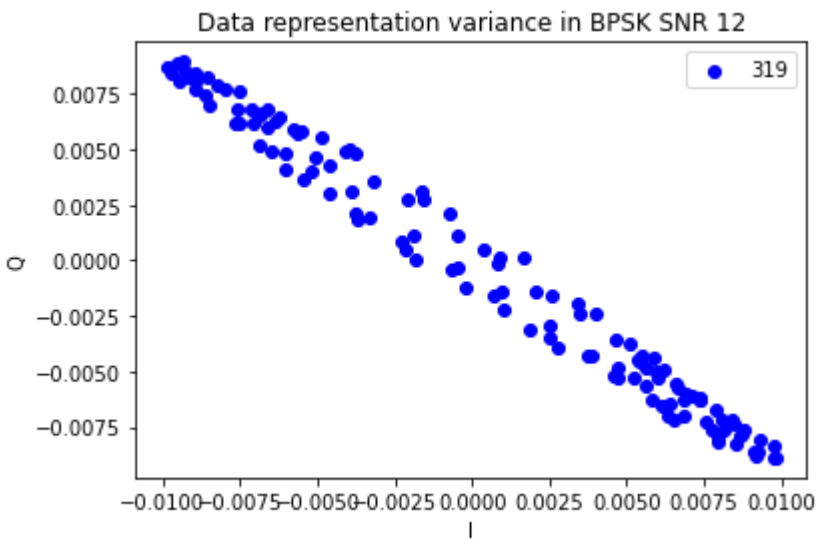

Data representation variance in BPSK SNR 12
317
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
318
0.010
0.005
0.000
−0.005
−0.010
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I


Data representation variance in BPSK SNR 12
319
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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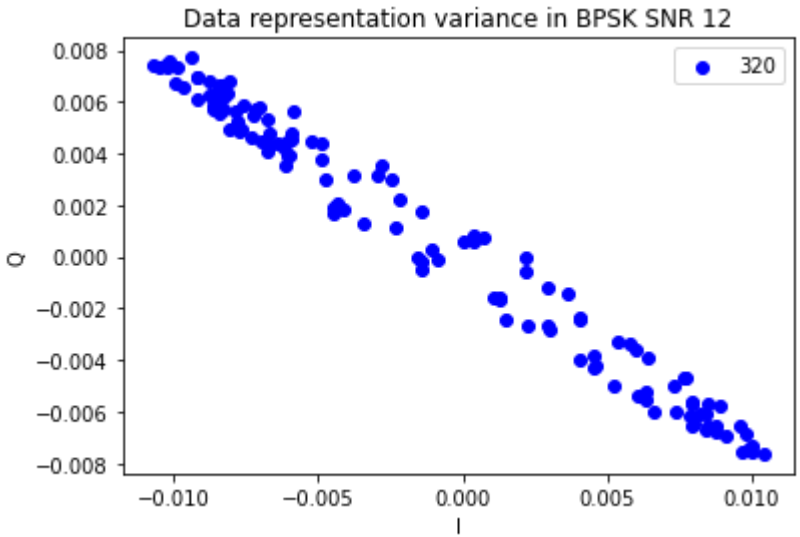
Data representation variance in BPSK SNR 12
320
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010
−0.005
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0.005
0.010
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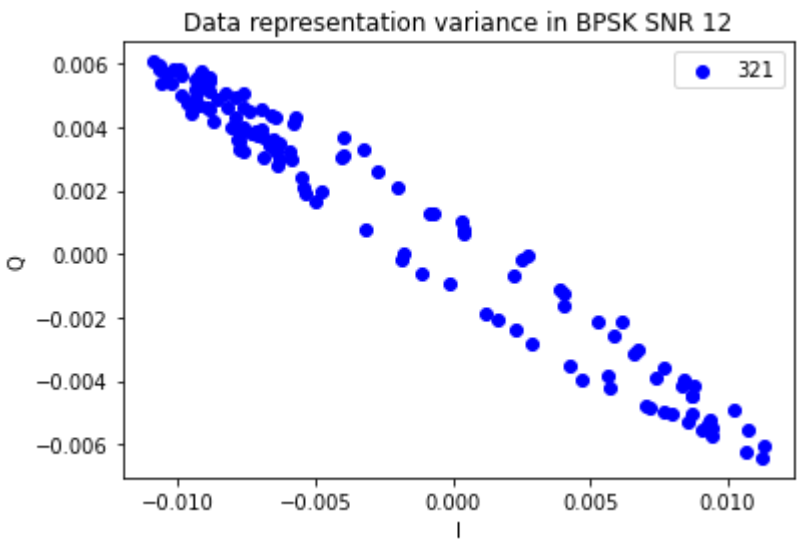
Data representation variance in BPSK SNR 12
321
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
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0.005
0.010
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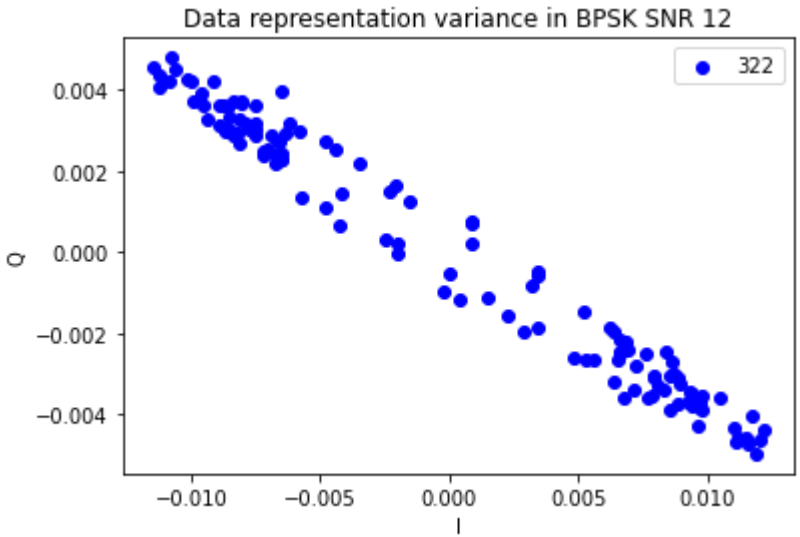
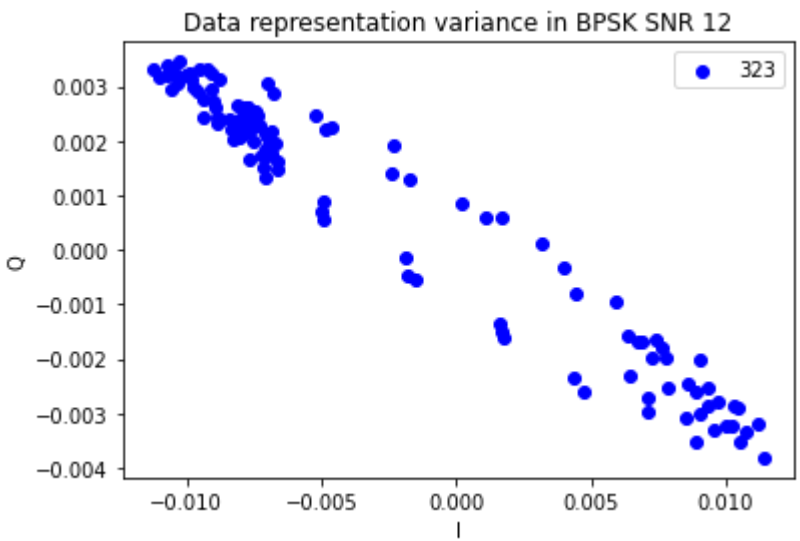
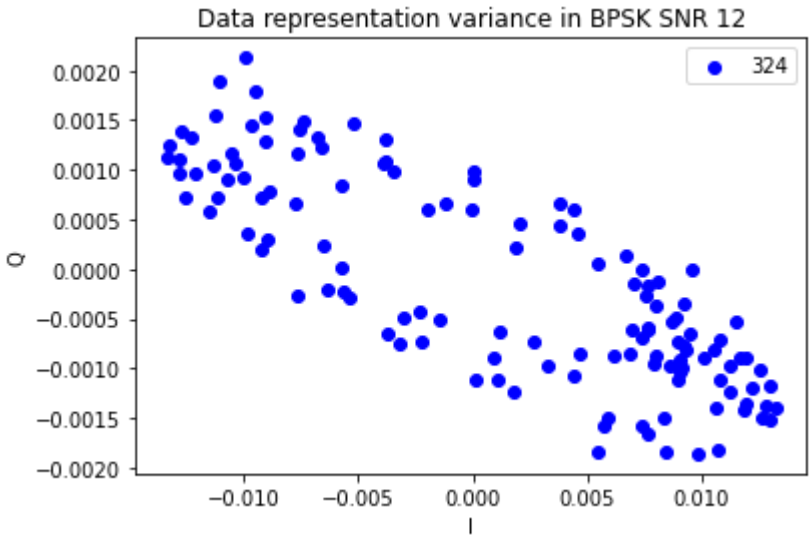

Data representation variance in BPSK SNR 12
322
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
323
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
324
0.0020
0.0015
0.0010
0.0005
0.0000
−0.0005
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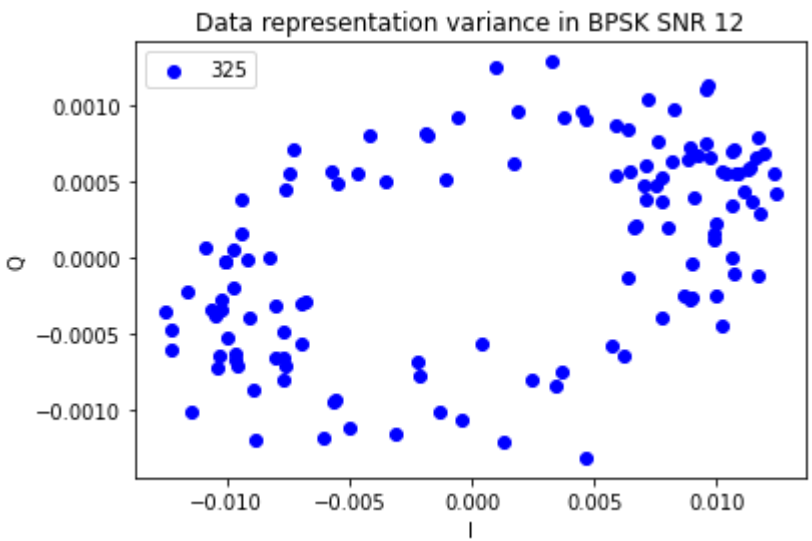
−0.0015
−0.0020
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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0.0005
0.0000
−0.0005
−0.0010
Q
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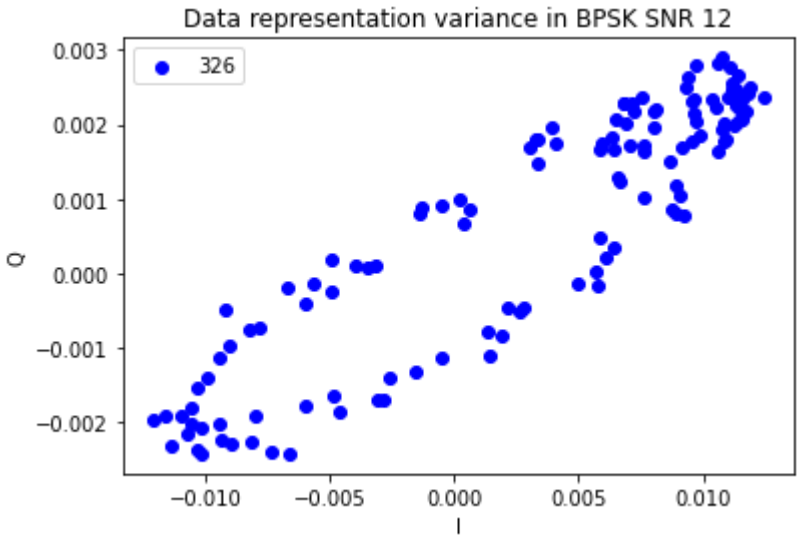
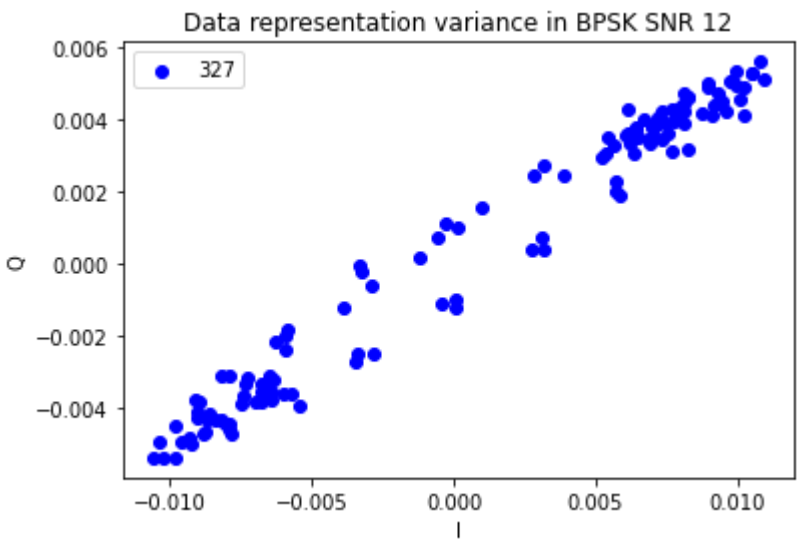
I


Data representation variance in BPSK SNR 12
326
0.003
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
327
0.006
0.004
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0.000
−0.002
−0.004
Q
−0.010
−0.005
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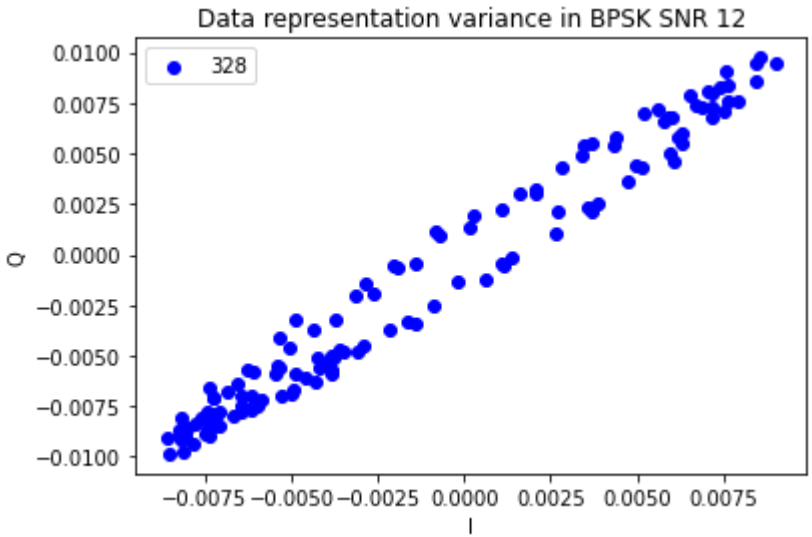
I


Data representation variance in BPSK SNR 12
328
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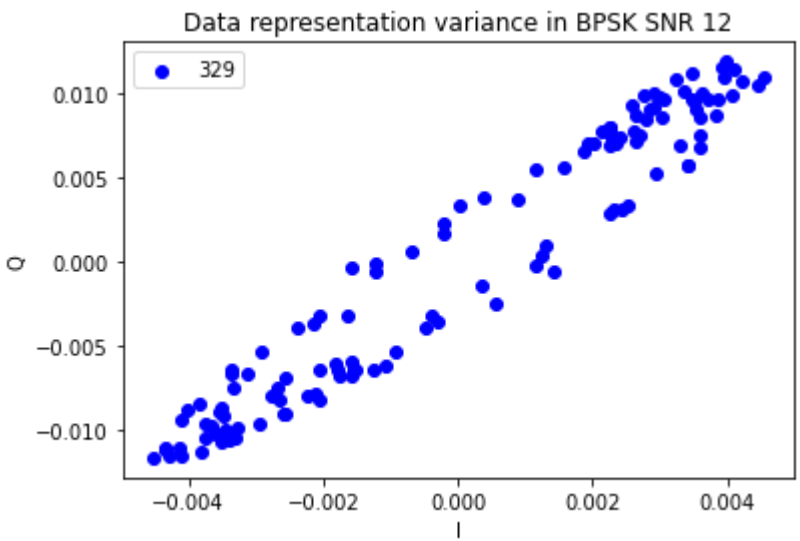
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
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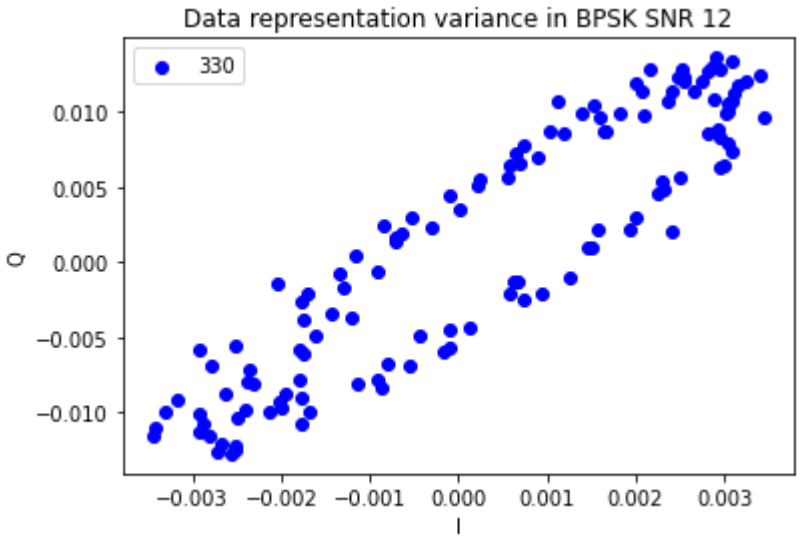
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I


Data representation variance in BPSK SNR 12
330
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.002
−0.001
0.000
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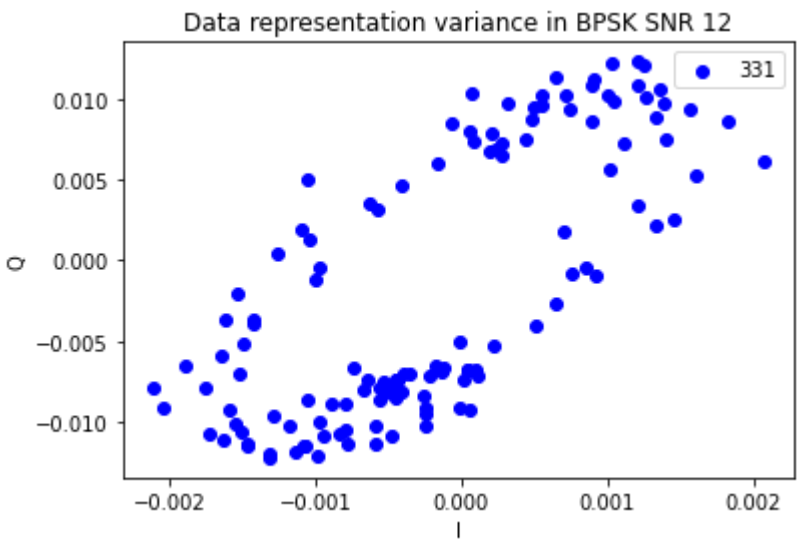
0.002
0.003
I


Data representation variance in BPSK SNR 12
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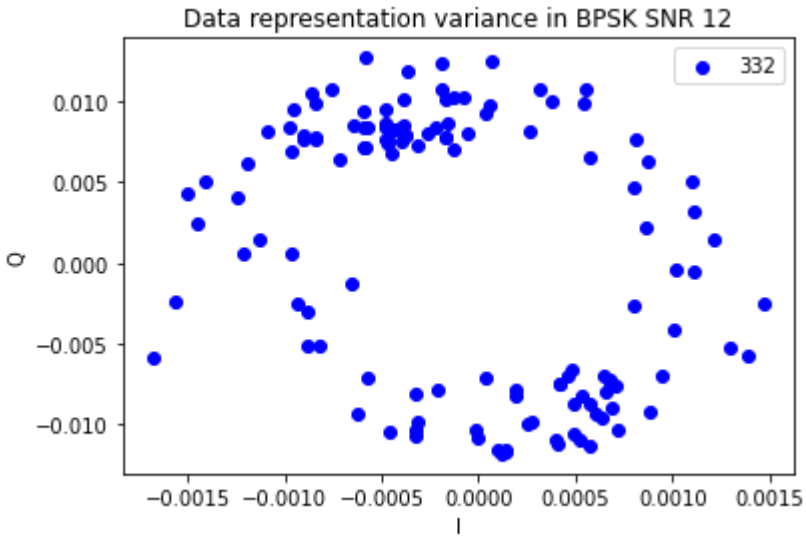
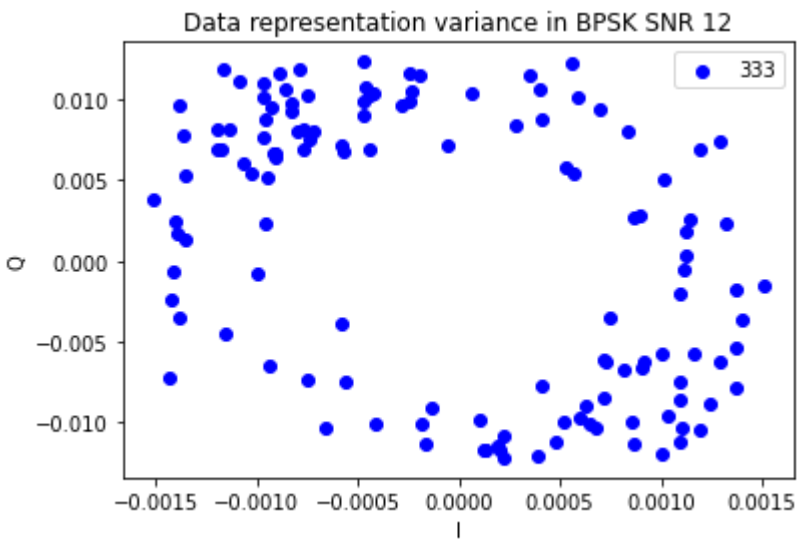
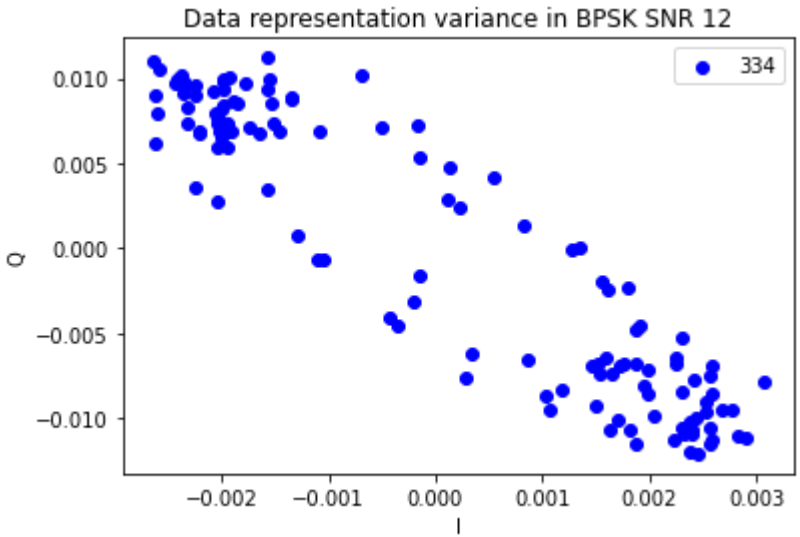
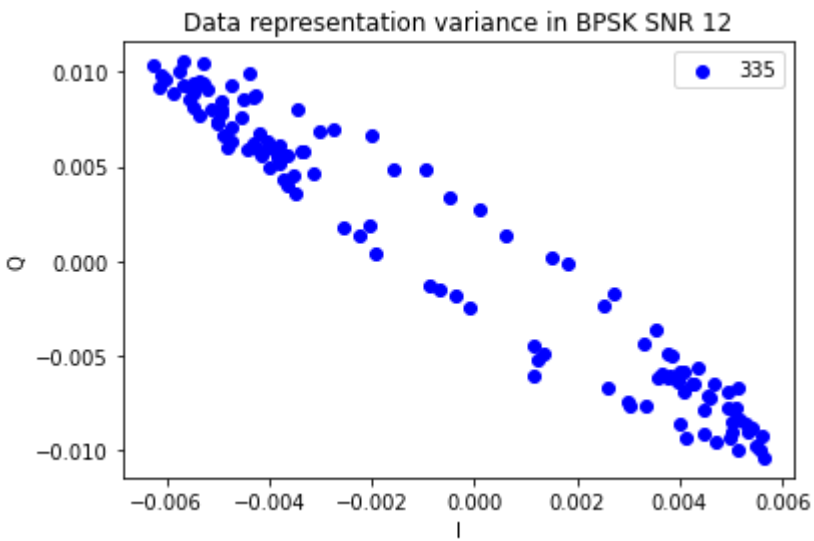
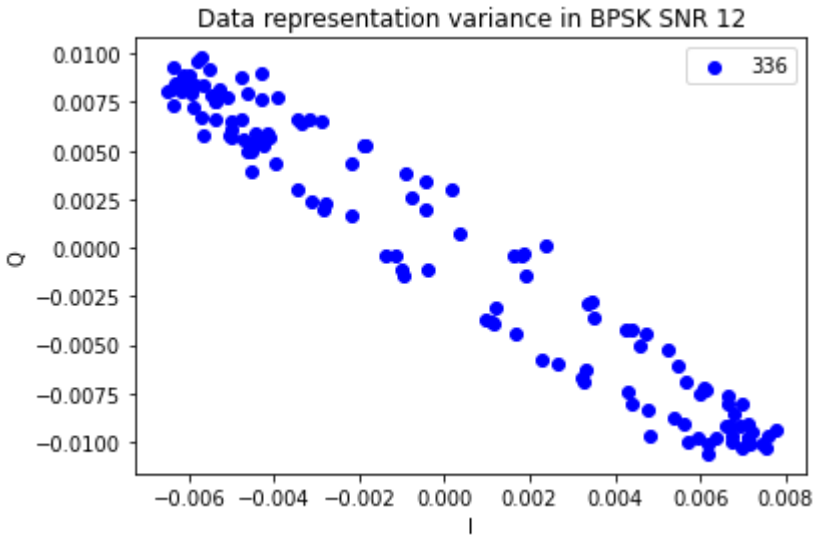
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
332
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
I


Data representation variance in BPSK SNR 12
333
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
I


Data representation variance in BPSK SNR 12
334
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
335
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
336
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
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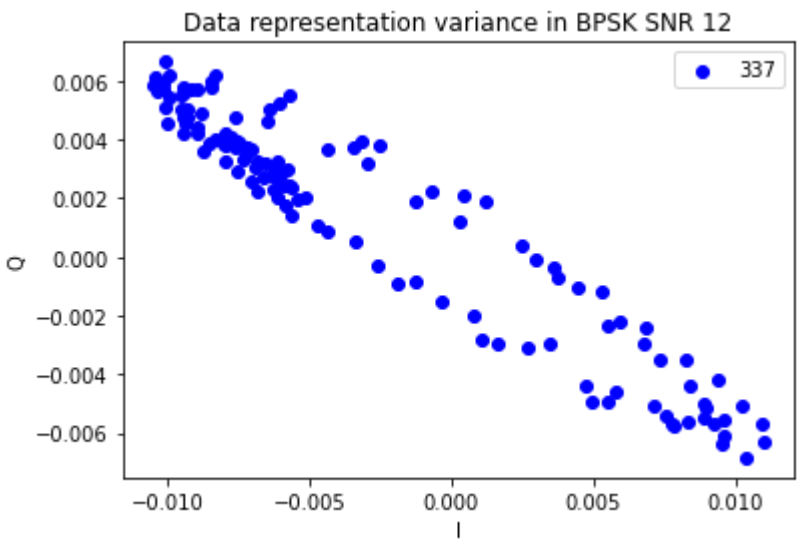
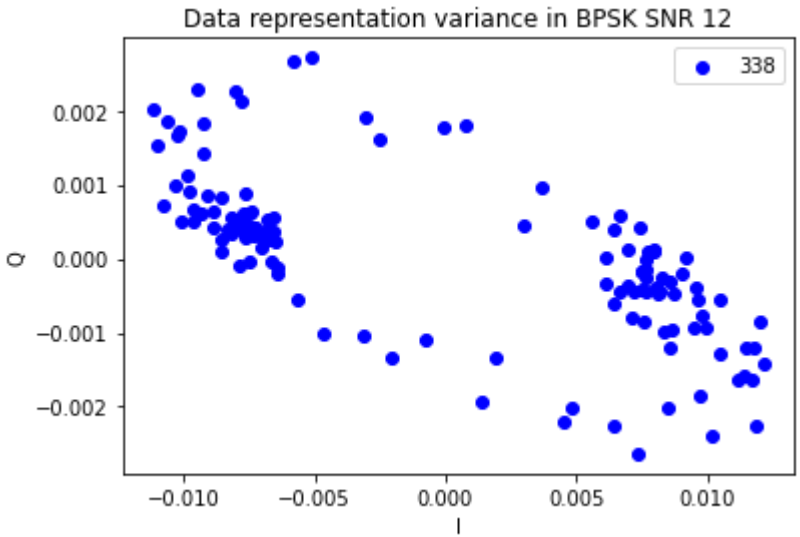
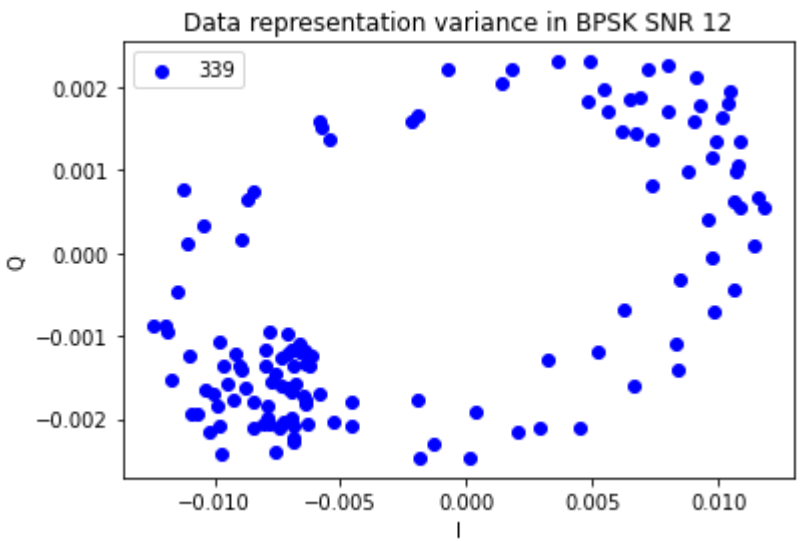
0.006
0.008
I


Data representation variance in BPSK SNR 12
337
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
338
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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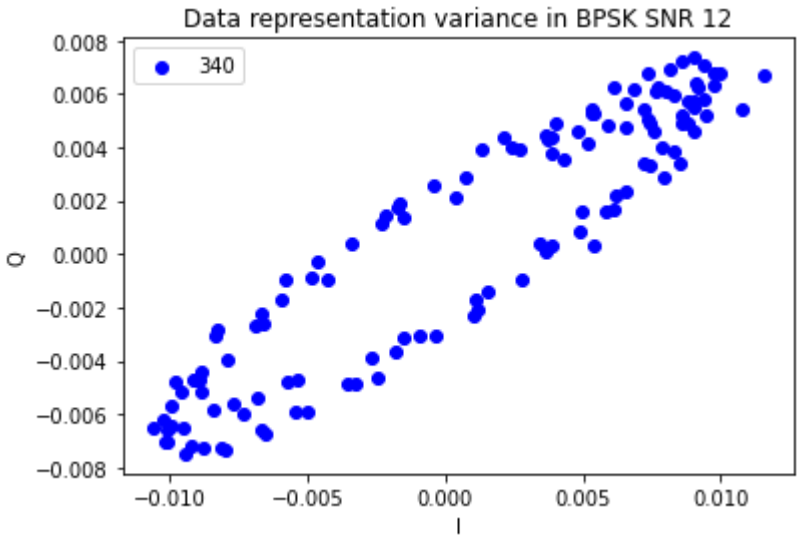
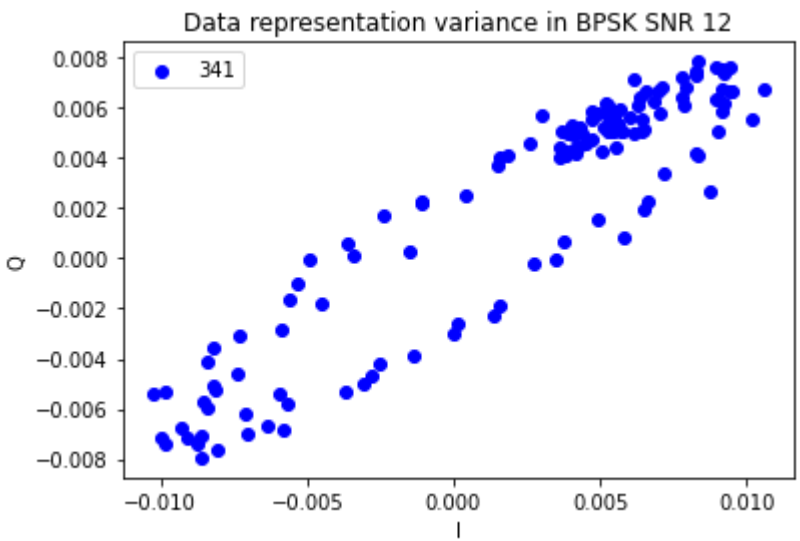
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
340
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
341
0.008
0.006
0.004
0.002
0.000
−0.002
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−0.006
−0.008
Q
−0.010
−0.005
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0.005
0.010
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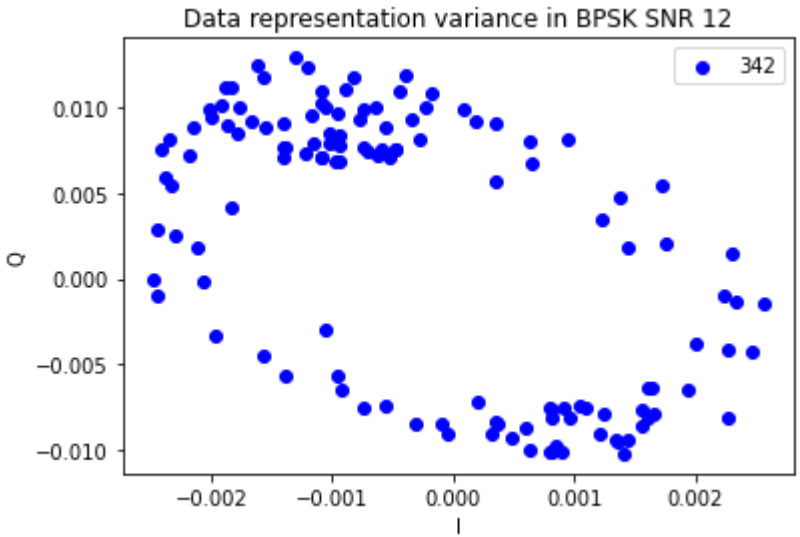
Data representation variance in BPSK SNR 12
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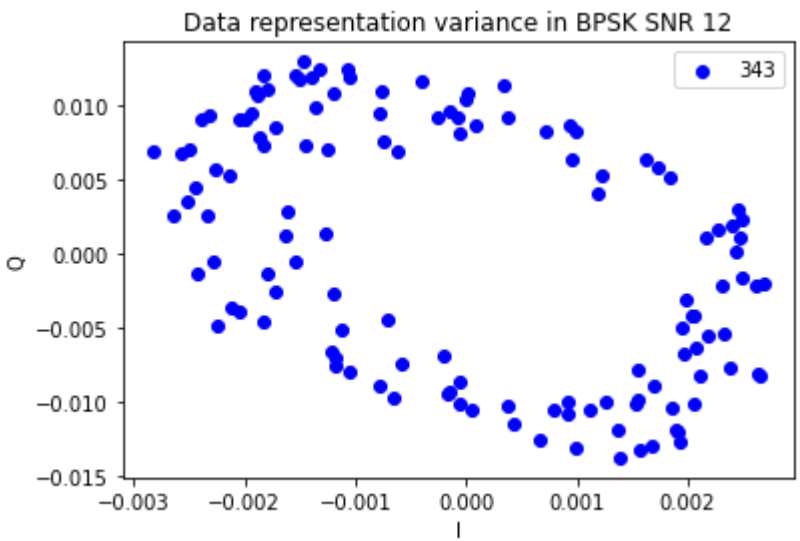
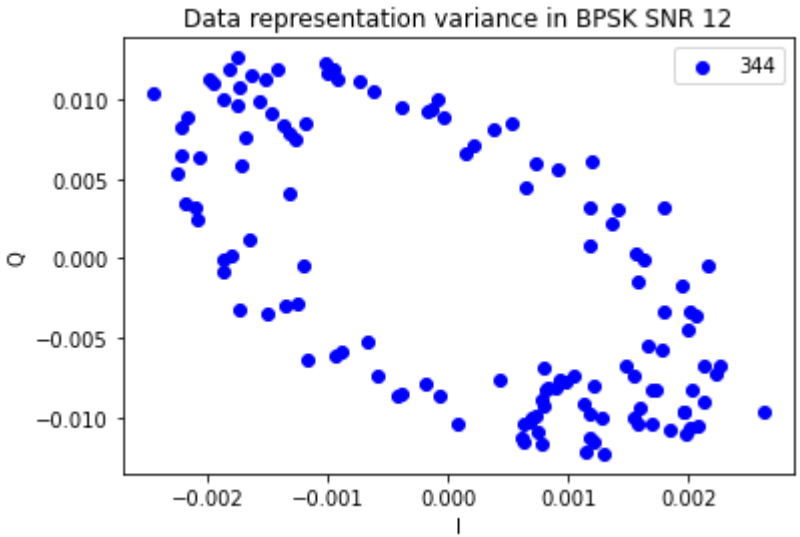
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
343
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
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0.010
0.005
0.000
−0.005
−0.010
Q
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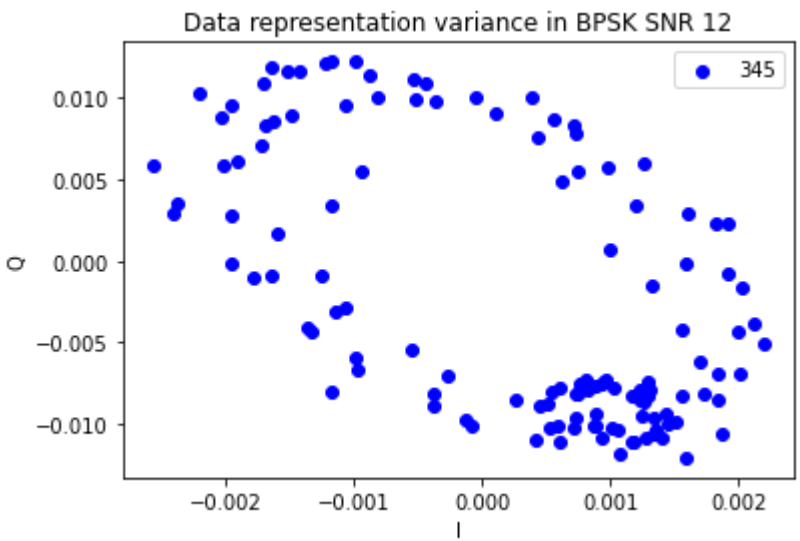
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
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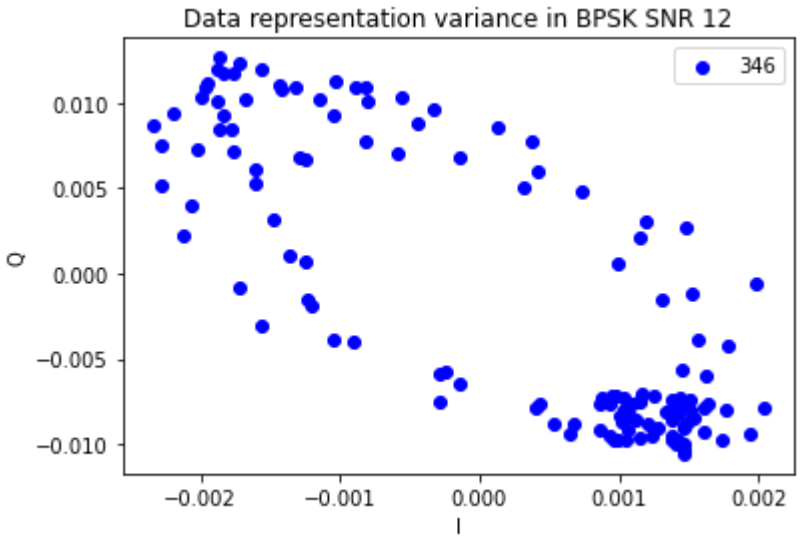
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
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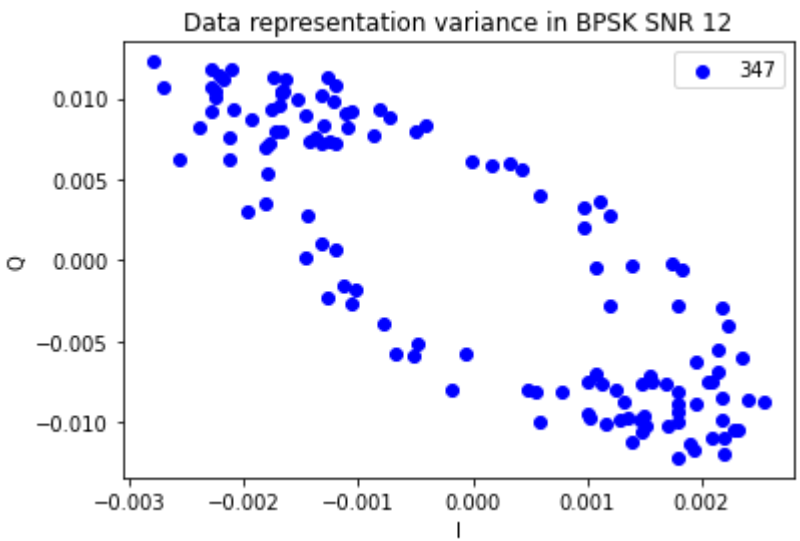
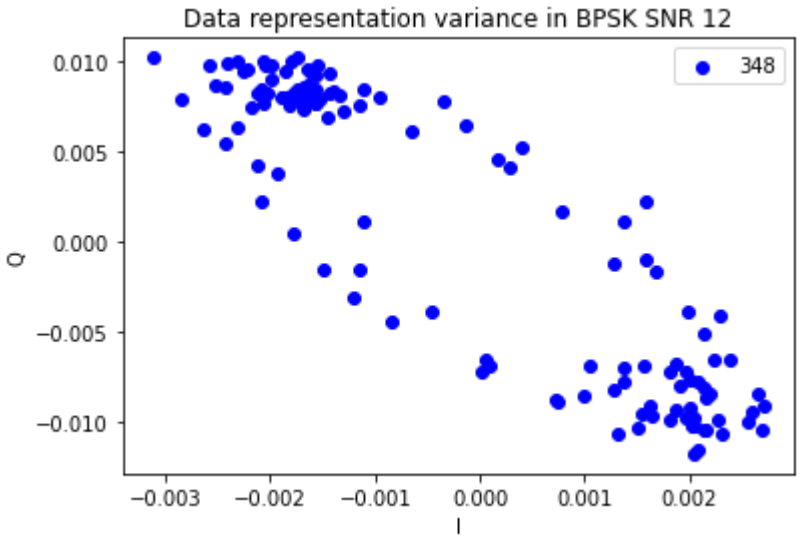
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
347
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
348
0.010
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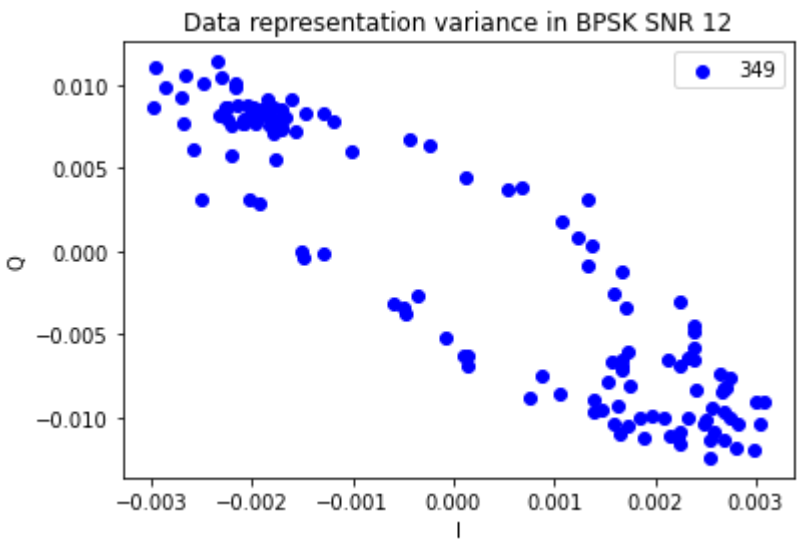
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
349
0.010
0.005
0.000
−0.005
−0.010
Q
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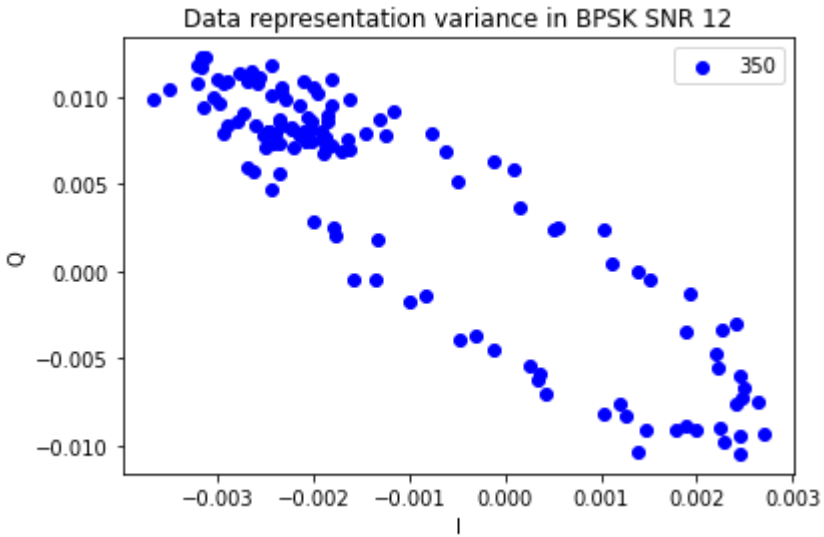
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
350
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
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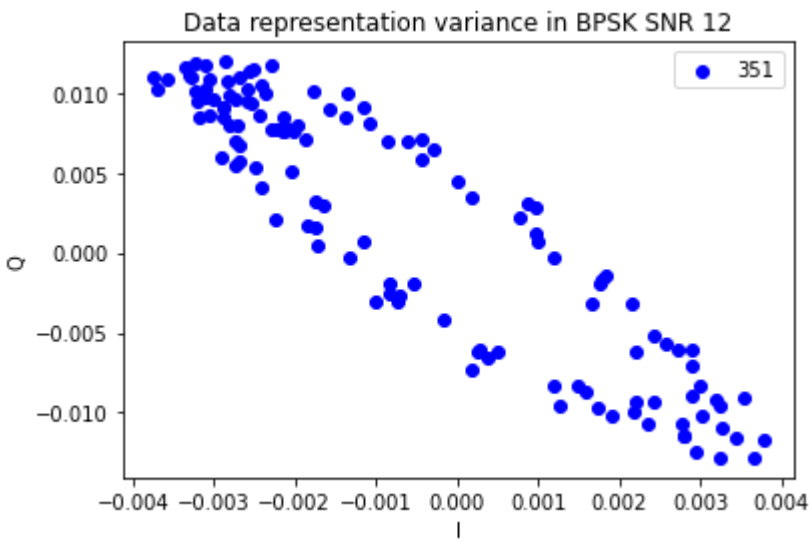
Data representation variance in BPSK SNR 12
351
0.010
0.005
0.000
−0.005
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Q
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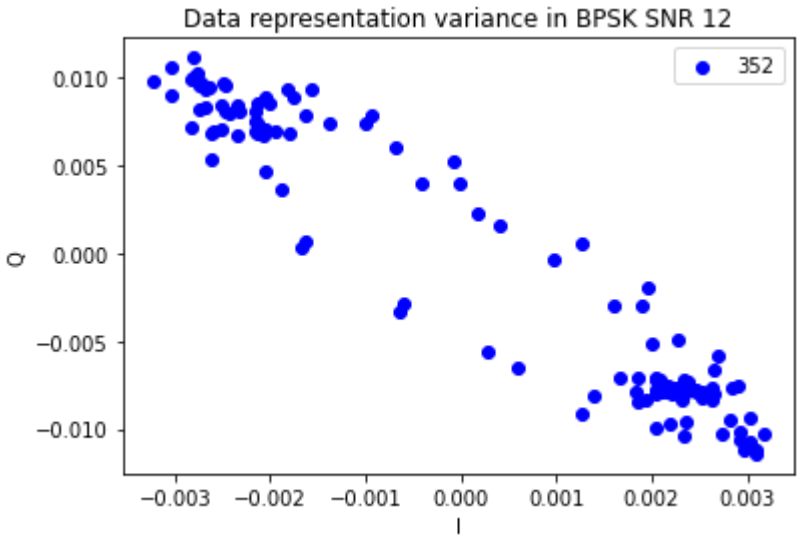
Data representation variance in BPSK SNR 12
352
0.010
0.005
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−0.005
−0.010
Q
−0.003
−0.002
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0.003
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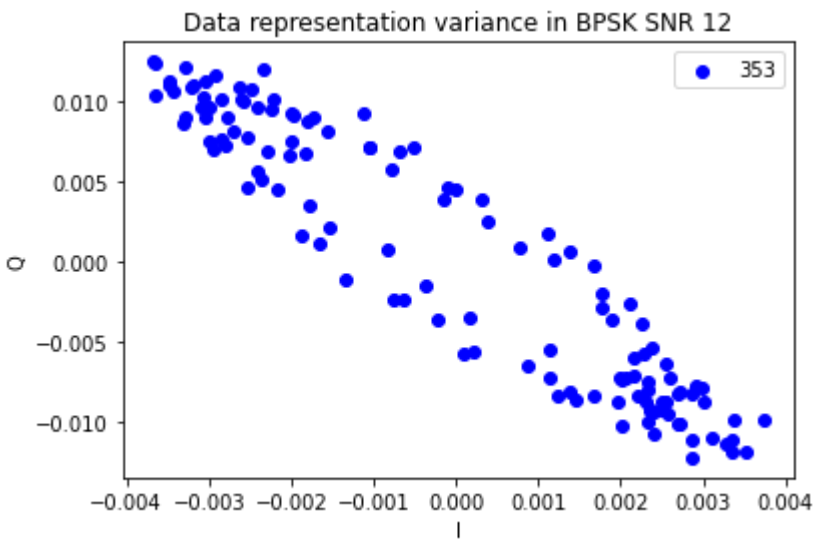
Data representation variance in BPSK SNR 12
353
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.003
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0.001
0.002
0.003
0.004
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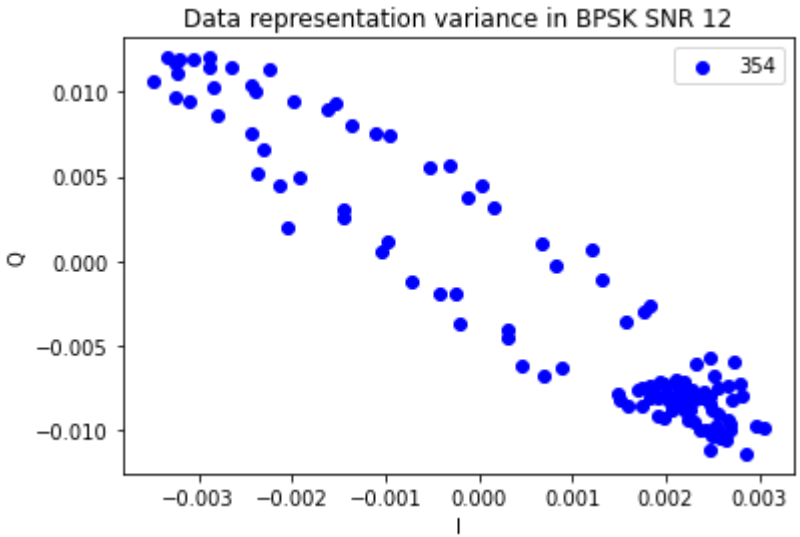
Data representation variance in BPSK SNR 12
354
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
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0.000
0.001
0.002
0.003
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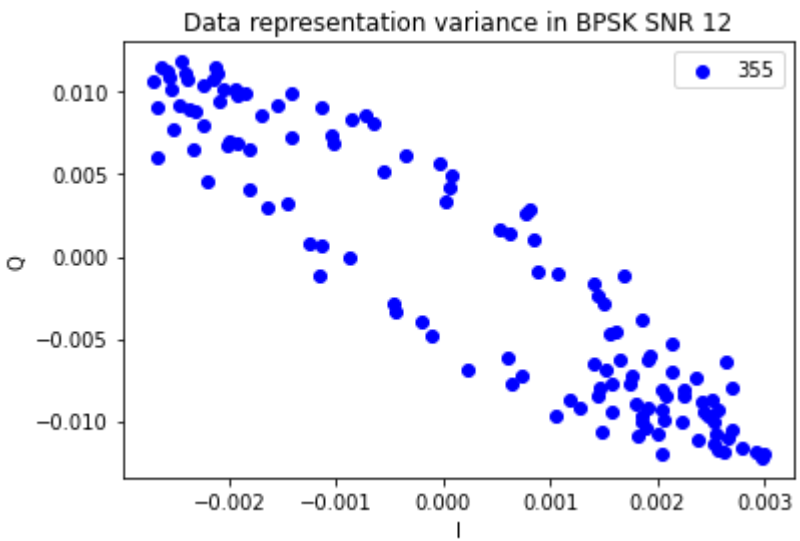
Data representation variance in BPSK SNR 12
355
0.010
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0.000
−0.005
−0.010
Q
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−0.001
0.000
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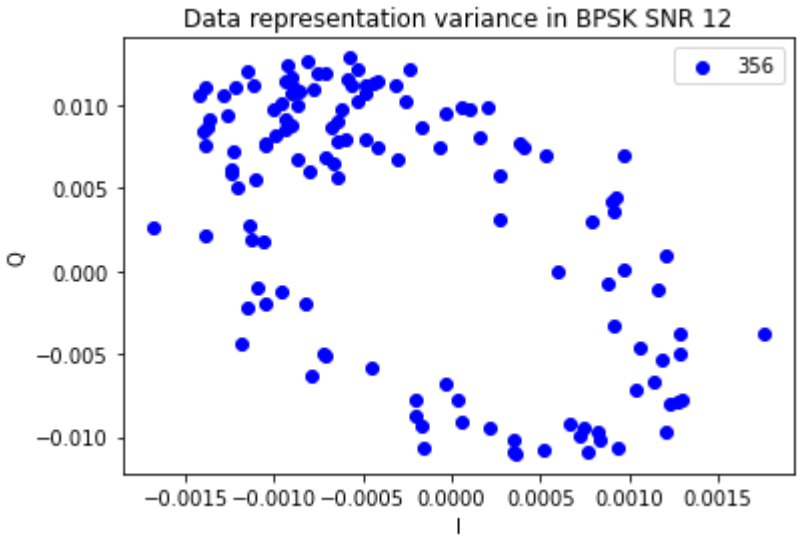
Data representation variance in BPSK SNR 12
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0.005
0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
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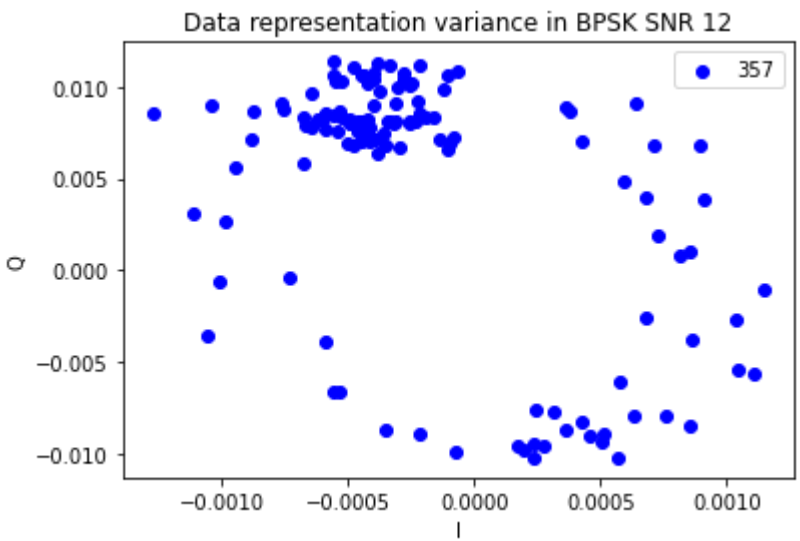
Data representation variance in BPSK SNR 12
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0.005
0.000
−0.005
−0.010
Q
−0.0010 −0.0005 0.0000 0.0005 0.0010
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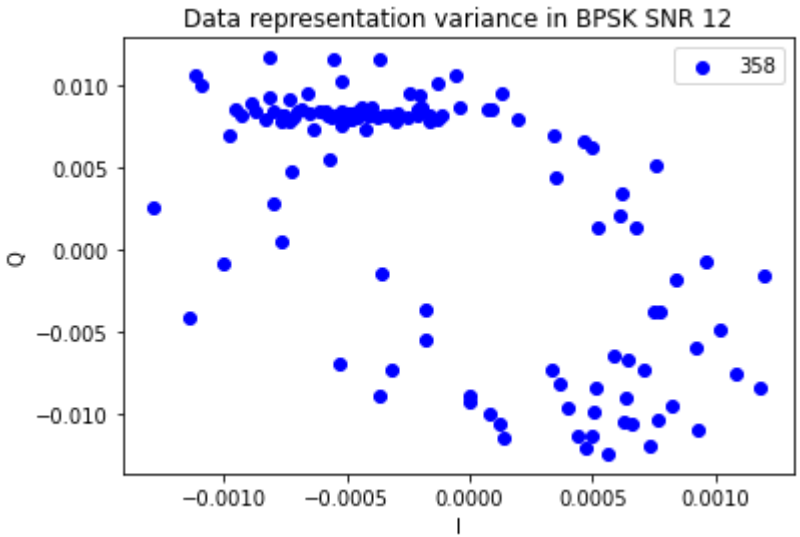
Data representation variance in BPSK SNR 12
358
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0.005
0.000
−0.005
−0.010
Q
−0.0010
−0.0005
0.0000
0.0005
0.0010
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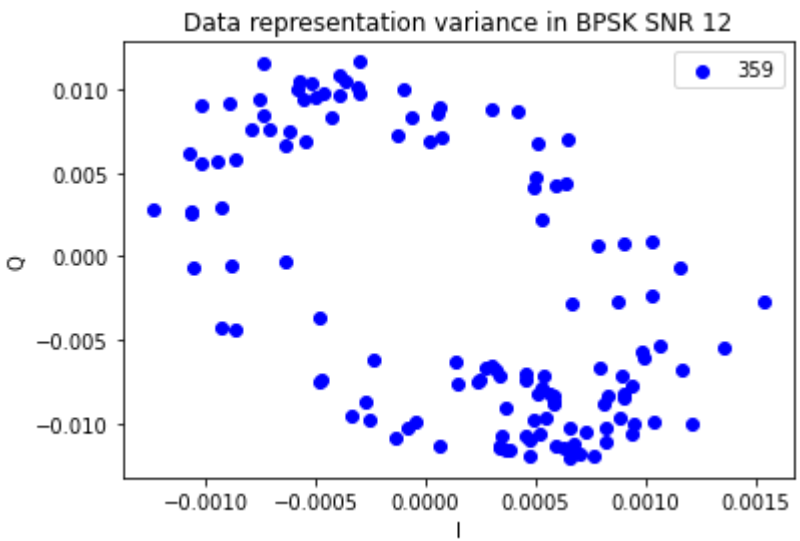
Data representation variance in BPSK SNR 12
359
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0.000
−0.005
−0.010
Q
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−0.0005
0.0000
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0.0010
0.0015
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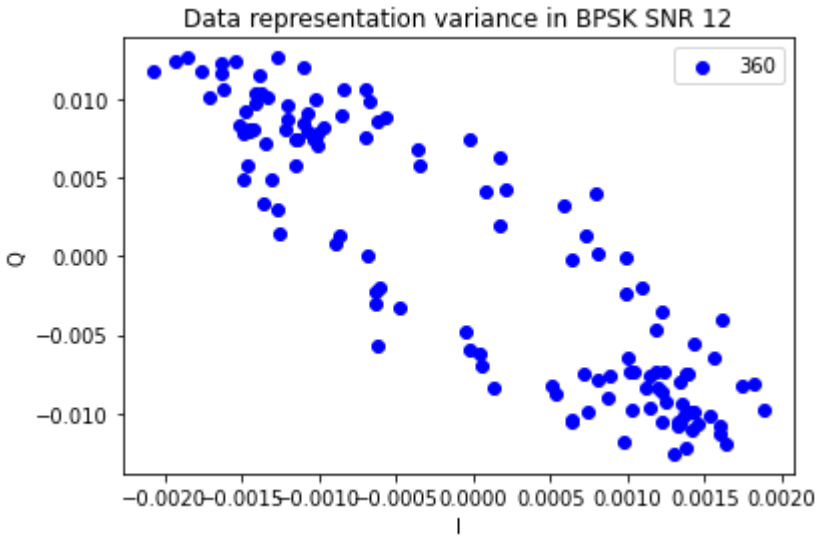
Data representation variance in BPSK SNR 12
360
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0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
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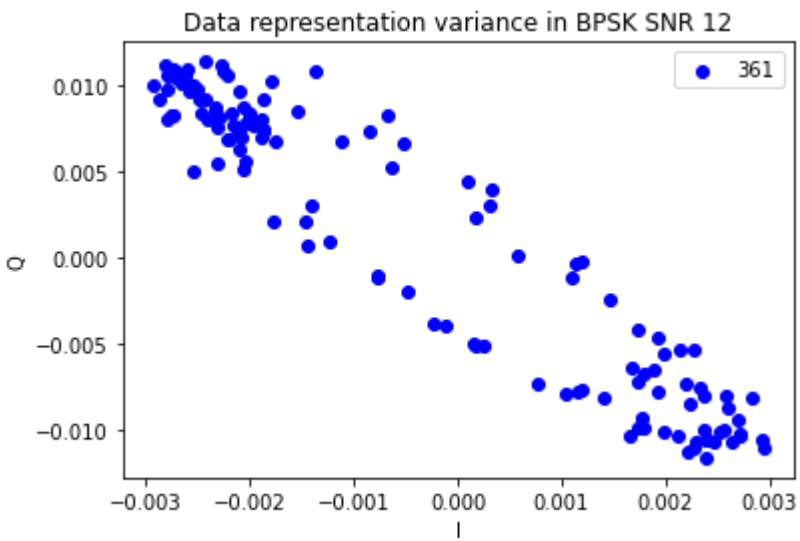
Data representation variance in BPSK SNR 12
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0.000
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−0.010
Q
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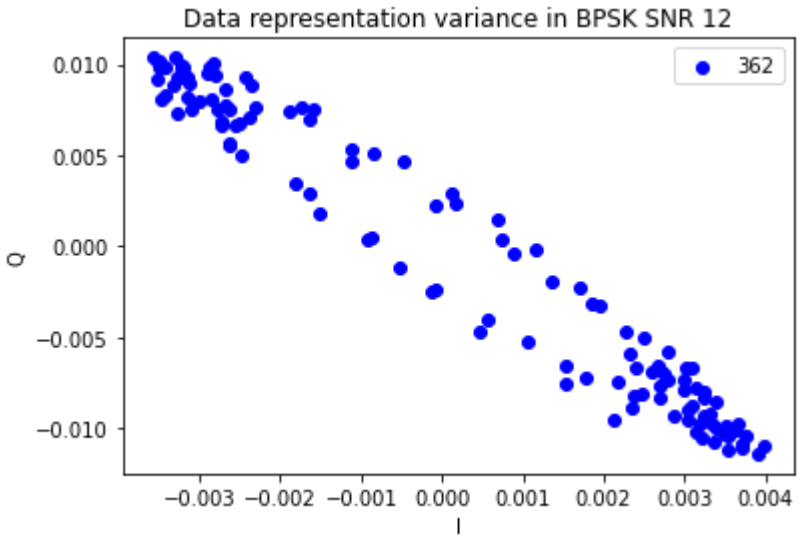
Data representation variance in BPSK SNR 12
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−0.010
Q
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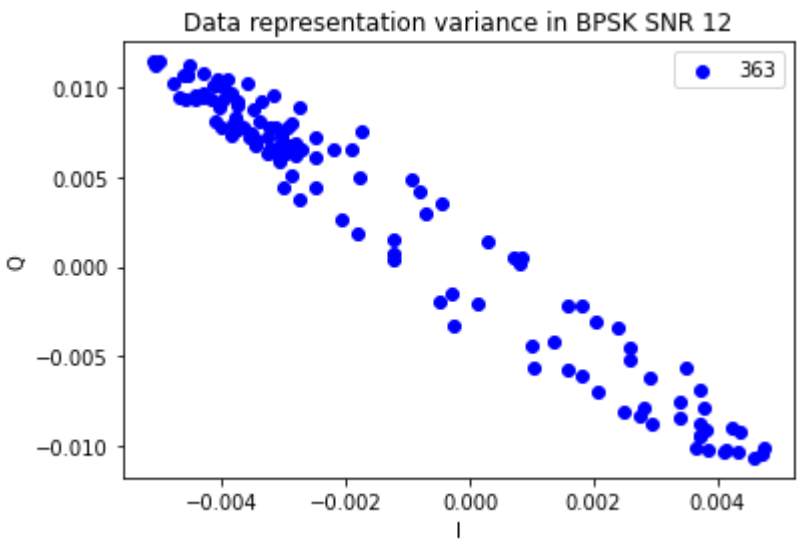
Data representation variance in BPSK SNR 12
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0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
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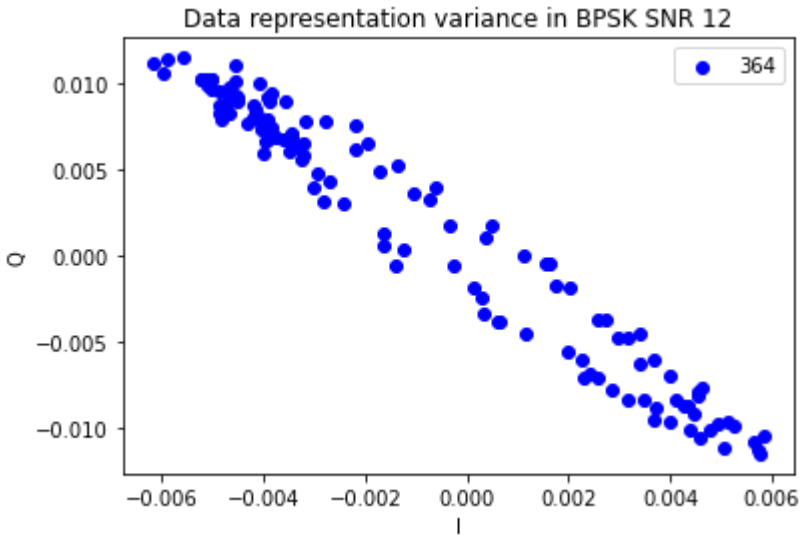
Data representation variance in BPSK SNR 12
364
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.004
−0.002
0.000
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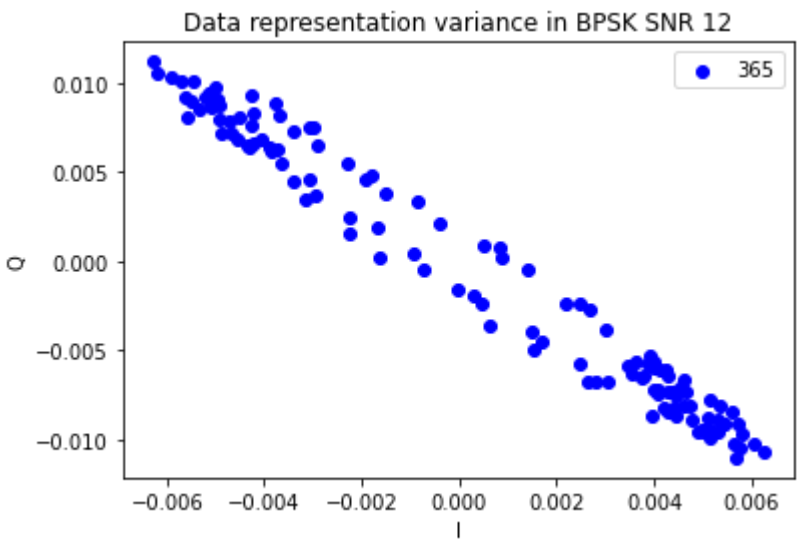
0.004
0.006
I


Data representation variance in BPSK SNR 12
365
0.010
0.005
0.000
−0.005
−0.010
Q
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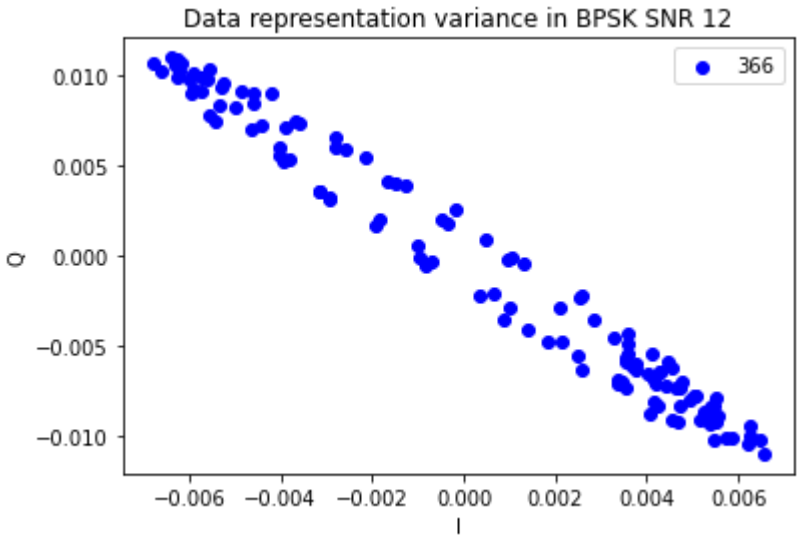
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
366
0.010
0.005
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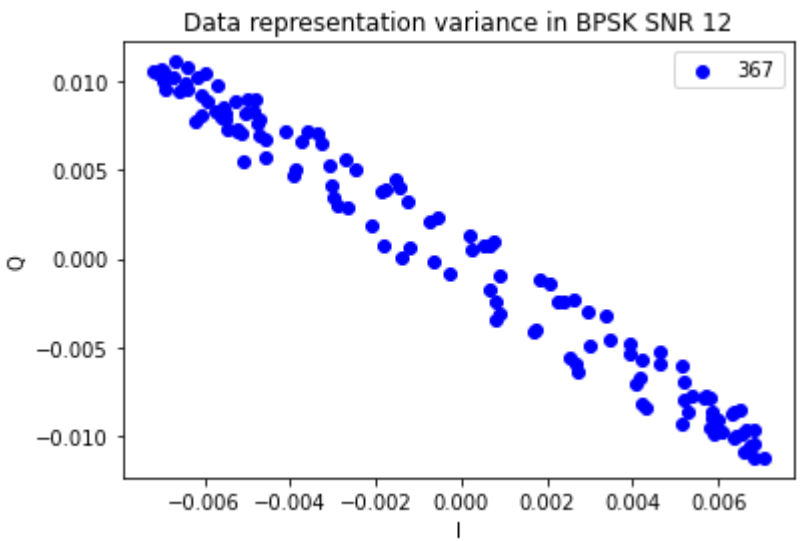
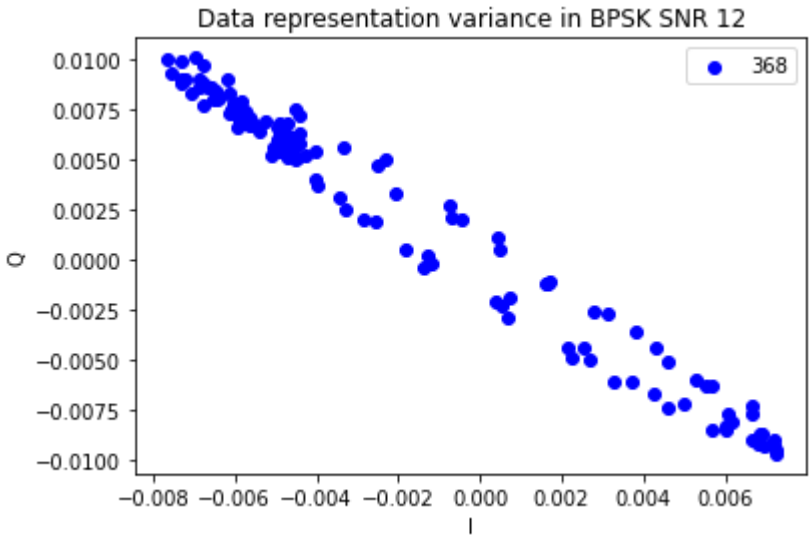
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
367
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
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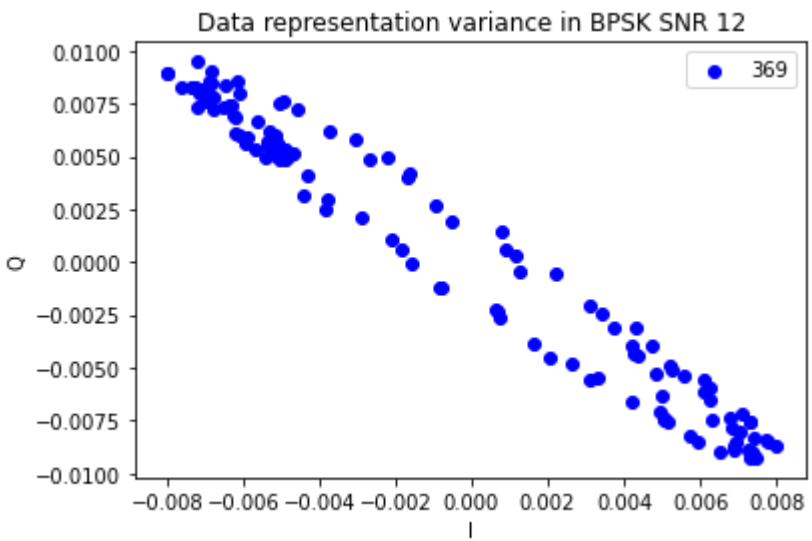
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I


Data representation variance in BPSK SNR 12
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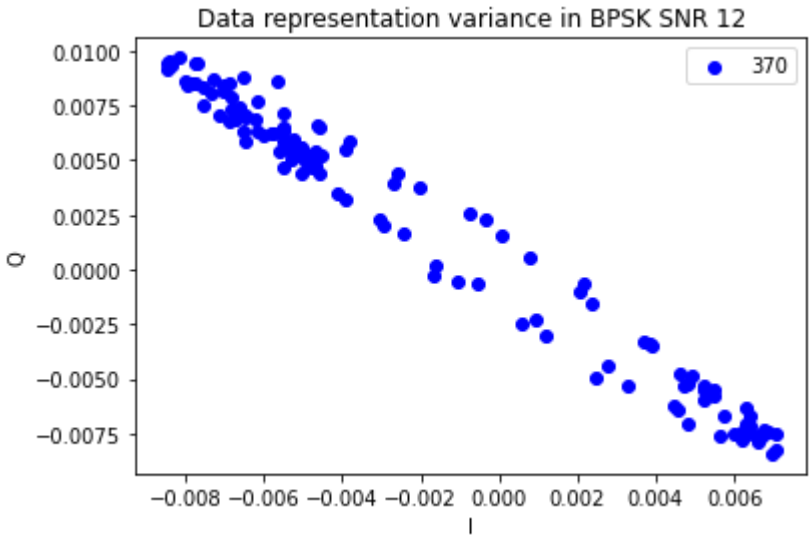
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I


Data representation variance in BPSK SNR 12
370
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
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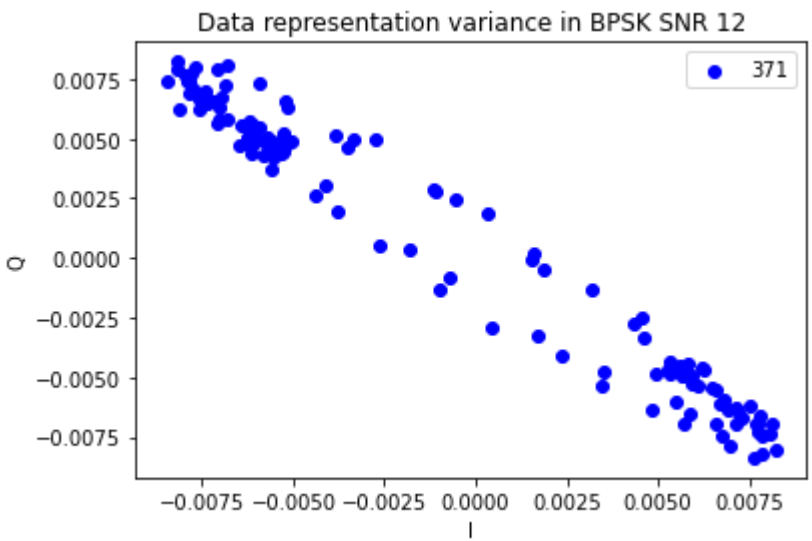
Data representation variance in BPSK SNR 12
371
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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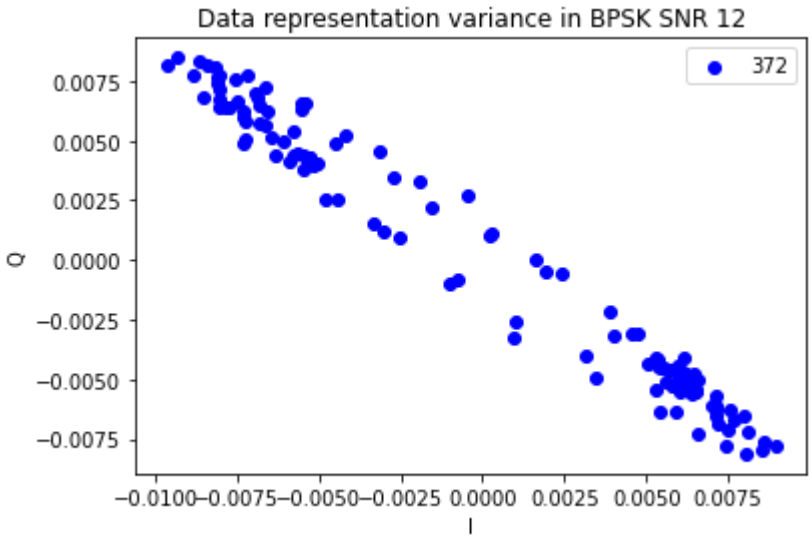
Data representation variance in BPSK SNR 12
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0.0075
0.0050
0.0025
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−0.0050
−0.0075
Q
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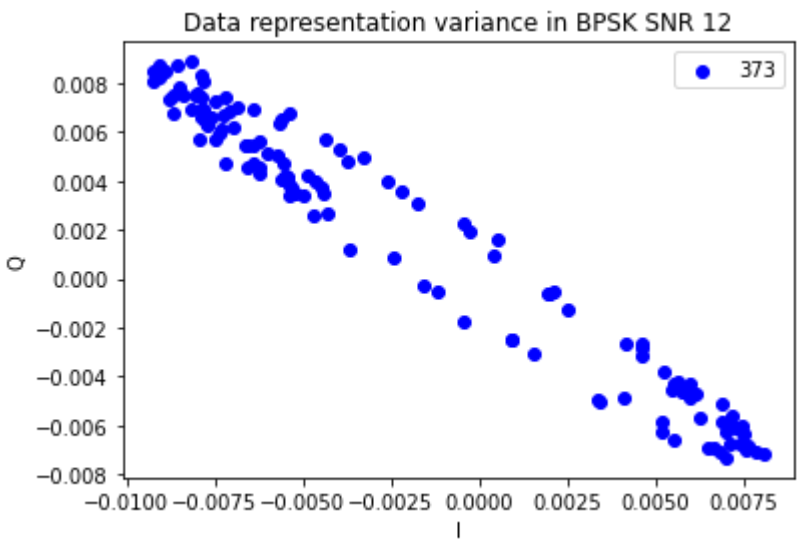
Data representation variance in BPSK SNR 12
373
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
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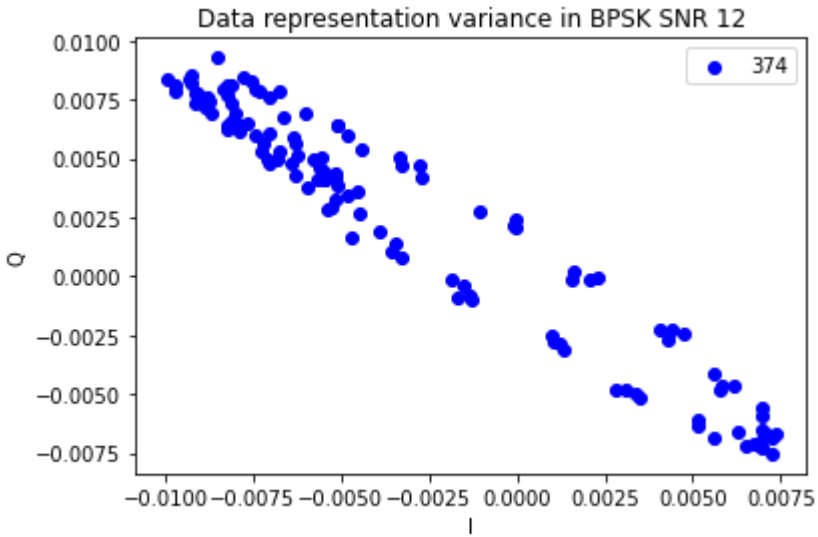
Data representation variance in BPSK SNR 12
374
0.0100
0.0075
0.0050
0.0025
0.0000
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−0.0050
−0.0075
Q
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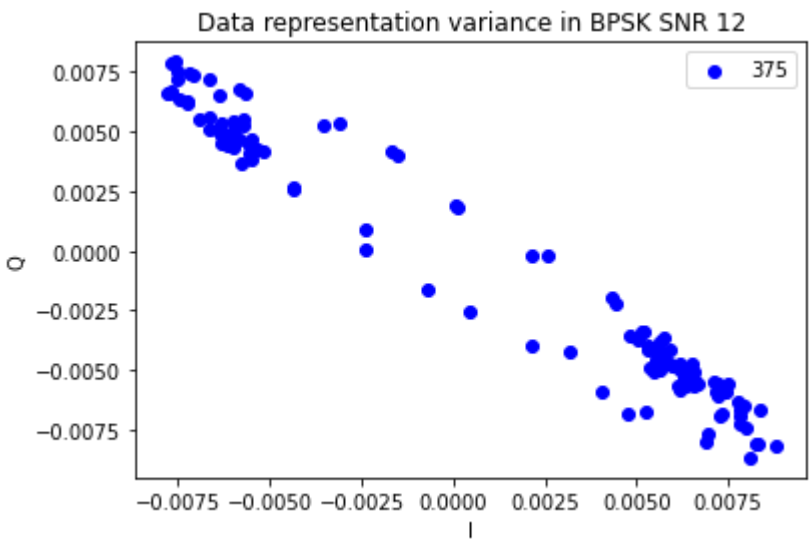
Data representation variance in BPSK SNR 12
375
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−0.0050
−0.0075
Q
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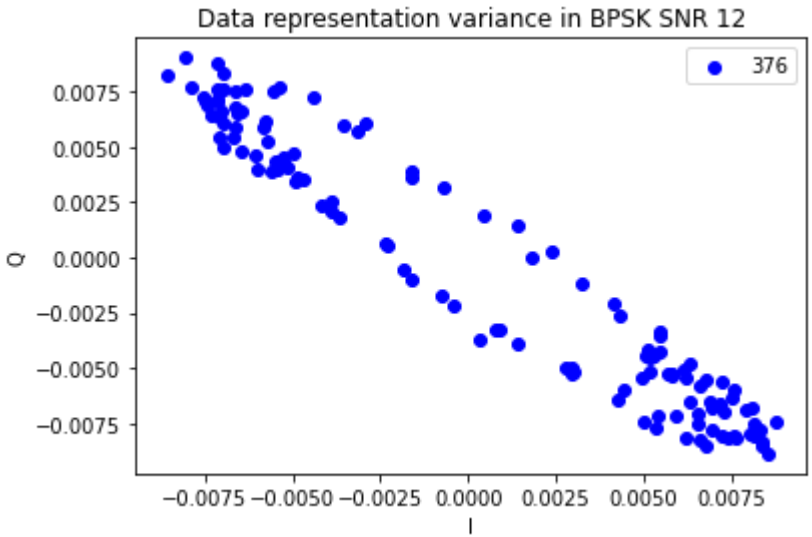
Data representation variance in BPSK SNR 12
376
0.0075
0.0050
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−0.0050
−0.0075
Q
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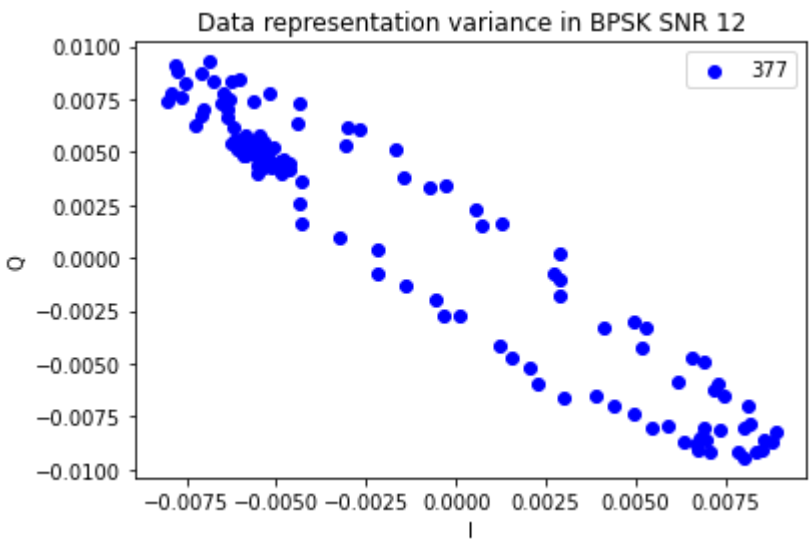
Data representation variance in BPSK SNR 12
377
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
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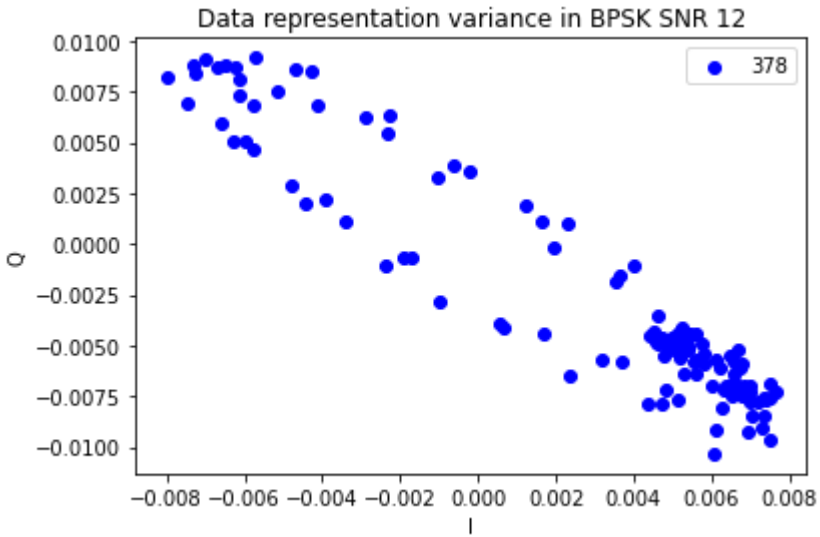
I


Data representation variance in BPSK SNR 12
378
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
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−0.0100
Q
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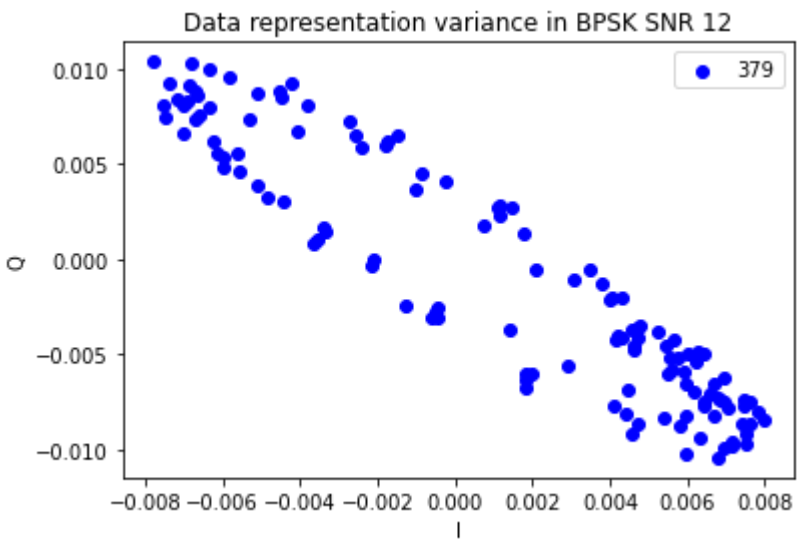
Data representation variance in BPSK SNR 12
379
0.010
0.005
0.000
−0.005
−0.010
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
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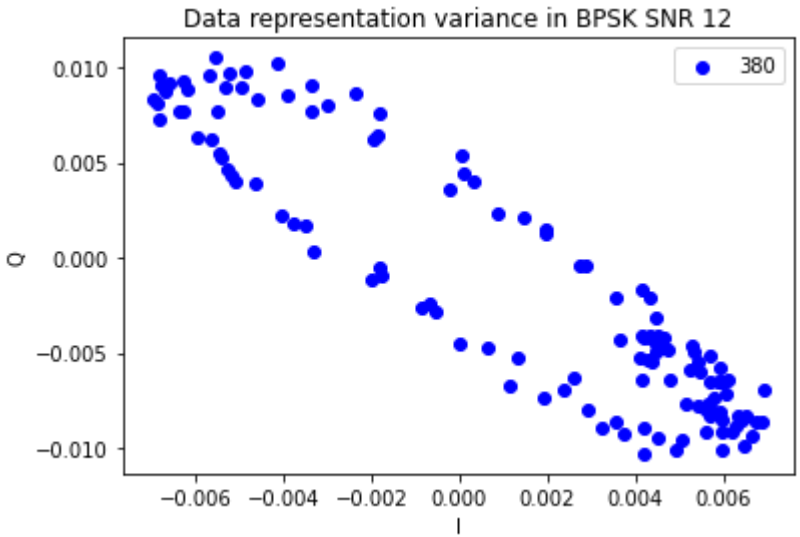
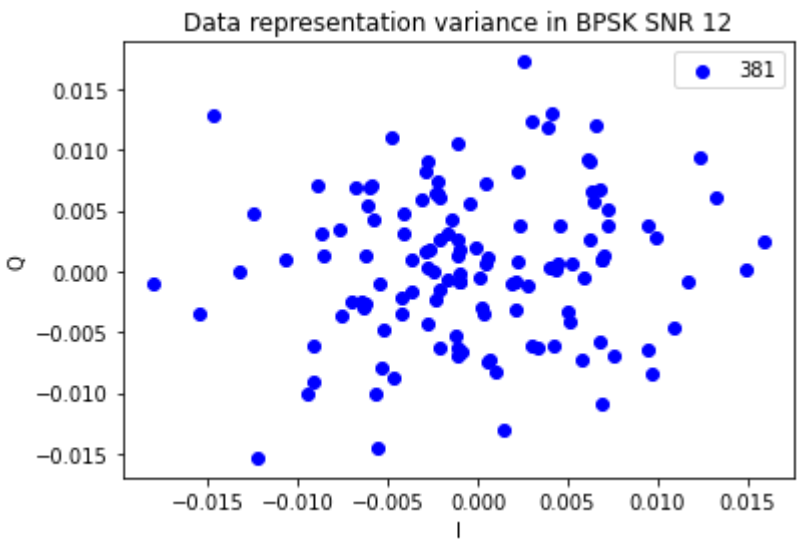

Data representation variance in BPSK SNR 12
380
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
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0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
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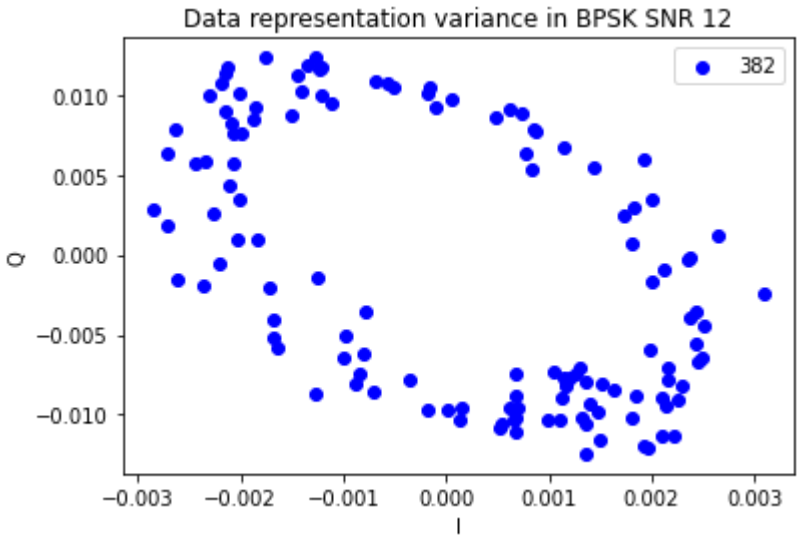
−0.010
−0.005
0.000
0.005
0.010
0.015
I


Data representation variance in BPSK SNR 12
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0.010
0.005
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−0.010
Q
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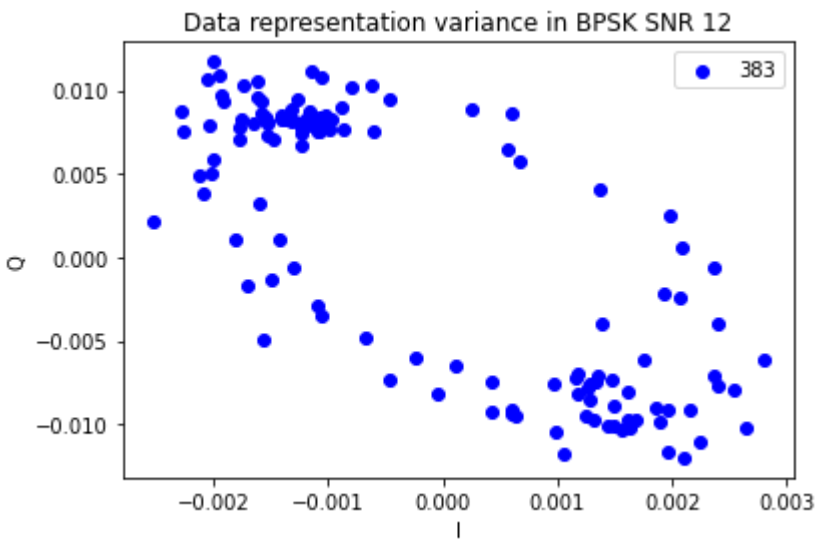
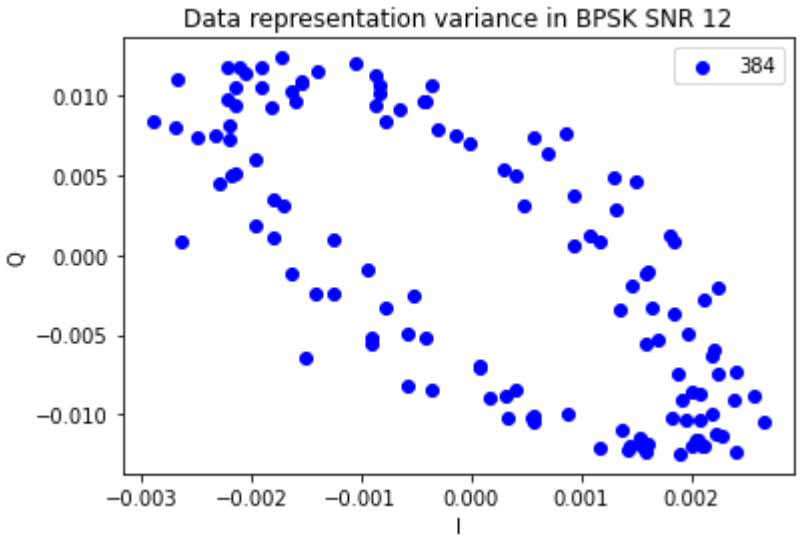
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
383
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
384
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
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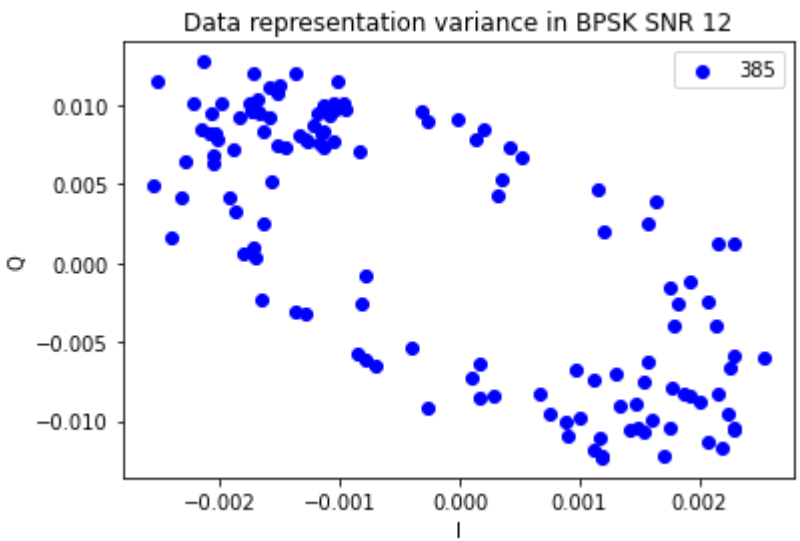
Data representation variance in BPSK SNR 12
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0.000
−0.005
−0.010
Q
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−0.001
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0.002
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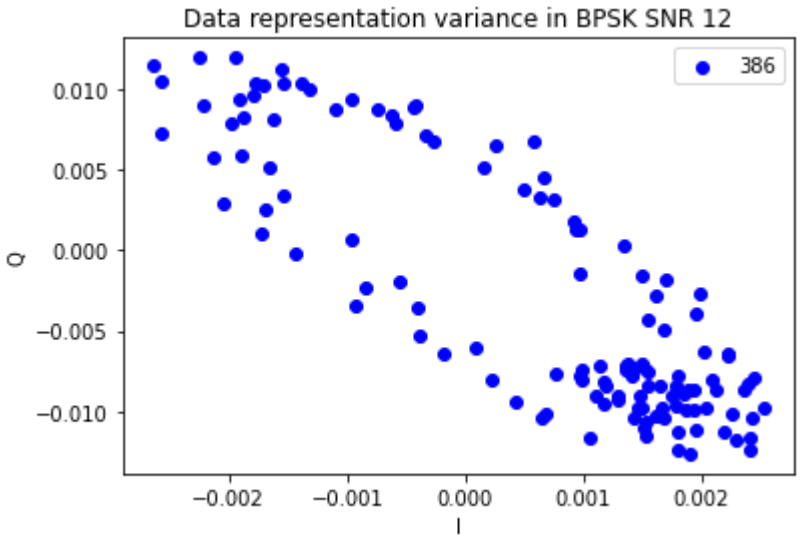
Data representation variance in BPSK SNR 12
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0.005
0.000
−0.005
−0.010
Q
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0.002
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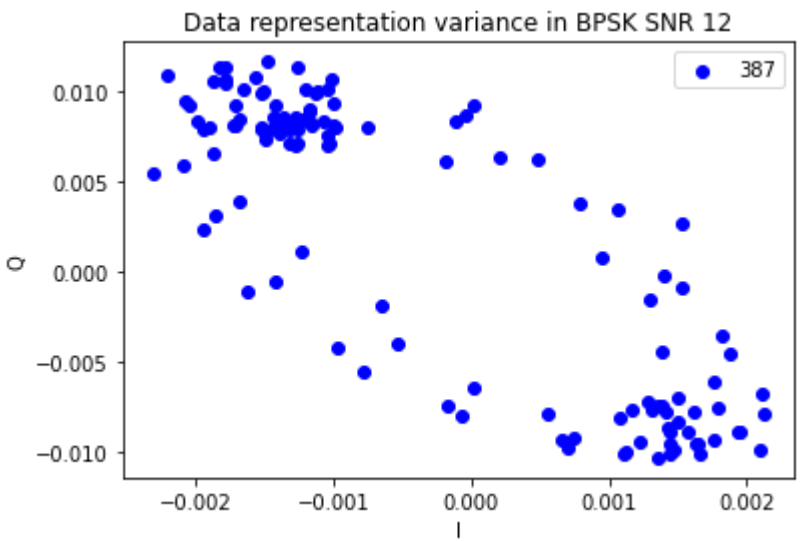
Data representation variance in BPSK SNR 12
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0.005
0.000
−0.005
−0.010
Q
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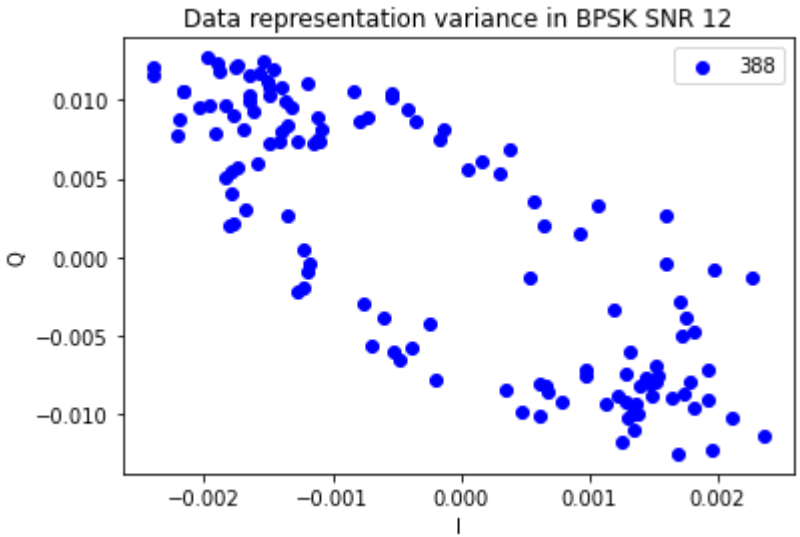
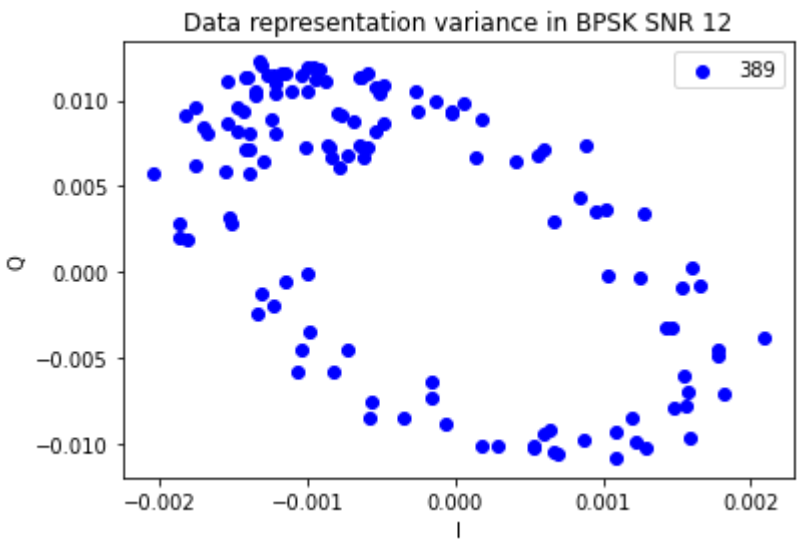

Data representation variance in BPSK SNR 12
388
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
389
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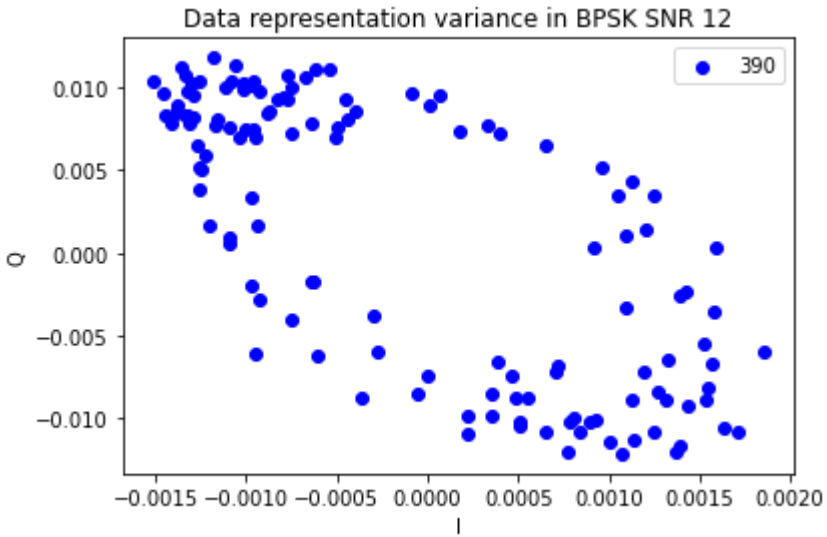
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
390
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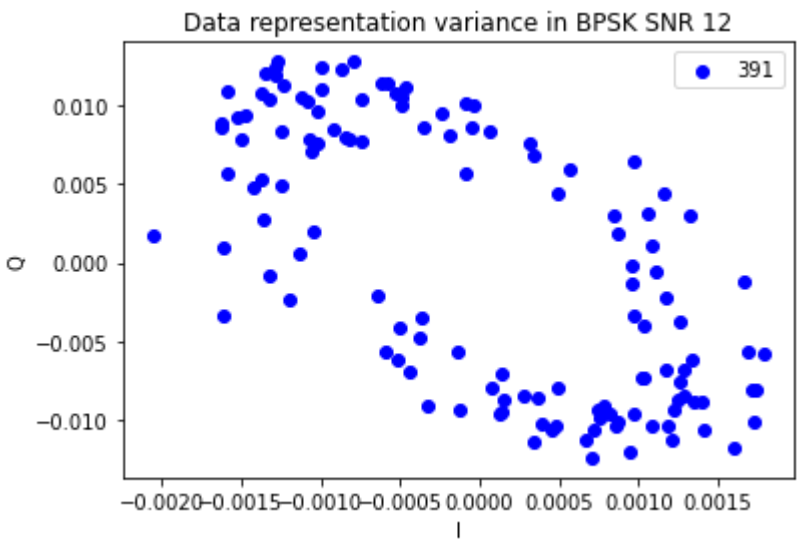
0.005
0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
I


Data representation variance in BPSK SNR 12
391
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0.005
0.000
−0.005
−0.010
Q
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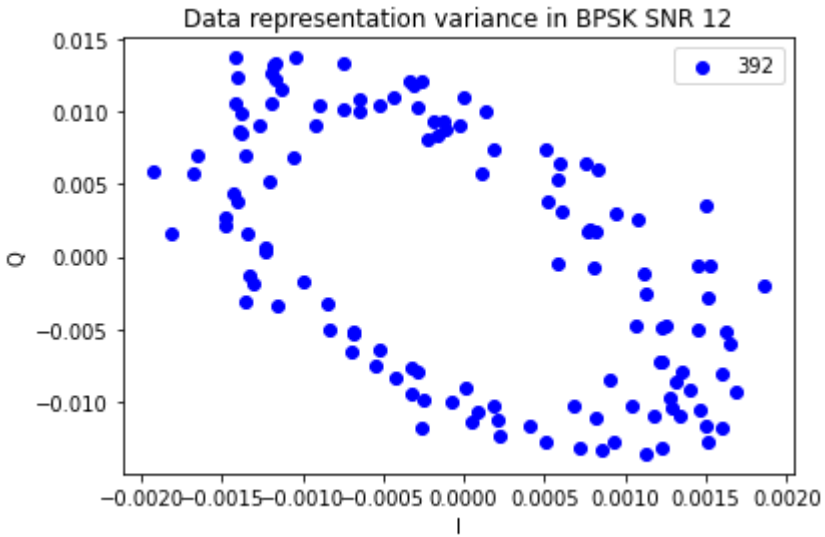
Data representation variance in BPSK SNR 12
392
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0.010
0.005
0.000
−0.005
−0.010
Q
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−0.0015
−0.0010
−0.0005
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0.0015
0.0020
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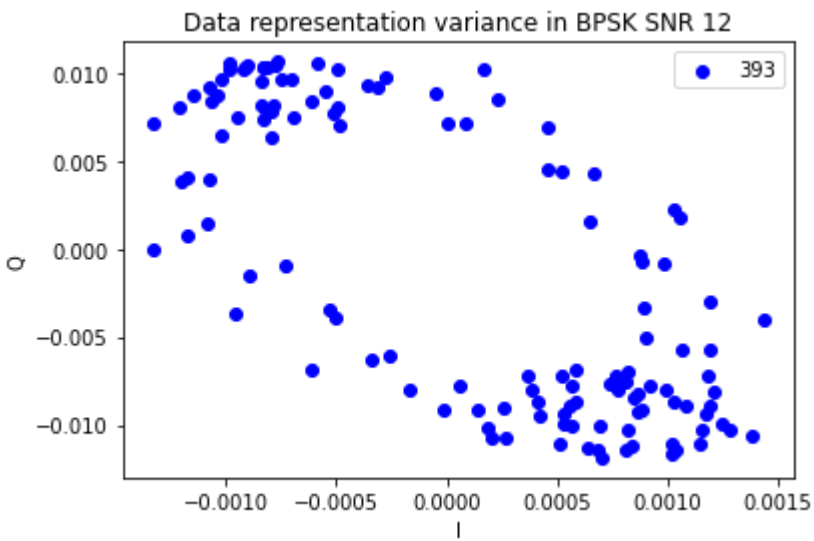
Data representation variance in BPSK SNR 12
393
0.010
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0.000
−0.005
−0.010
Q
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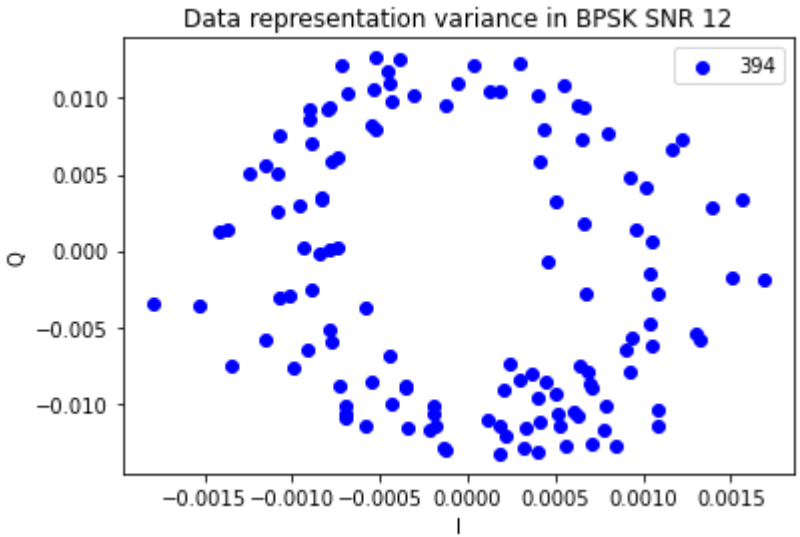
−0.0005
0.0000
0.0005
0.0010
0.0015
I


Data representation variance in BPSK SNR 12
394
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0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
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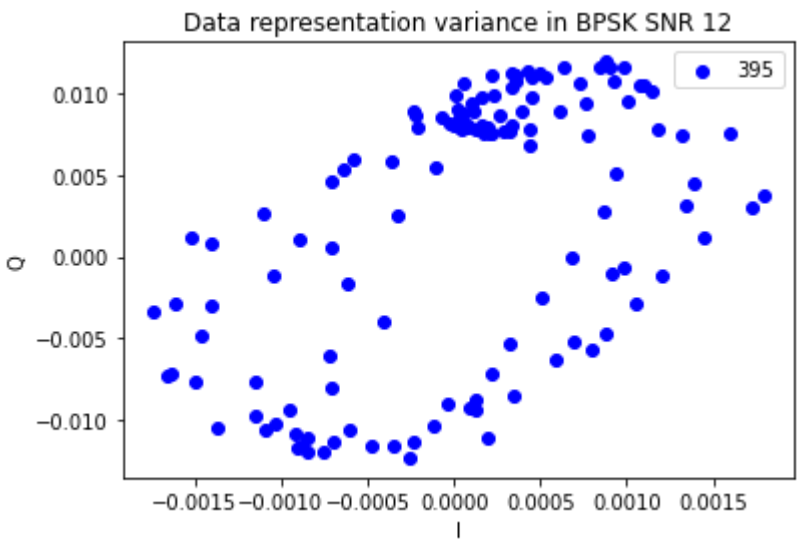
Data representation variance in BPSK SNR 12
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0.000
−0.005
−0.010
Q
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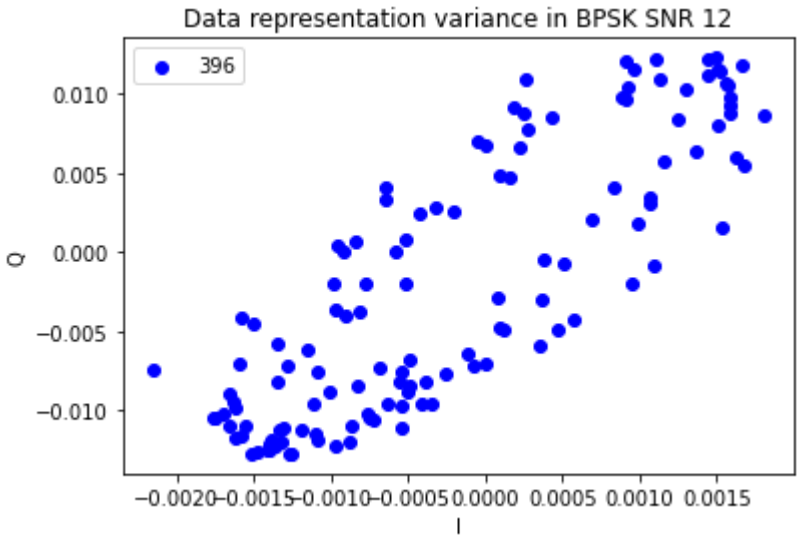
I


Data representation variance in BPSK SNR 12
396
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.0010
−0.0005
0.0000
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0.0015
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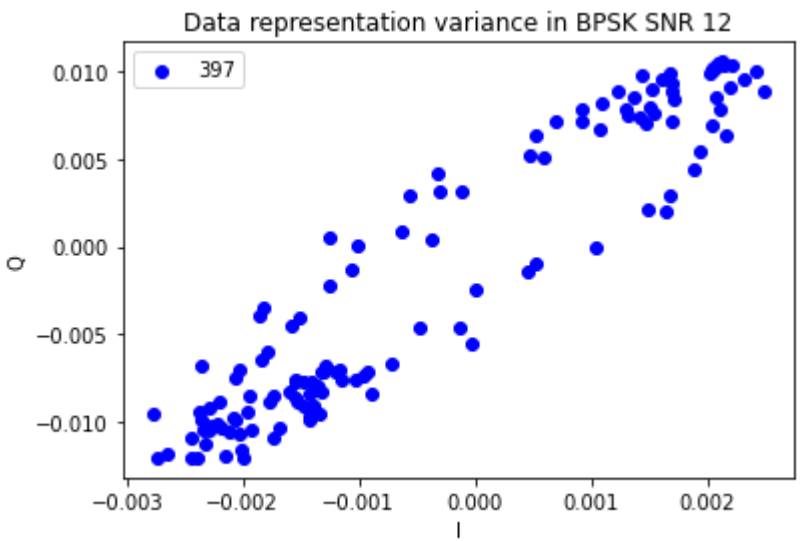
Data representation variance in BPSK SNR 12
397
0.010
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0.000
−0.005
−0.010
Q
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−0.002
−0.001
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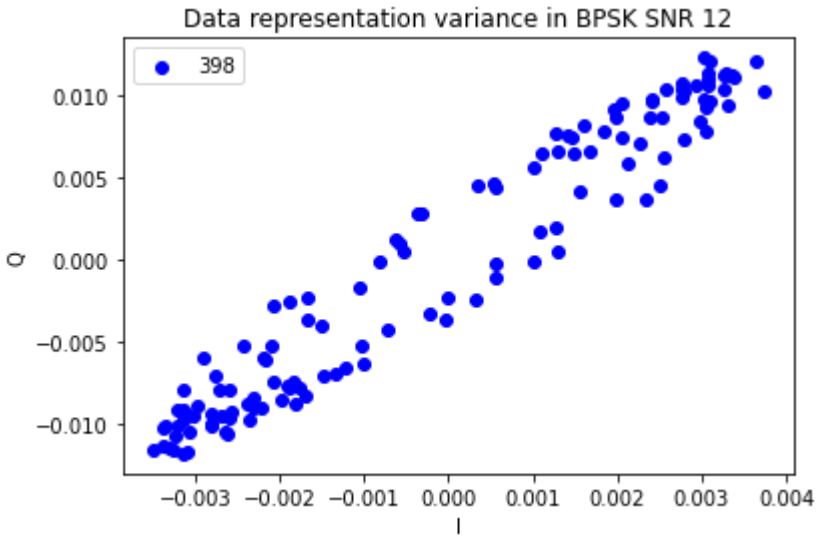
0.001
0.002
I


Data representation variance in BPSK SNR 12
398
0.010
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0.000
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Q
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−0.002
−0.001
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0.004
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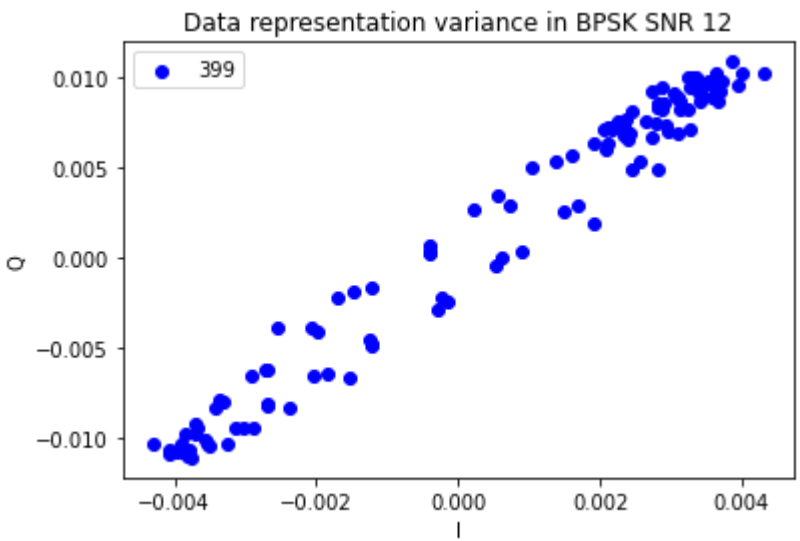
Data representation variance in BPSK SNR 12
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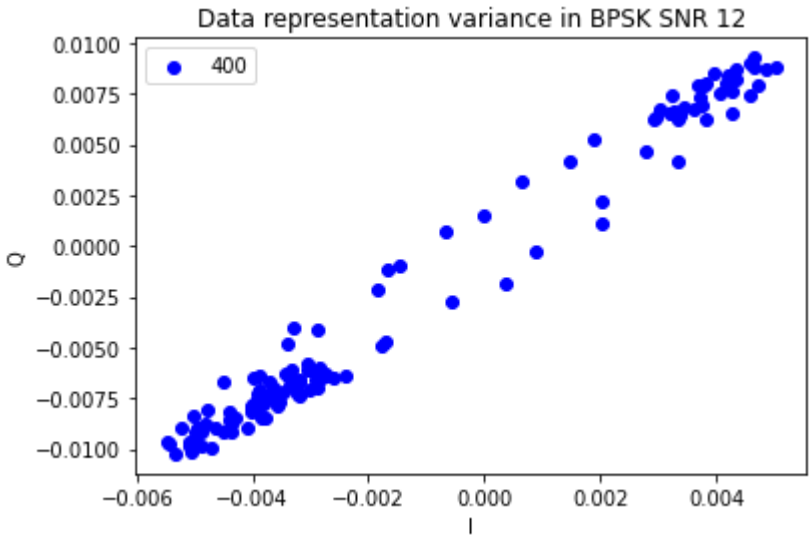
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
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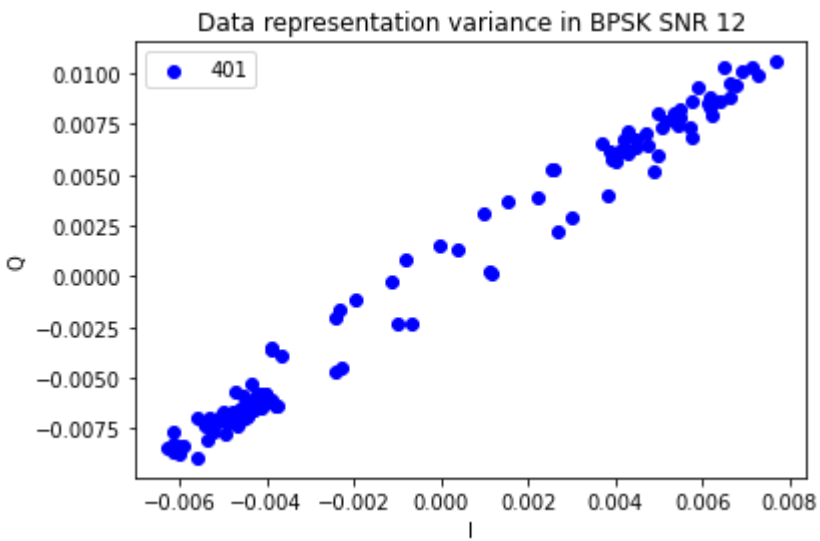
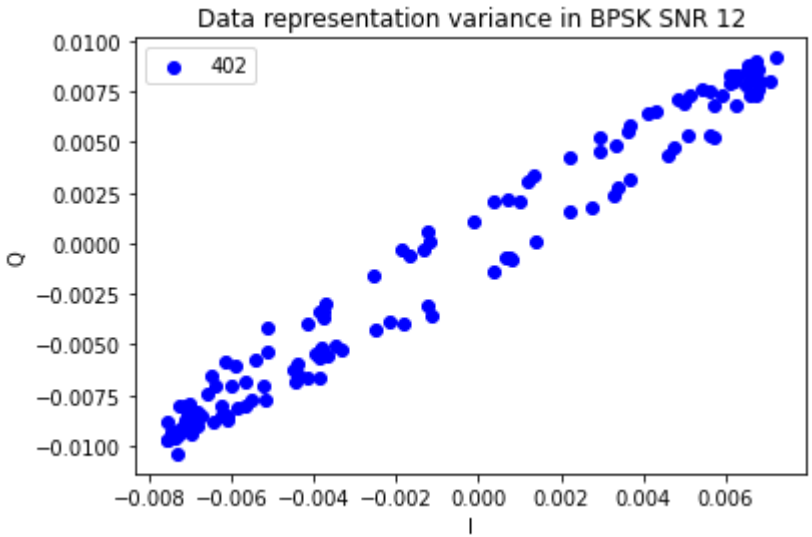
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
401
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I


Data representation variance in BPSK SNR 12
402
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0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
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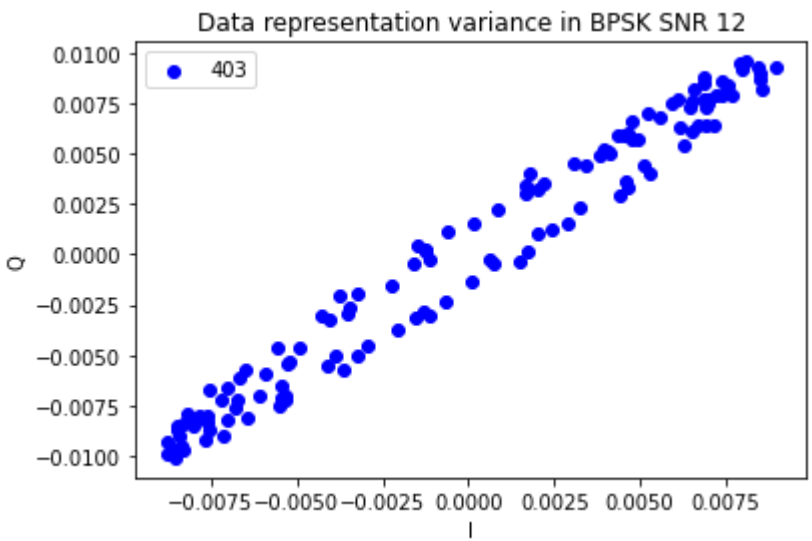
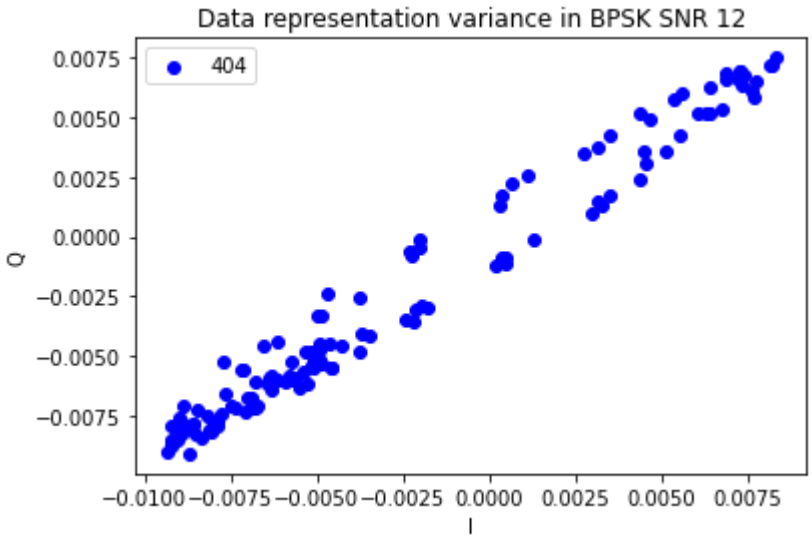
I


Data representation variance in BPSK SNR 12
403
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
404
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0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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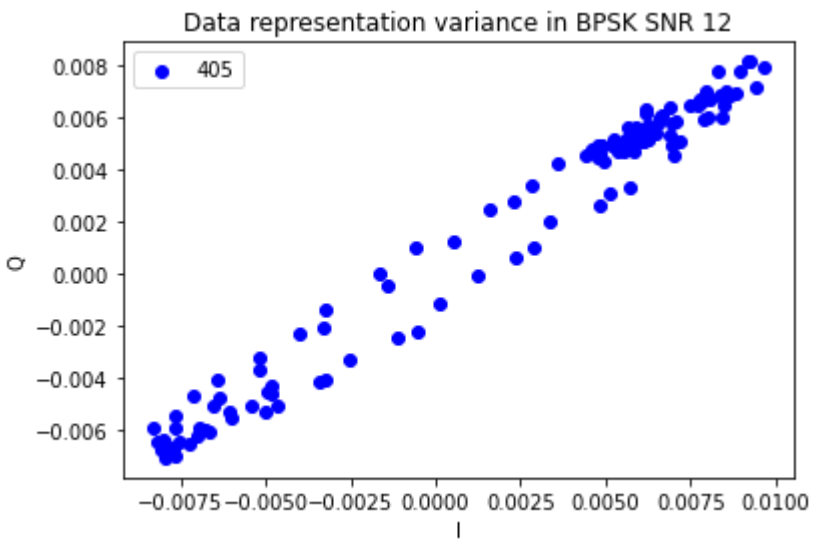
I


Data representation variance in BPSK SNR 12
405
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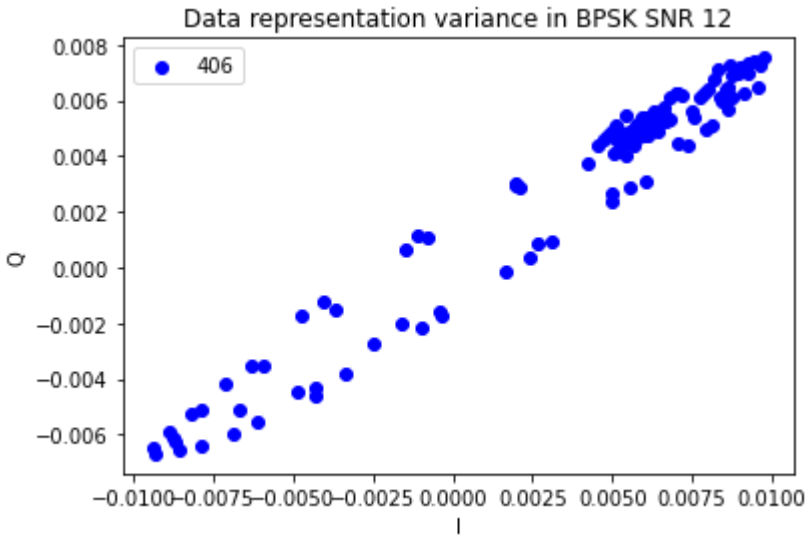
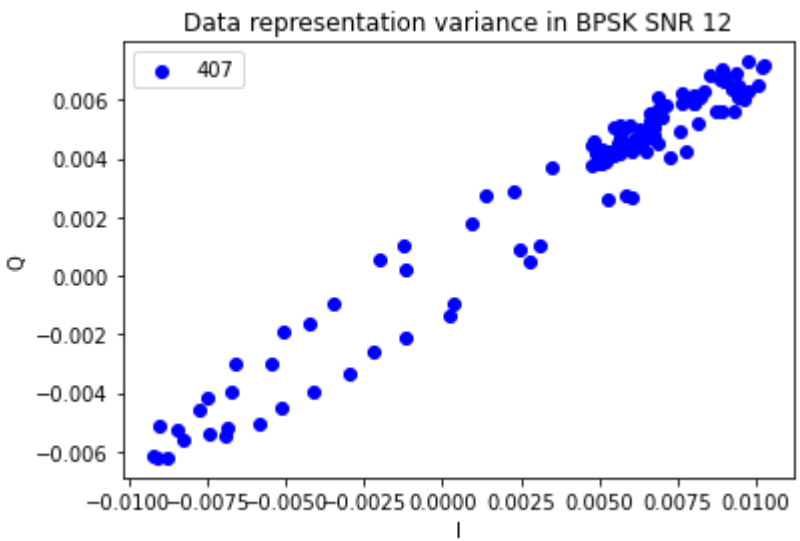
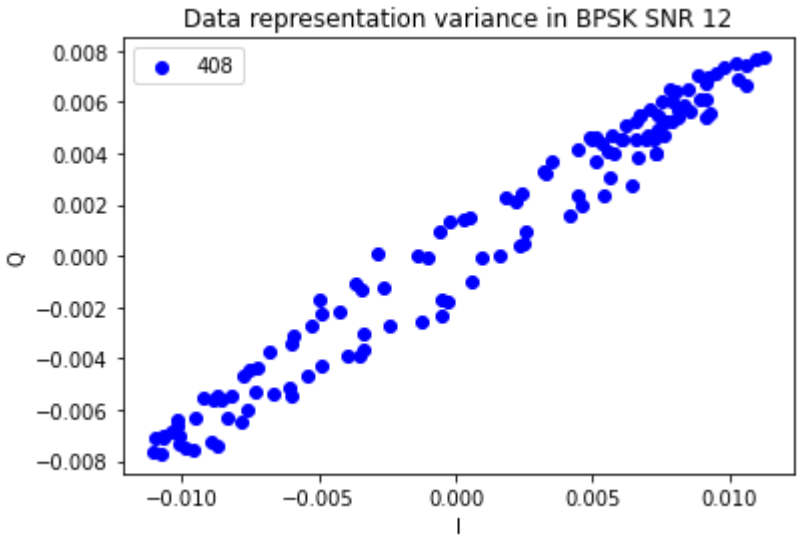
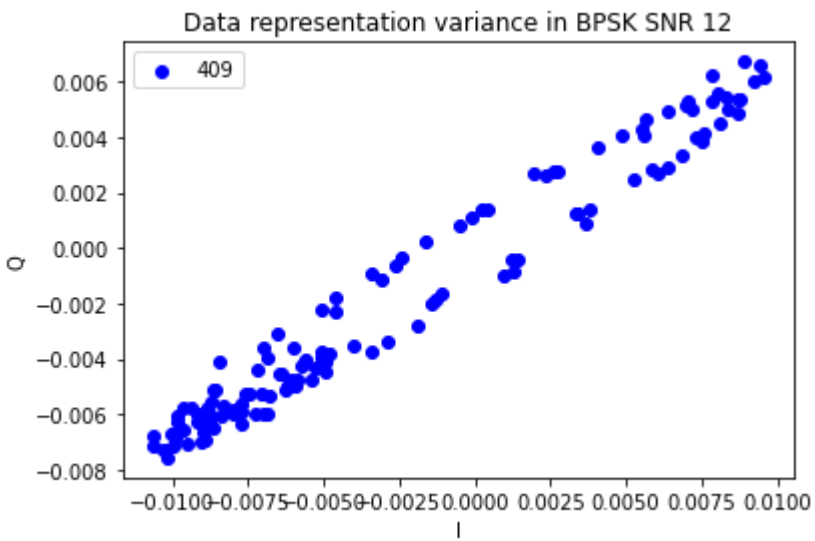
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
406
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
407
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
408
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
409
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0.004
0.002
0.000
−0.002
−0.004
−0.006
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Q
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−0.0075
−0.0050
−0.0025
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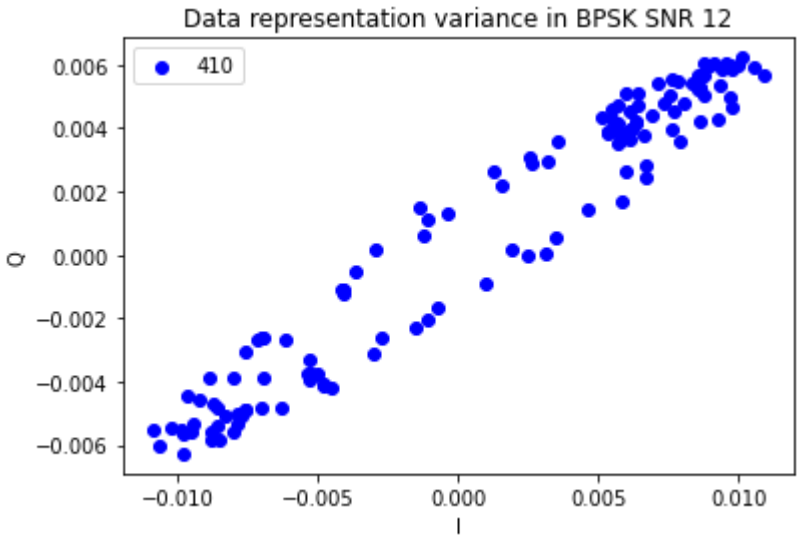
0.0075
0.0100
I


Data representation variance in BPSK SNR 12
410
0.006
0.004
0.002
0.000
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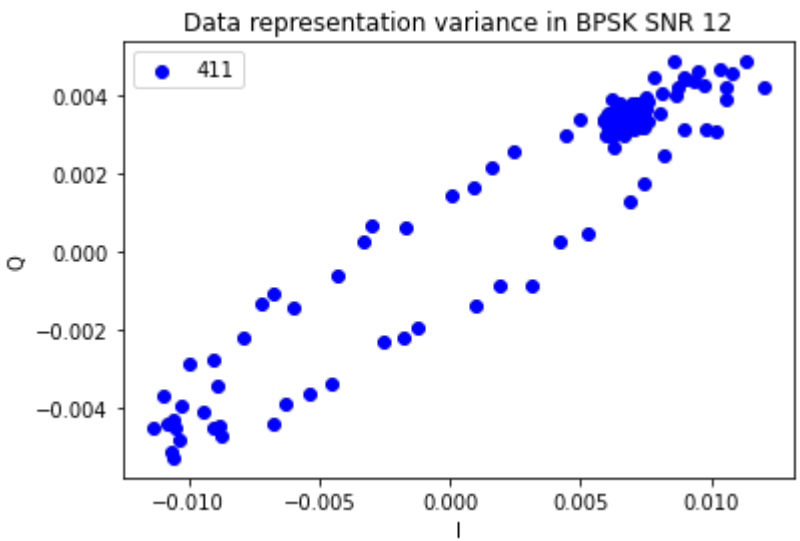
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
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0.010
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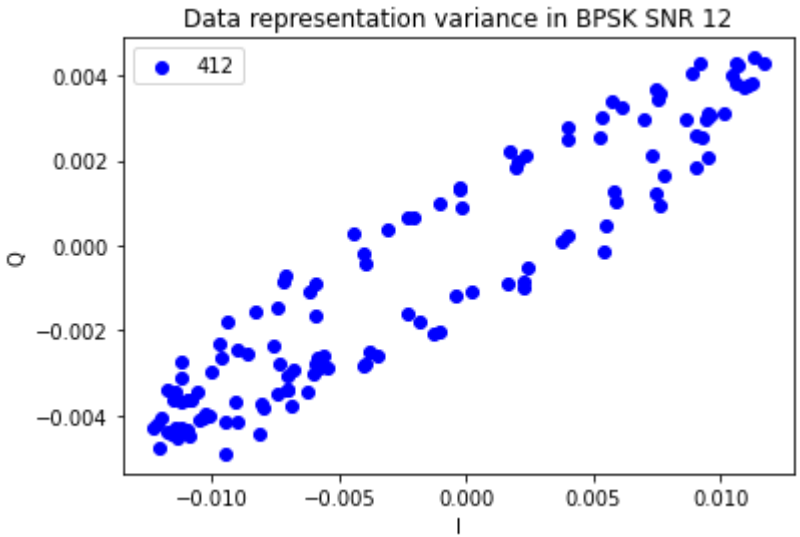
Data representation variance in BPSK SNR 12
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0.002
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−0.004
Q
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−0.005
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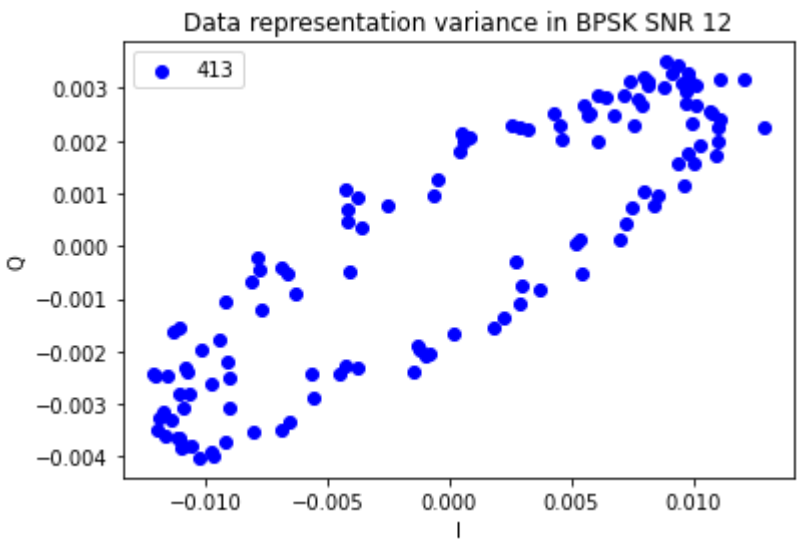
Data representation variance in BPSK SNR 12
413
0.003
0.002
0.001
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−0.004
Q
−0.010
−0.005
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0.005
0.010
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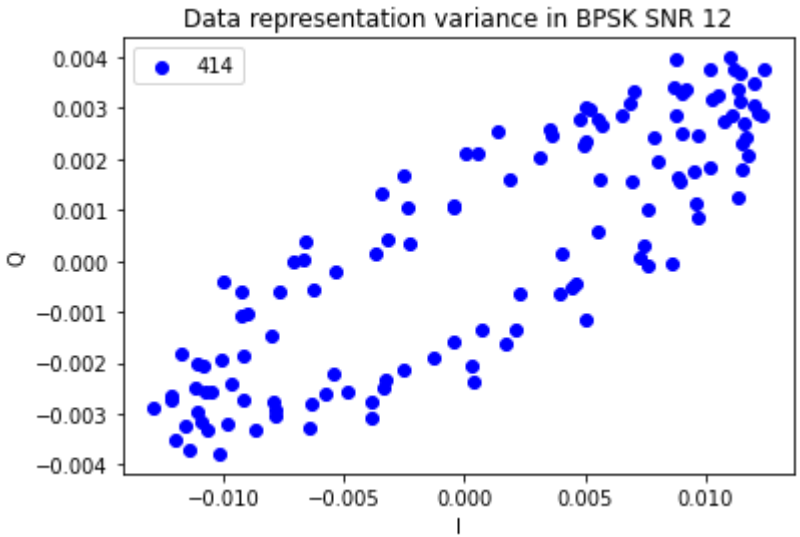
Data representation variance in BPSK SNR 12
414
0.004
0.003
0.002
0.001
0.000
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Q
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−0.005
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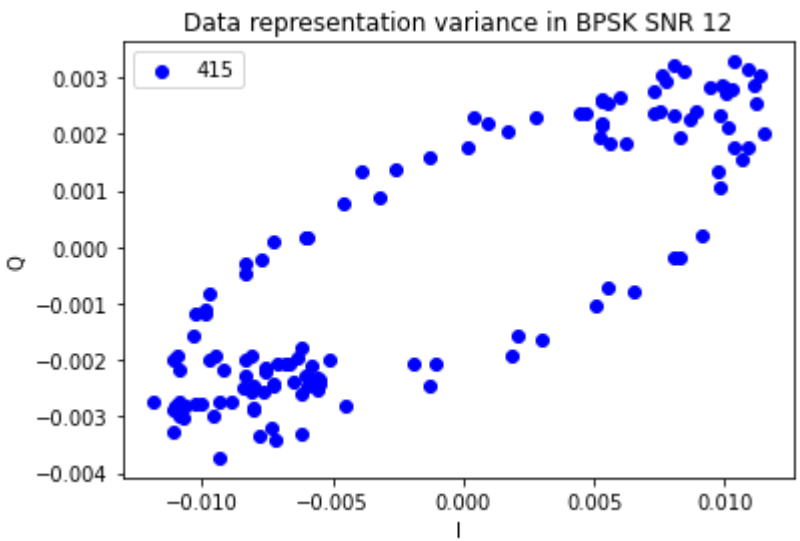
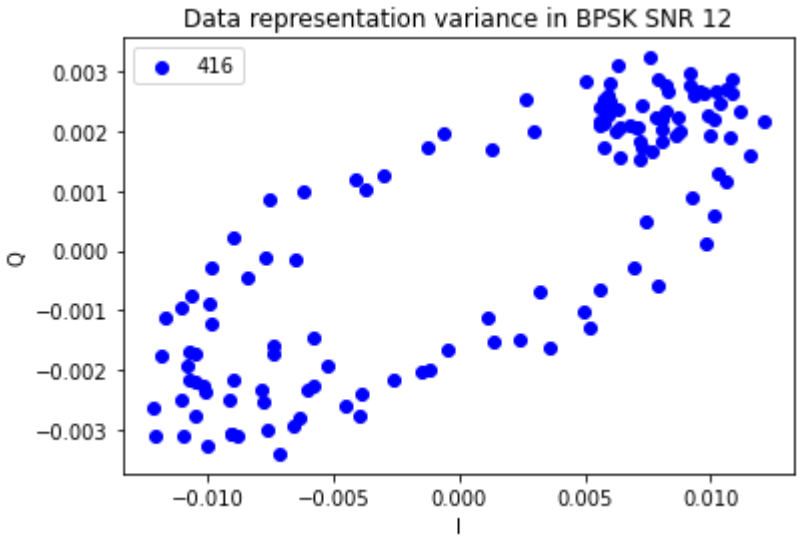

Data representation variance in BPSK SNR 12
415
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
416
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0.002
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−0.003
Q
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−0.005
0.000
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0.010
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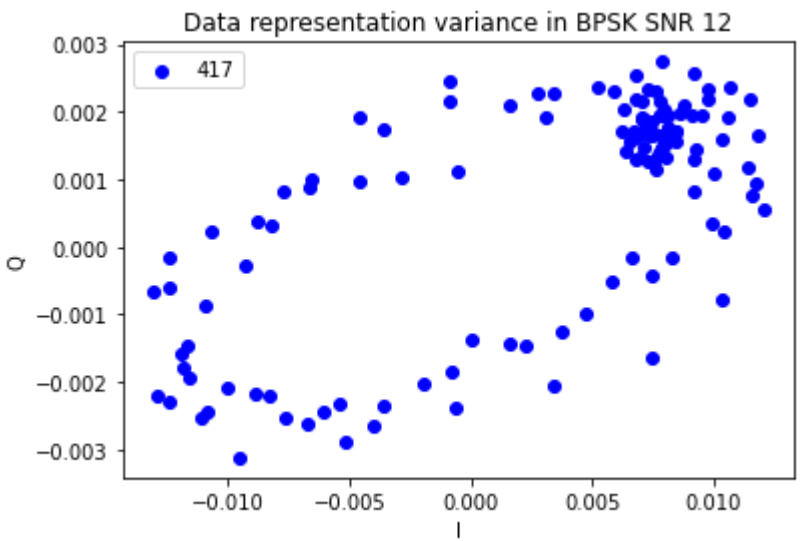
Data representation variance in BPSK SNR 12
417
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
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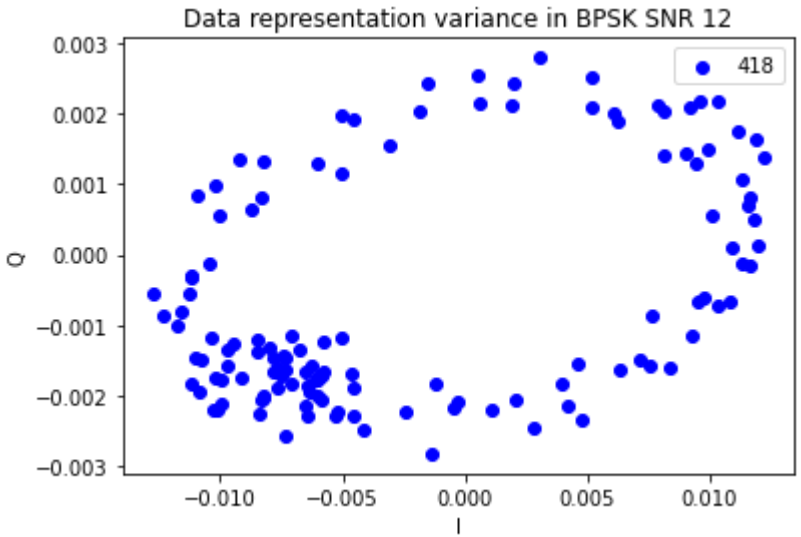
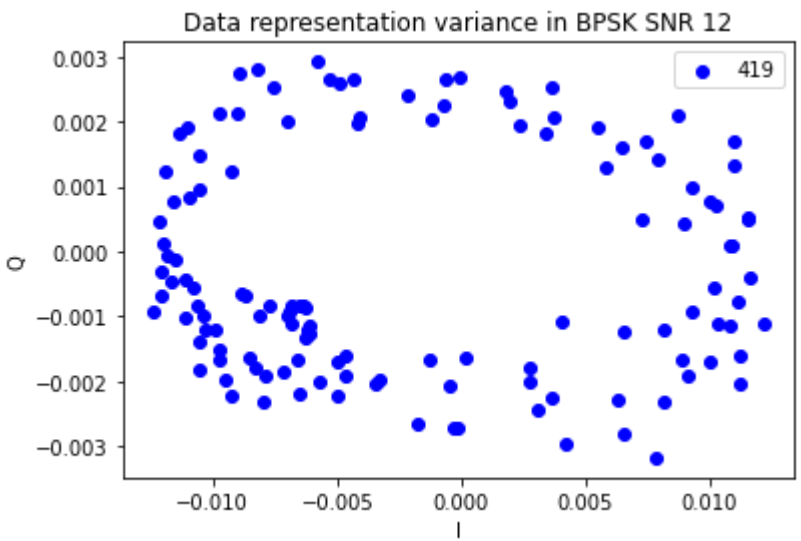
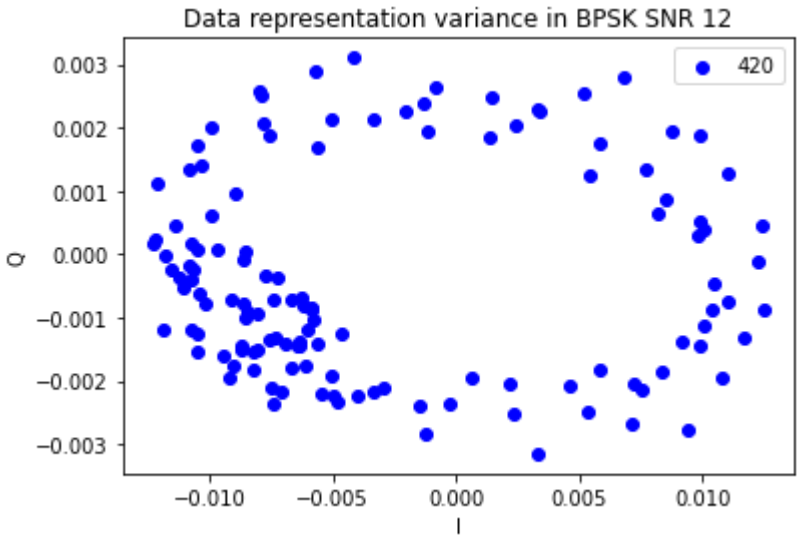
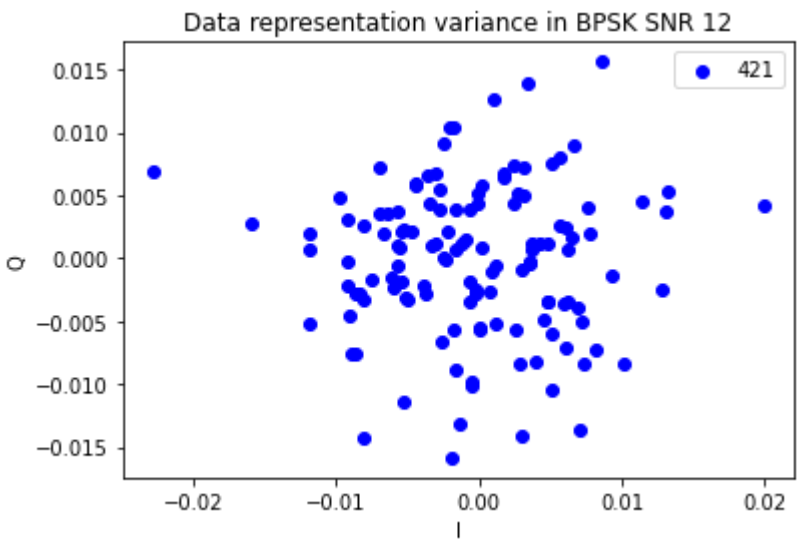
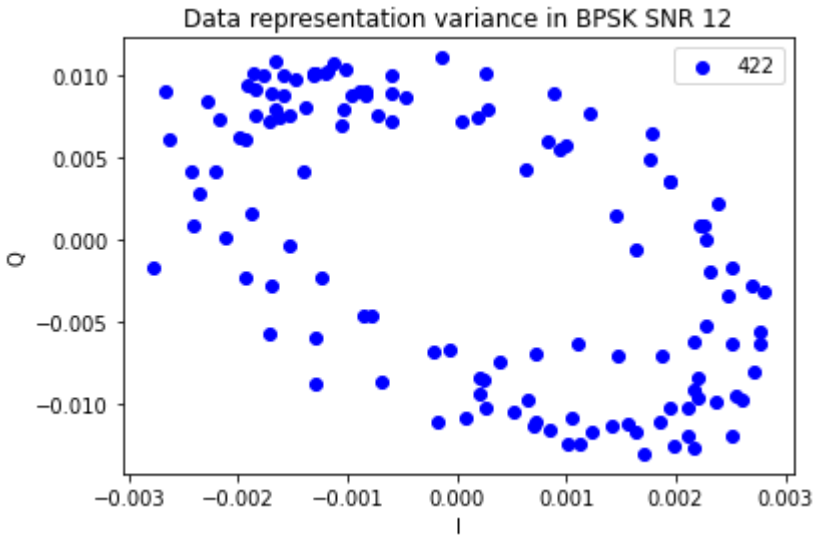
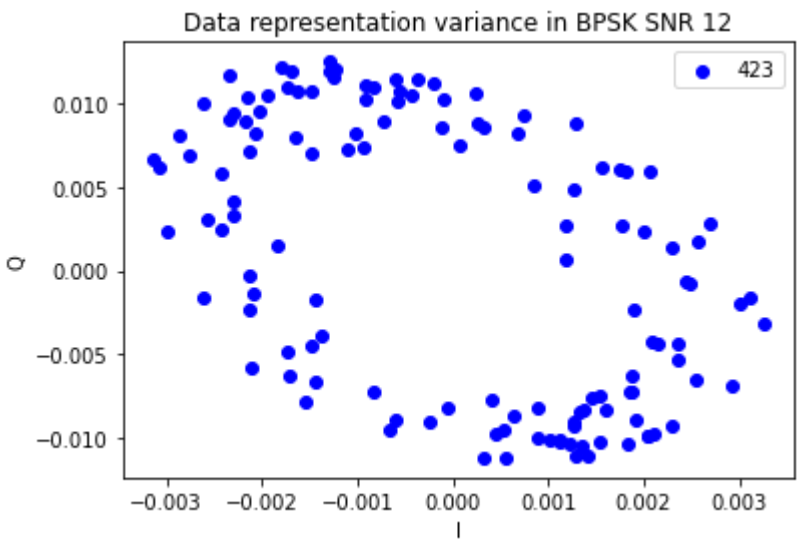

Data representation variance in BPSK SNR 12
418
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

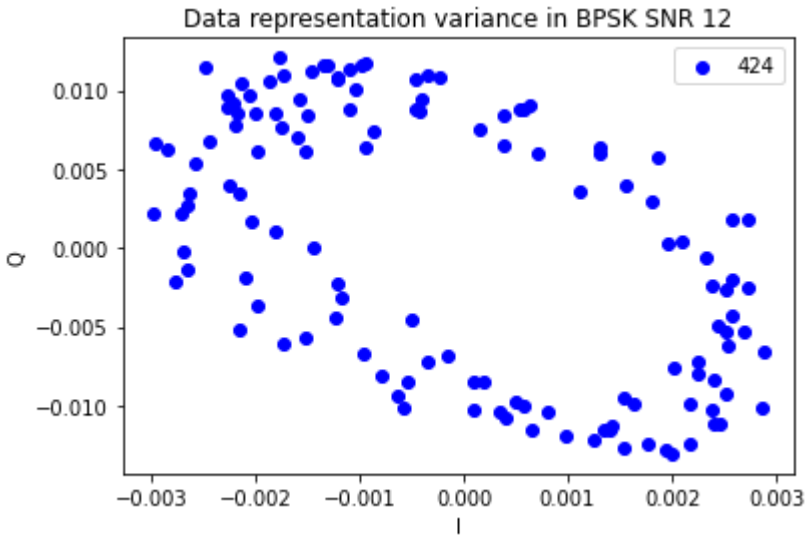

Data representation variance in BPSK SNR 12
419
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
420
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
421
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.02
−0.01
0.00
0.01
0.02
I


Data representation variance in BPSK SNR 12
422
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
423
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
424
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
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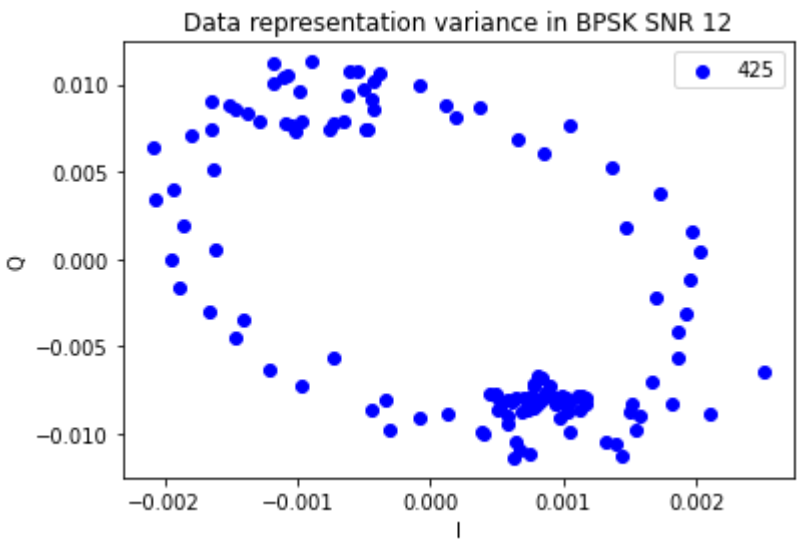
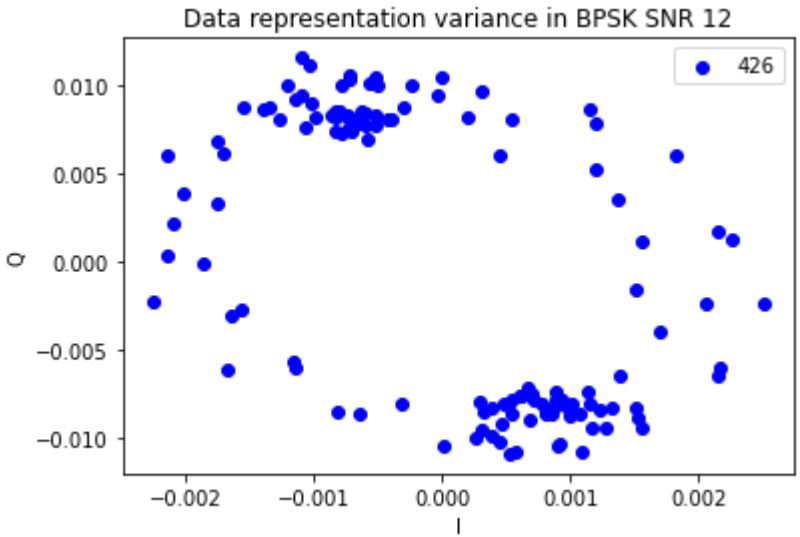
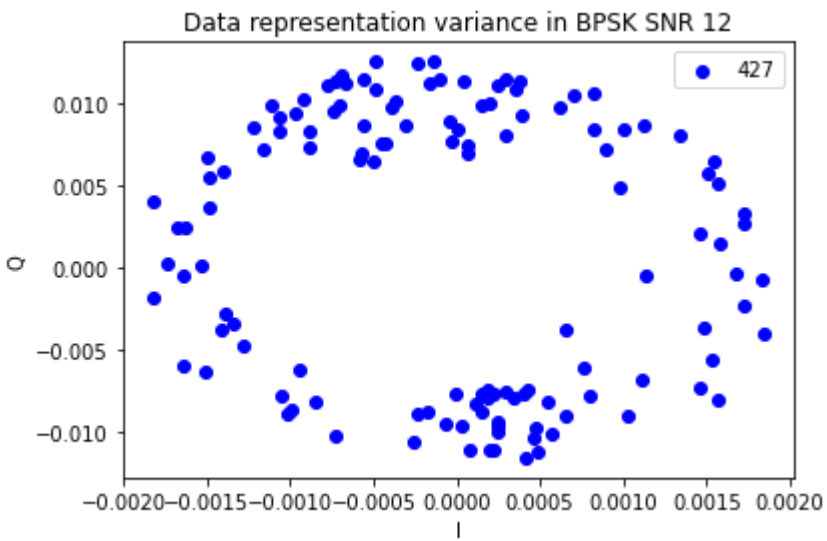

Data representation variance in BPSK SNR 12
425
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
426
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
427
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.0015
−0.0010
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0.0015
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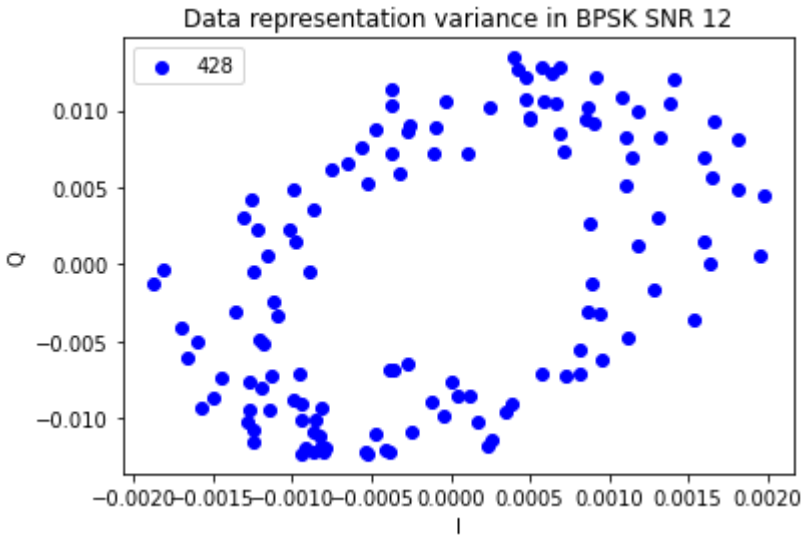
Data representation variance in BPSK SNR 12
428
0.010
0.005
0.000
−0.005
−0.010
Q
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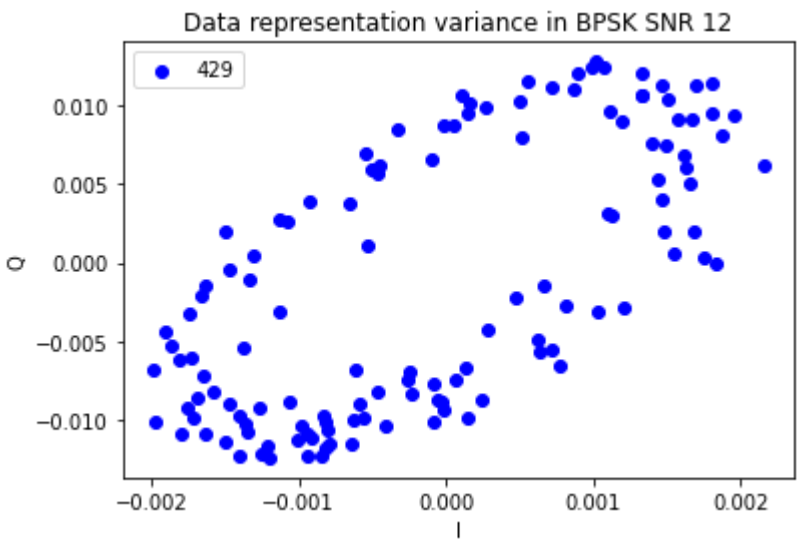
Data representation variance in BPSK SNR 12
429
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
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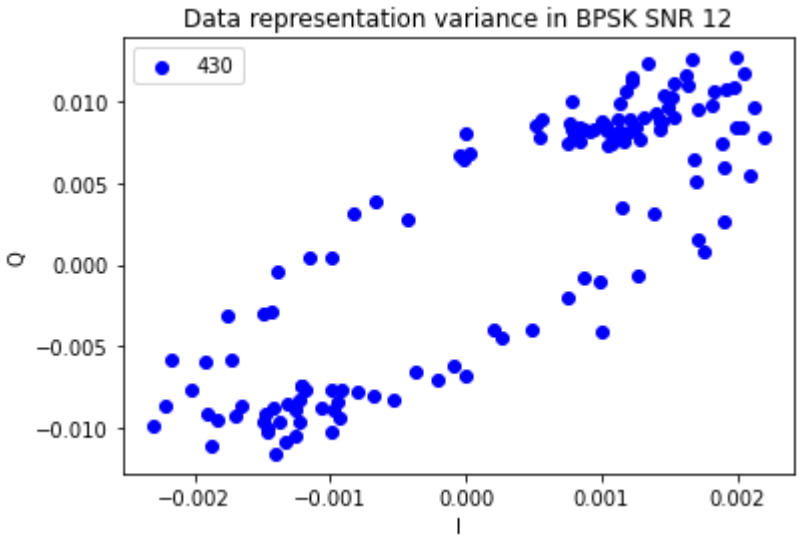
I


Data representation variance in BPSK SNR 12
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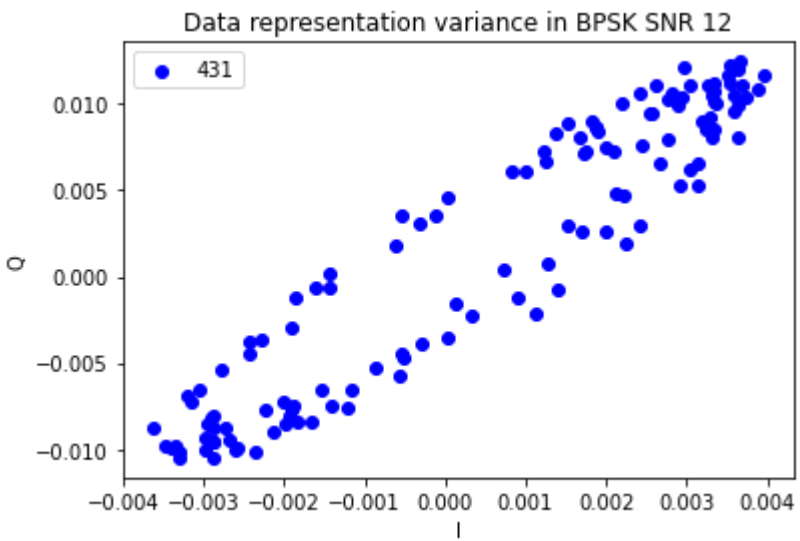
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
431
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.003
−0.002
−0.001
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0.001
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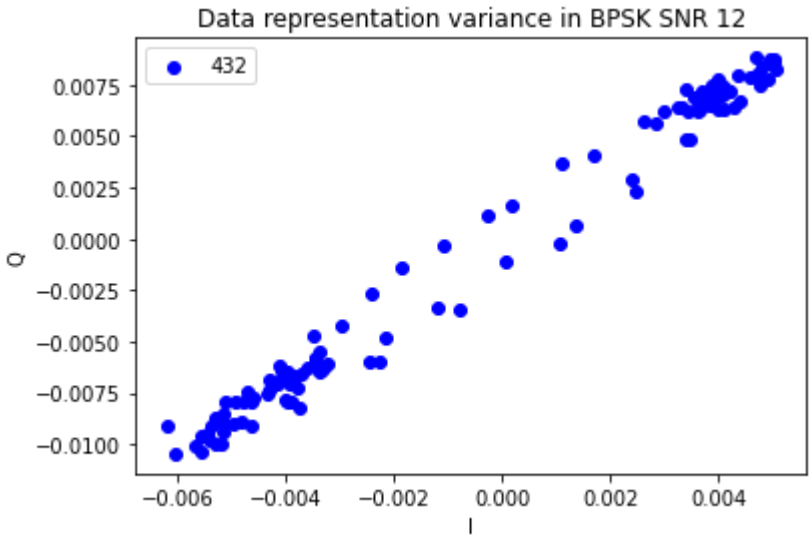
0.003
0.004
I


Data representation variance in BPSK SNR 12
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0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
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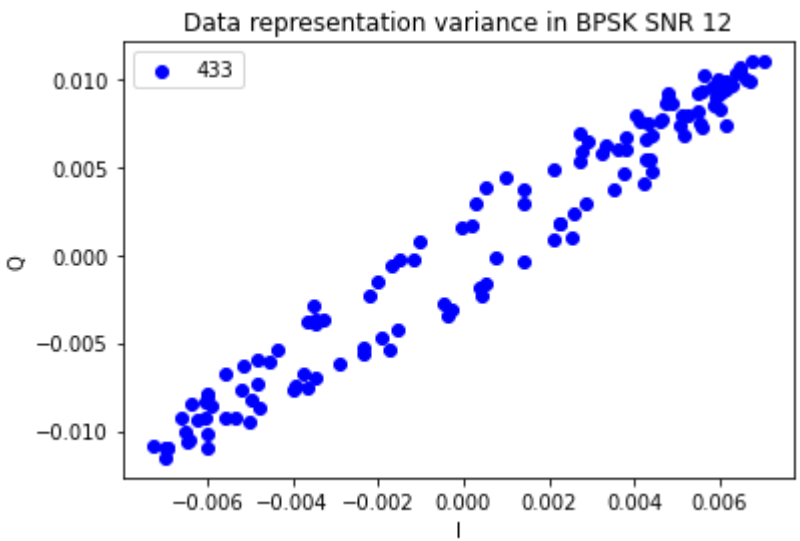
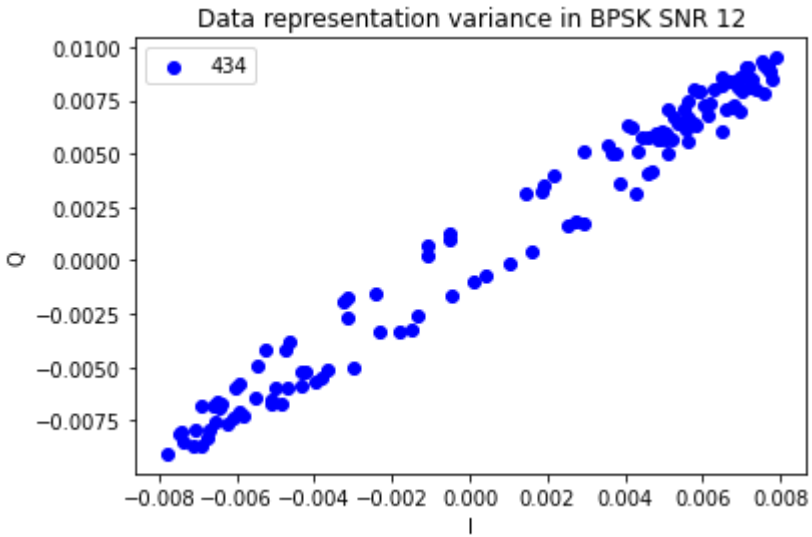
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
433
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
434
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0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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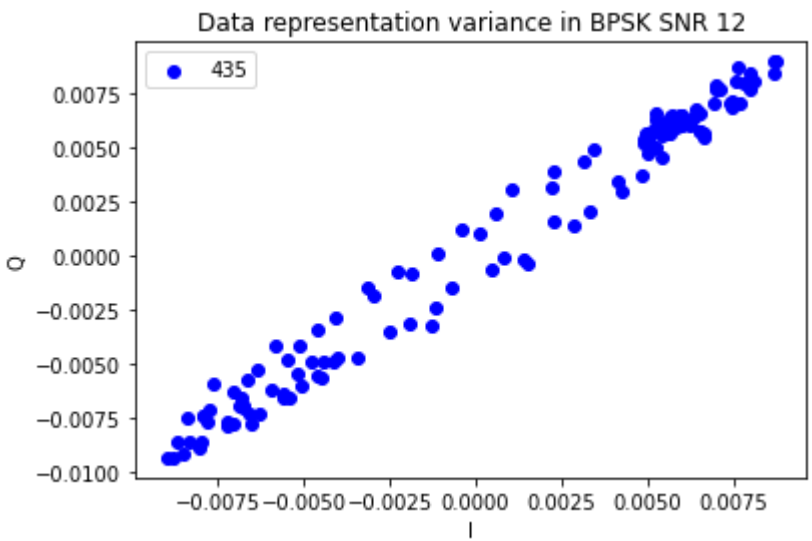
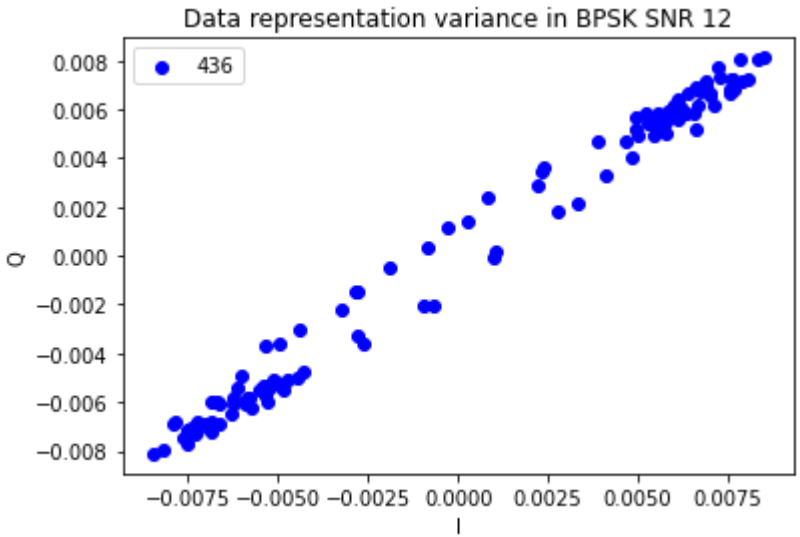
I


Data representation variance in BPSK SNR 12
435
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
436
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
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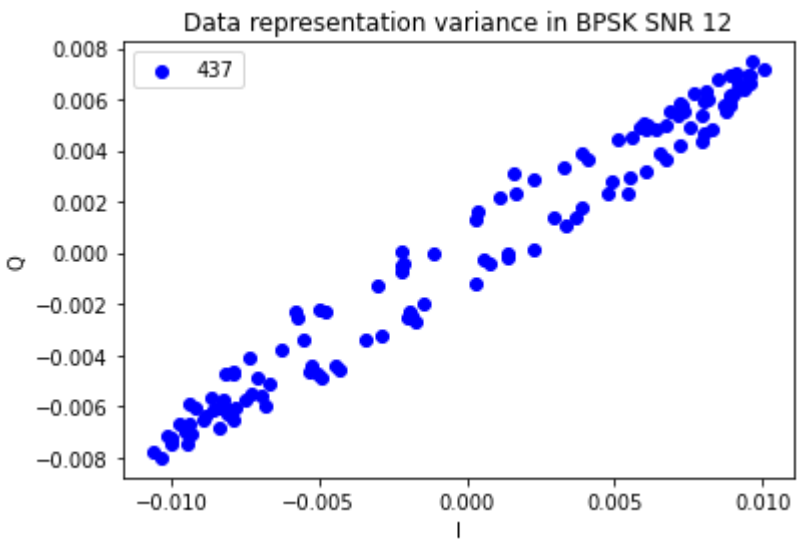
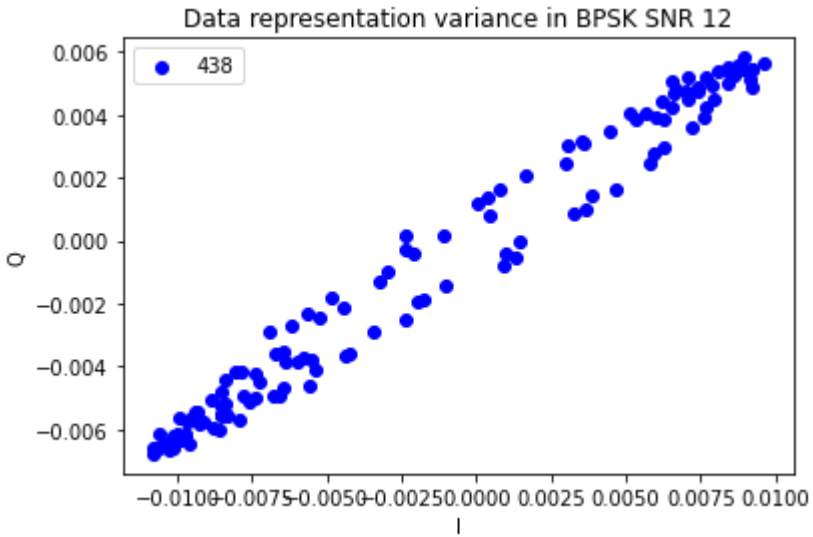
I


Data representation variance in BPSK SNR 12
437
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010 −0.005 0.000 0.005 0.010
I


Data representation variance in BPSK SNR 12
438
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
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−0.0075
−0.0050
−0.0025
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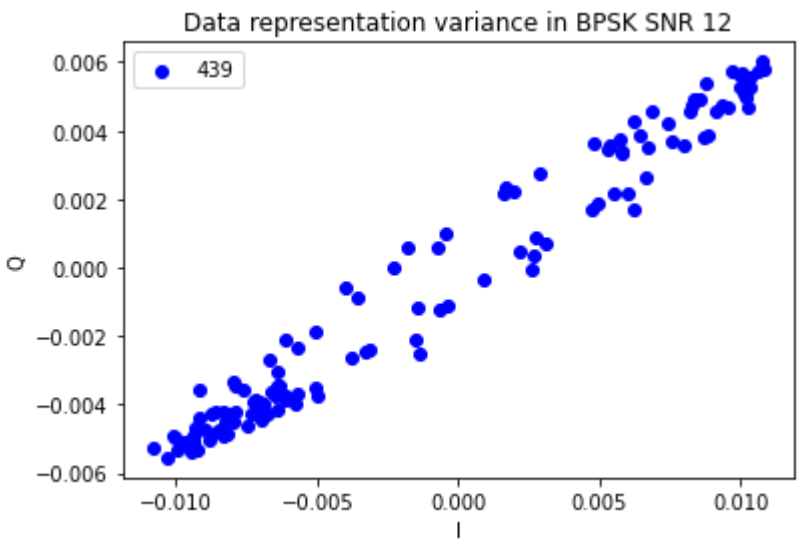
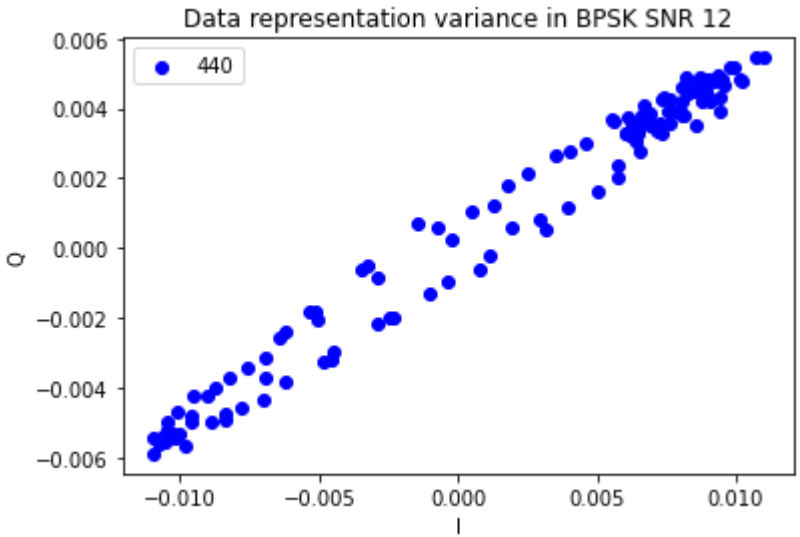
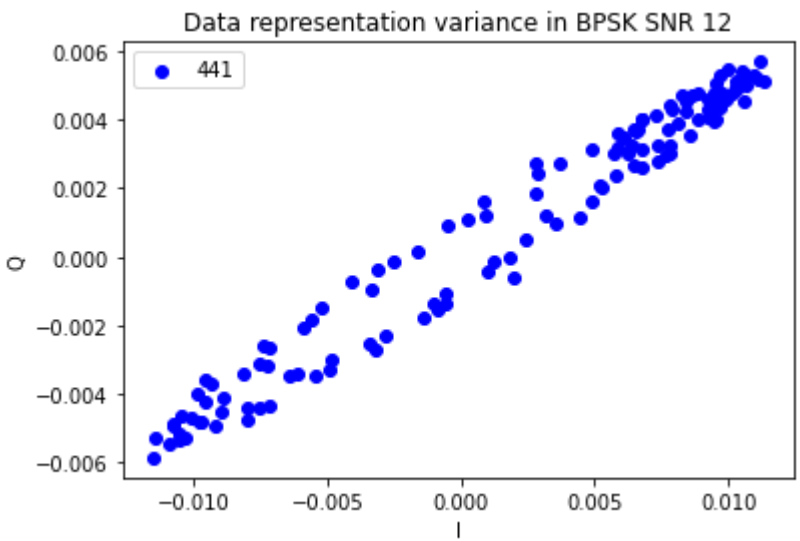
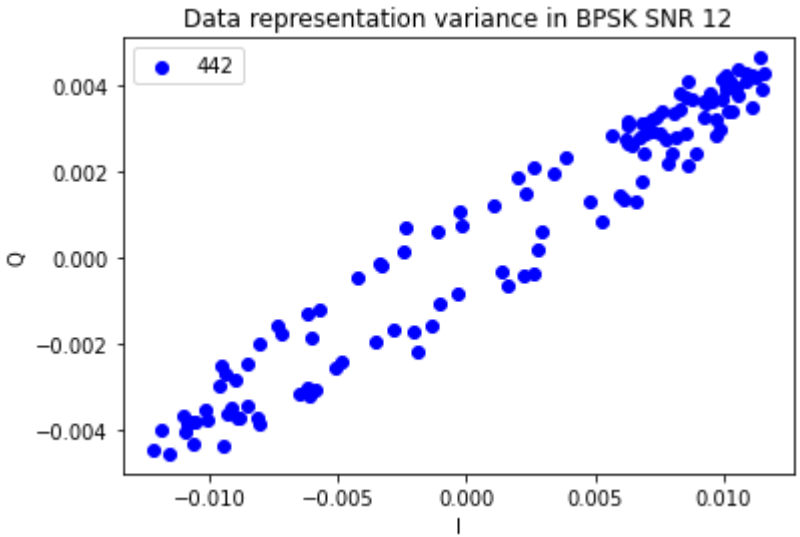
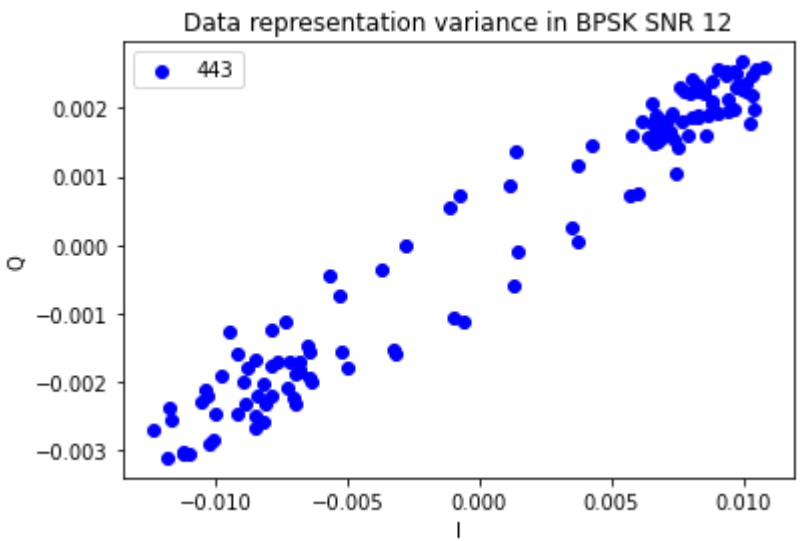
0.0025
0.0050
0.0075
0.0100
I

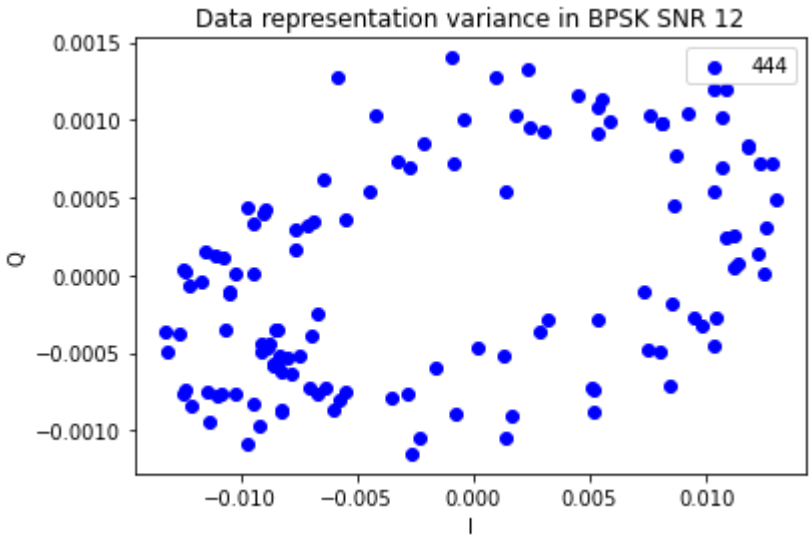

Data representation variance in BPSK SNR 12
439
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

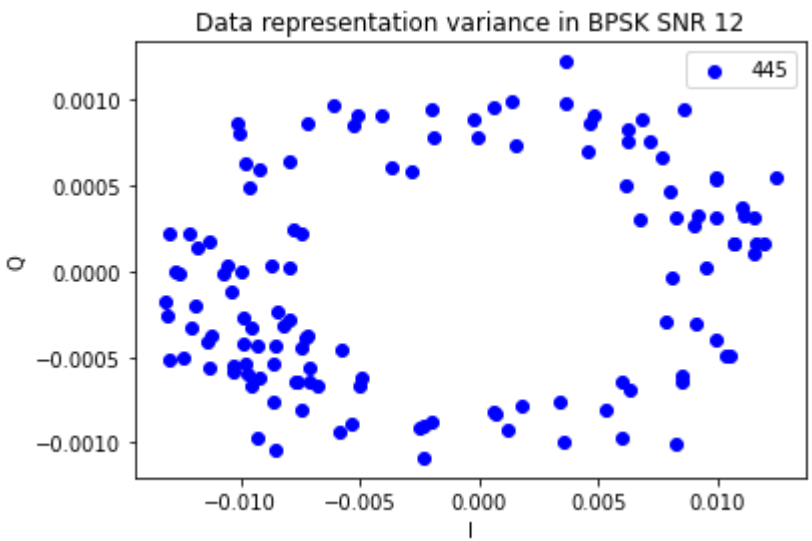

Data representation variance in BPSK SNR 12
440
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
441
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
442
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
443
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
444
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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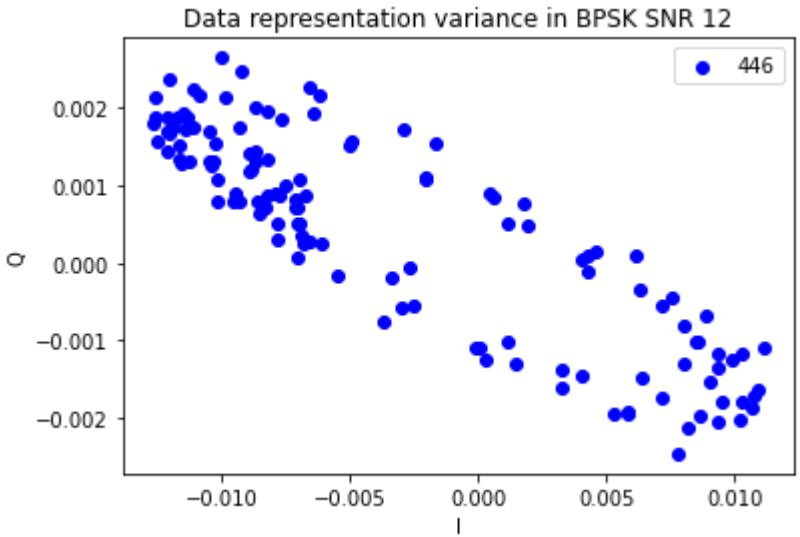
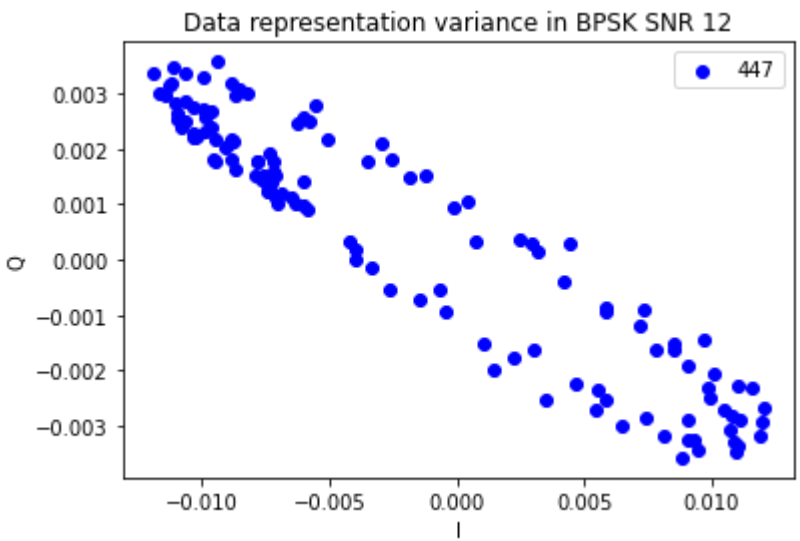
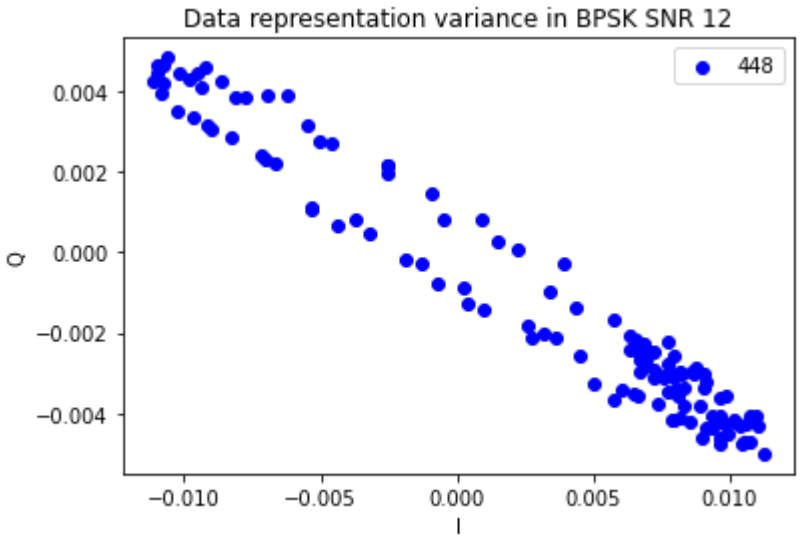
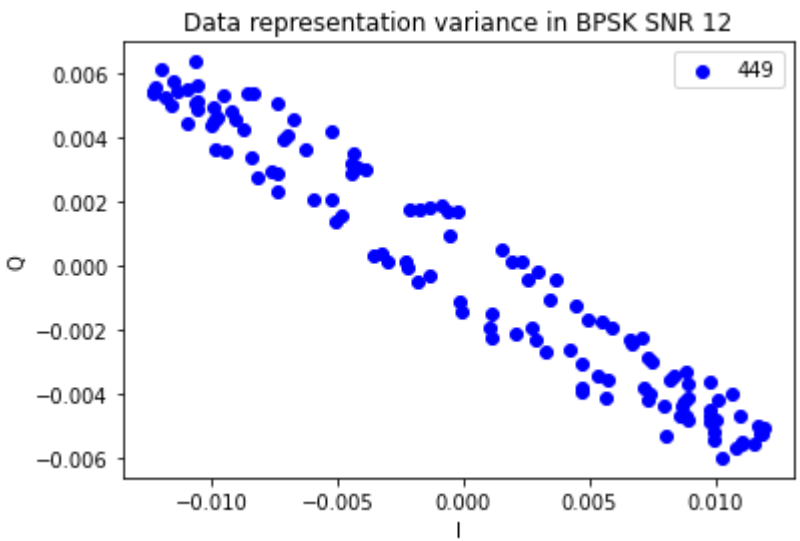
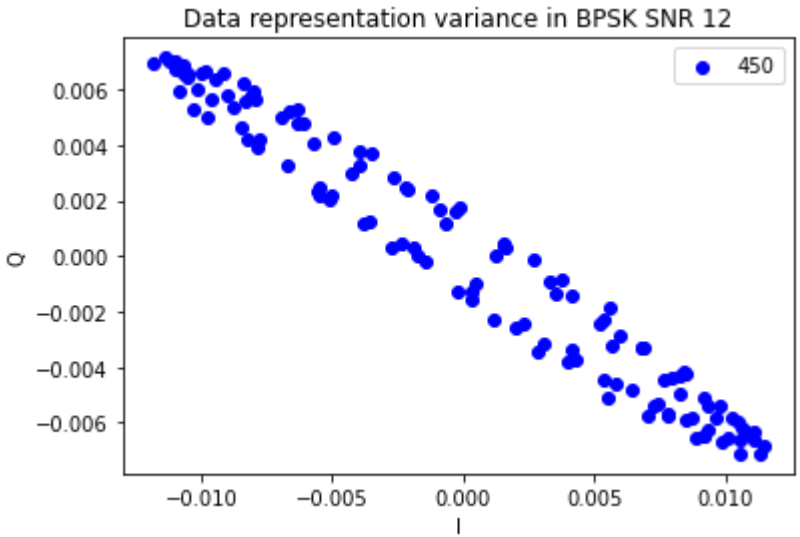
0.0005
0.0000
−0.0005
−0.0010
Q
−0.010
−0.005
0.000
0.005
0.010
I

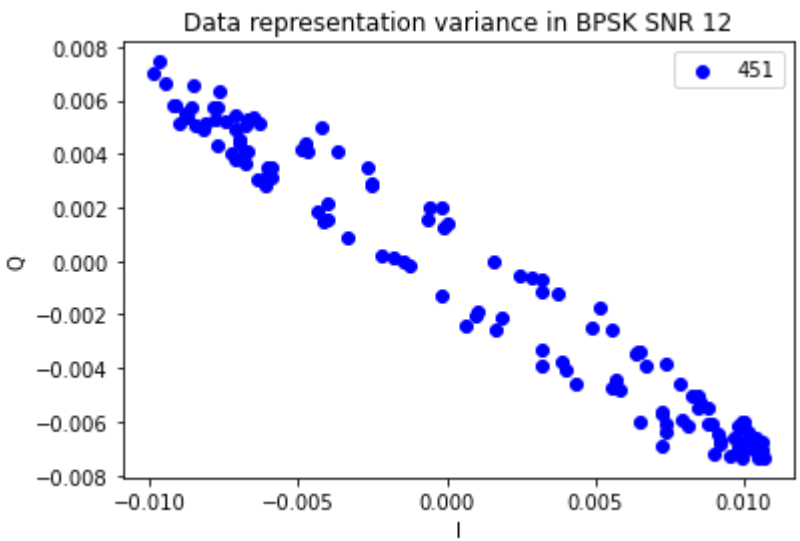

Data representation variance in BPSK SNR 12
446
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

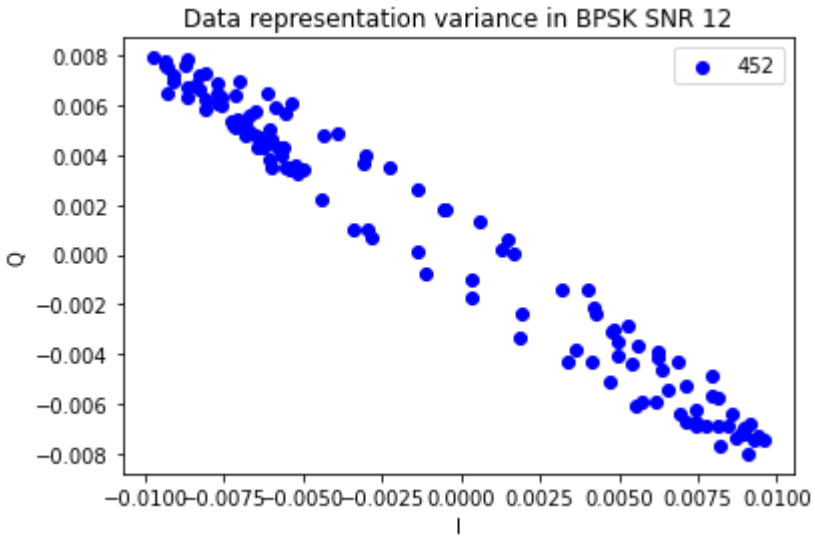

Data representation variance in BPSK SNR 12
447
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

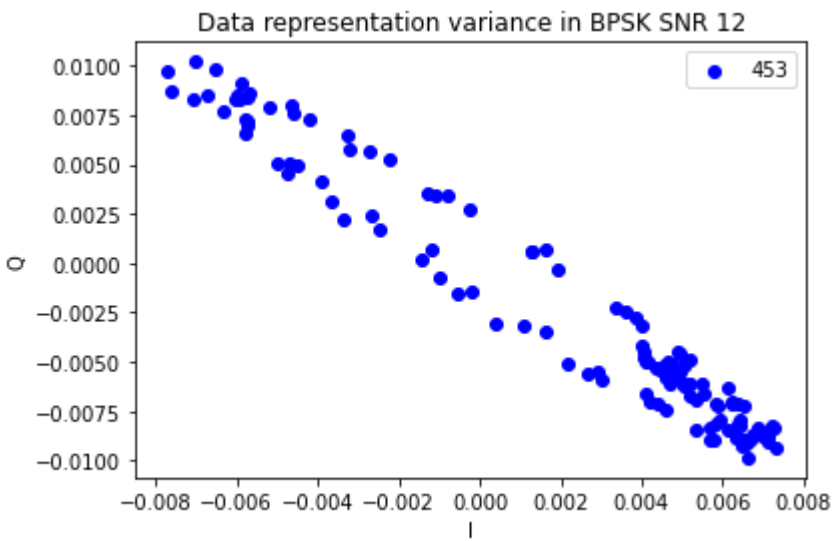

Data representation variance in BPSK SNR 12
448
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

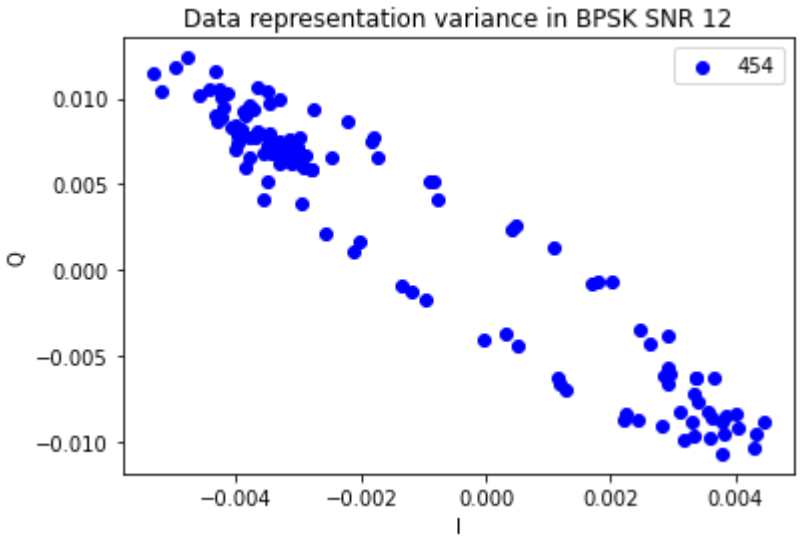

Data representation variance in BPSK SNR 12
449
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

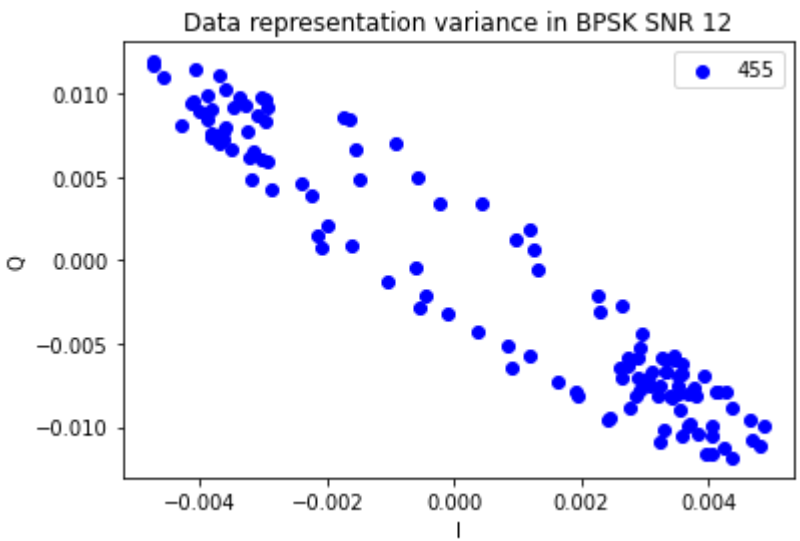

Data representation variance in BPSK SNR 12
450
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

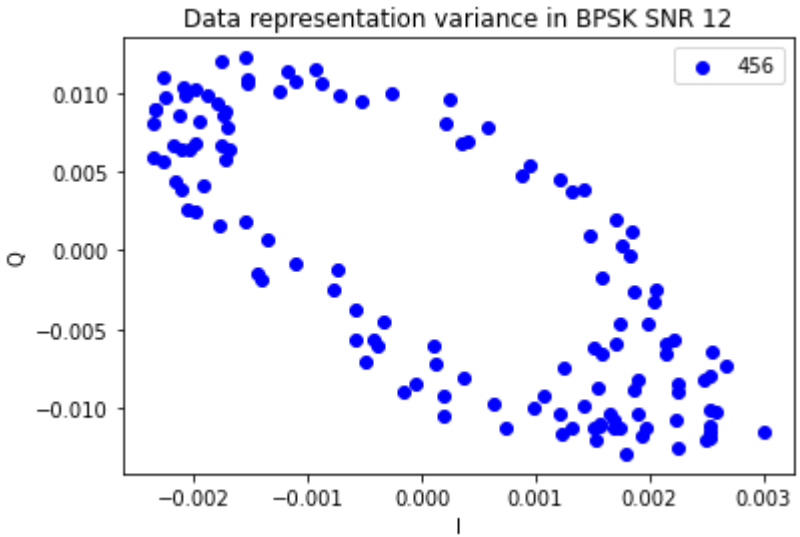

Data representation variance in BPSK SNR 12
451
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010
−0.005
0.000
0.005
0.010
I

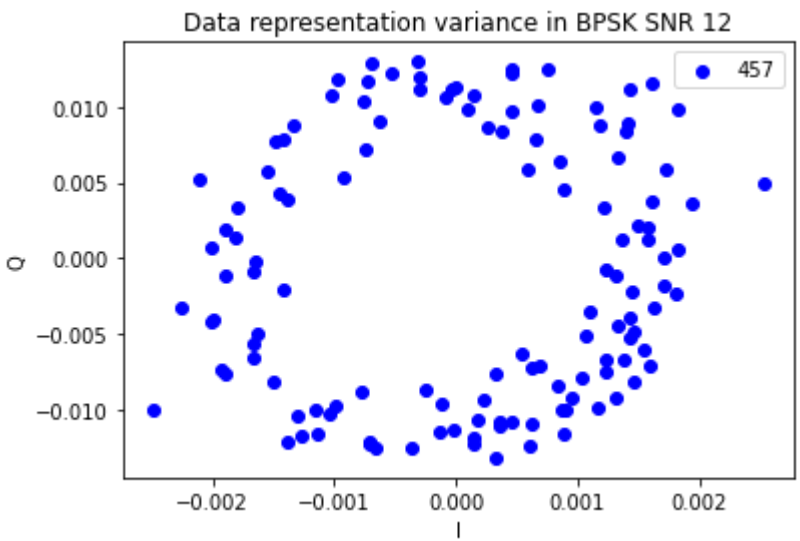

Data representation variance in BPSK SNR 12
452
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

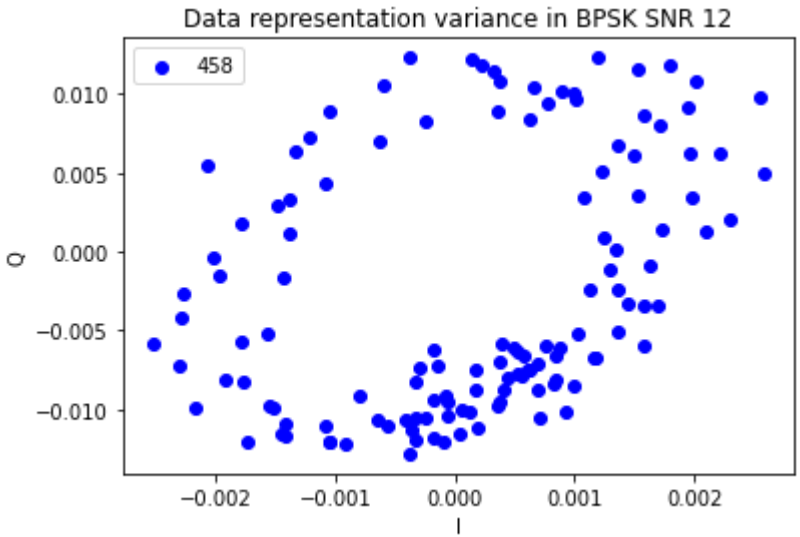

Data representation variance in BPSK SNR 12
453
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

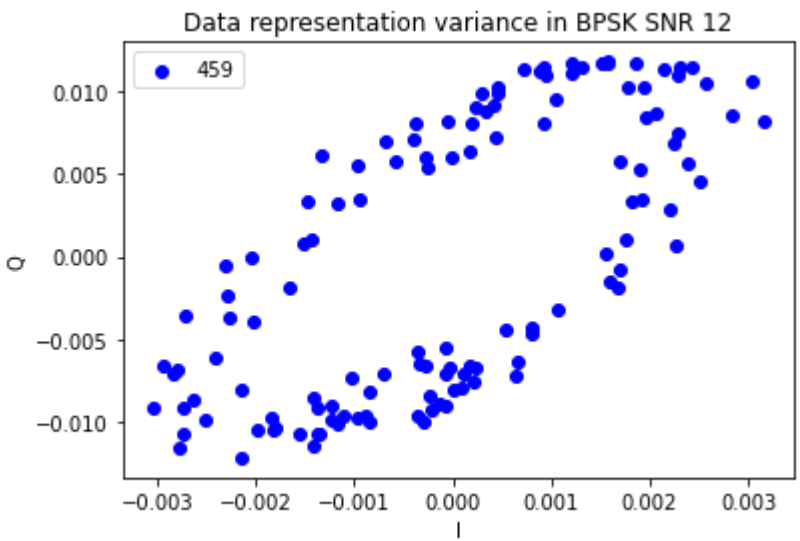

Data representation variance in BPSK SNR 12
454
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

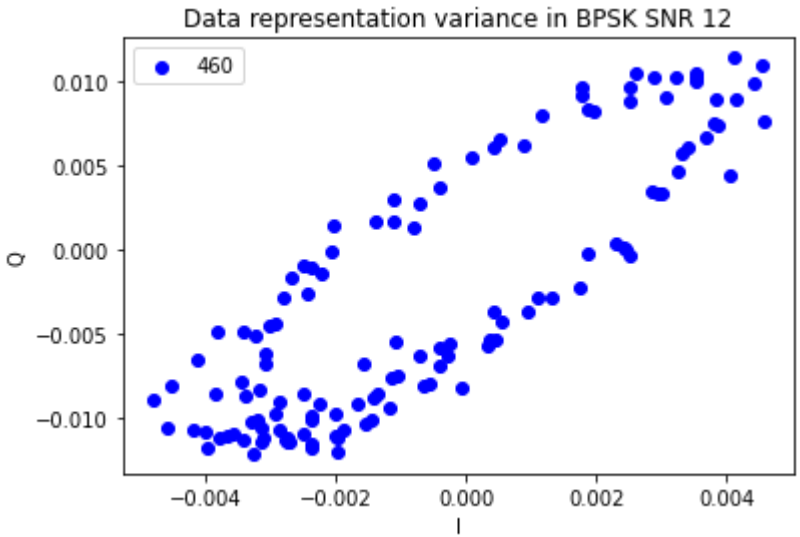

Data representation variance in BPSK SNR 12
455
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

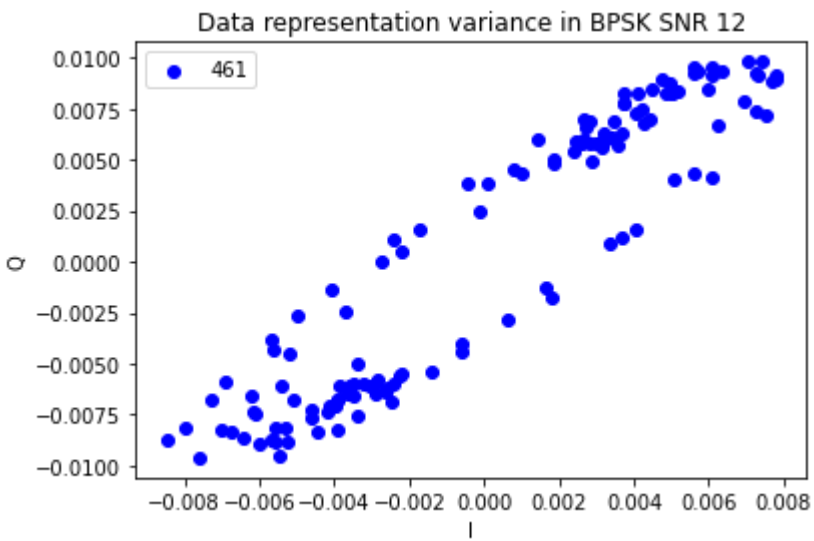

Data representation variance in BPSK SNR 12
456
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
457
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
458
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
459
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
460
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
461
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0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
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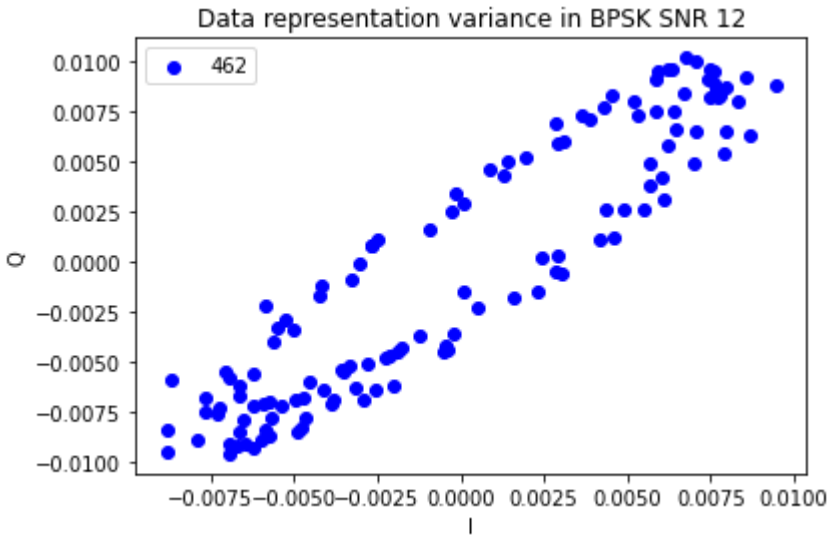
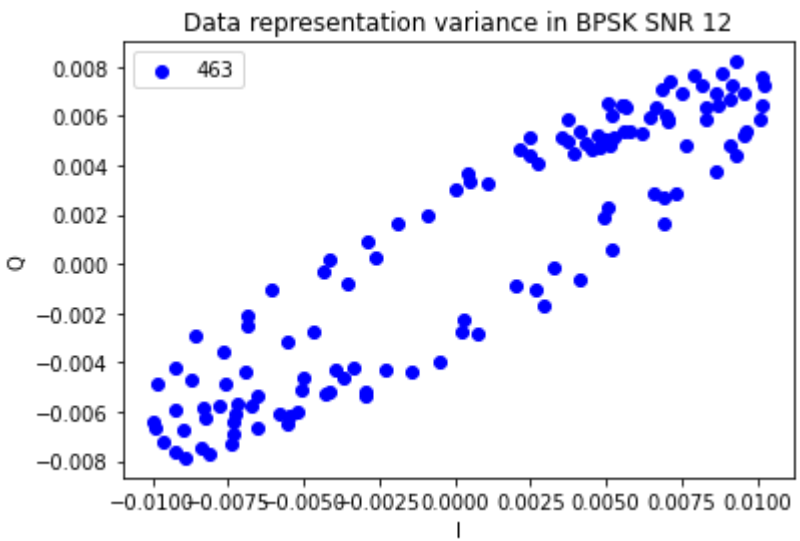
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I


Data representation variance in BPSK SNR 12
462
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
463
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
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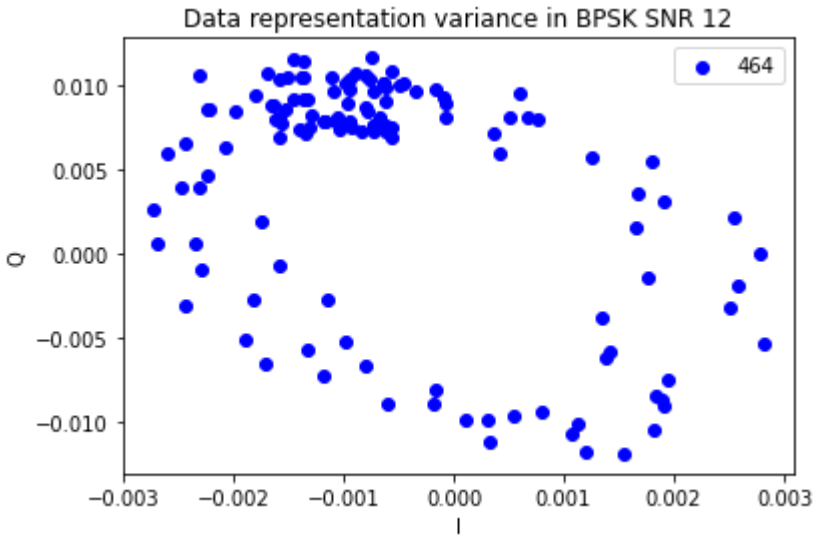
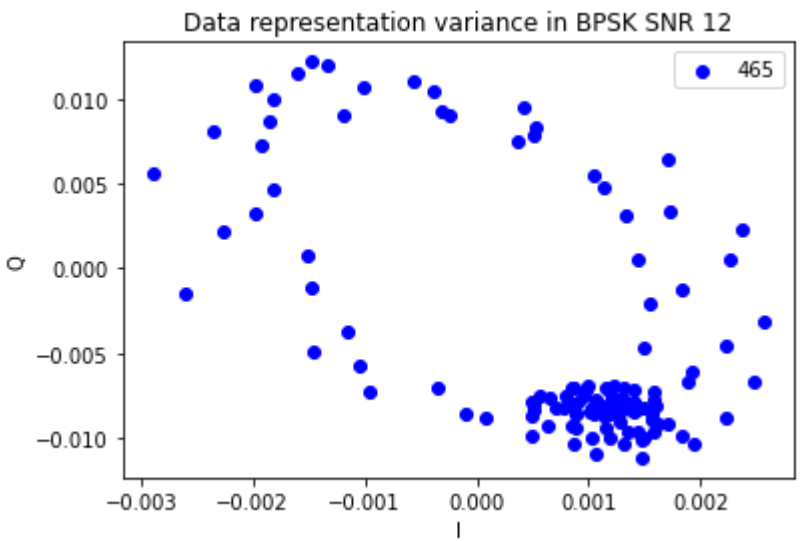

Data representation variance in BPSK SNR 12
464
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
465
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
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0.001
0.002
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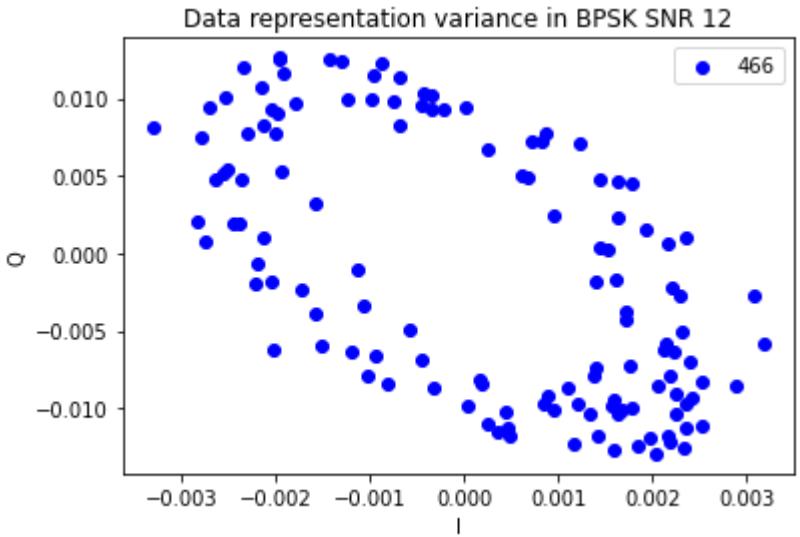
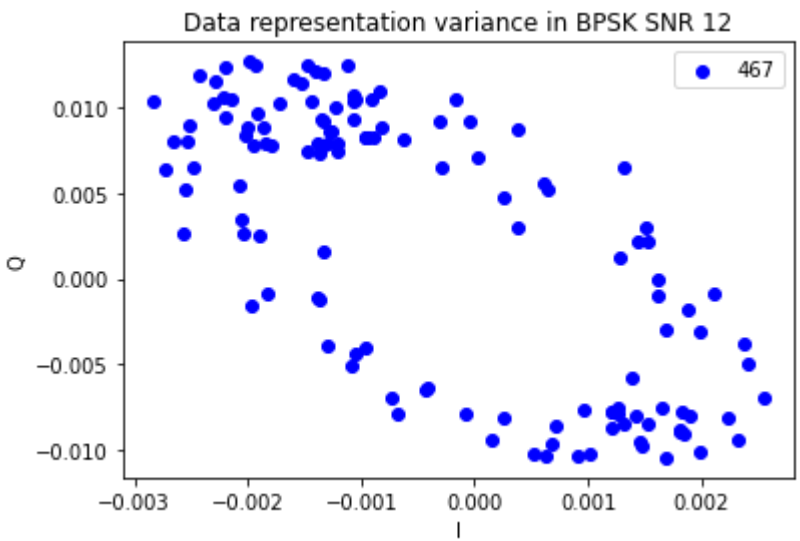
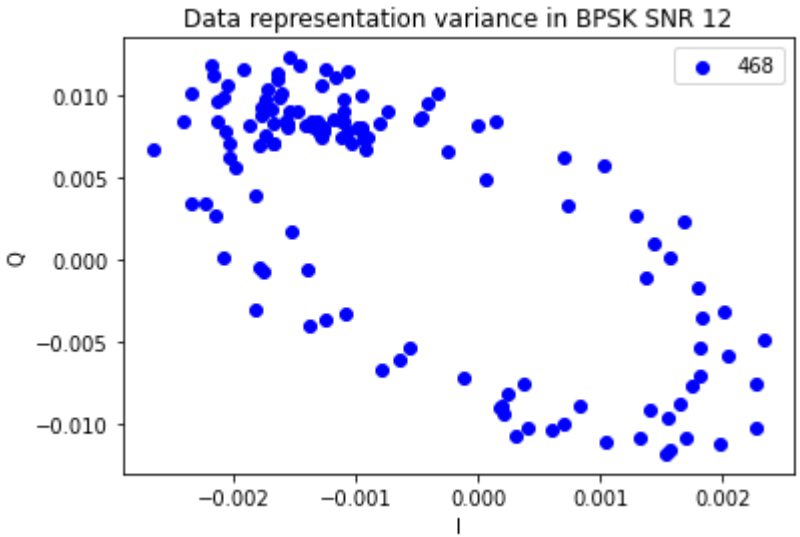

Data representation variance in BPSK SNR 12
466
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
467
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
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0.010
0.005
0.000
−0.005
−0.010
Q
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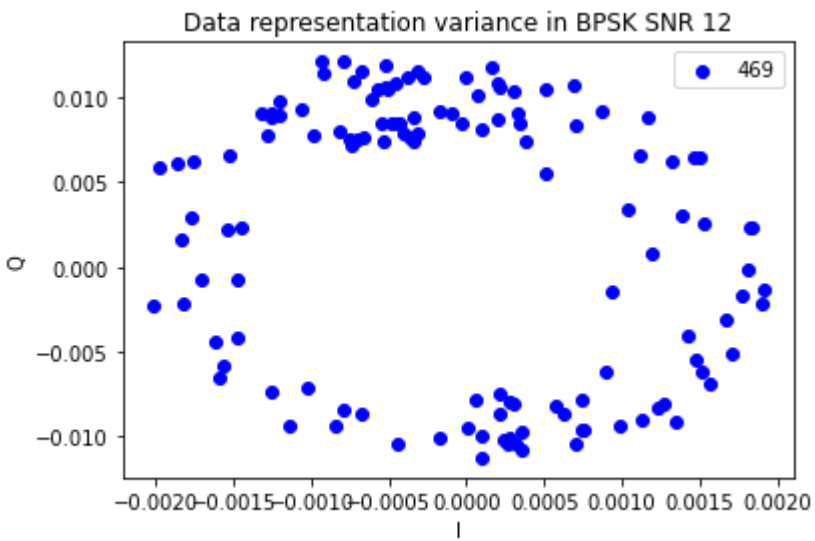
0.001
0.002
I


Data representation variance in BPSK SNR 12
469
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0.005
0.000
−0.005
−0.010
Q
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−0.0010
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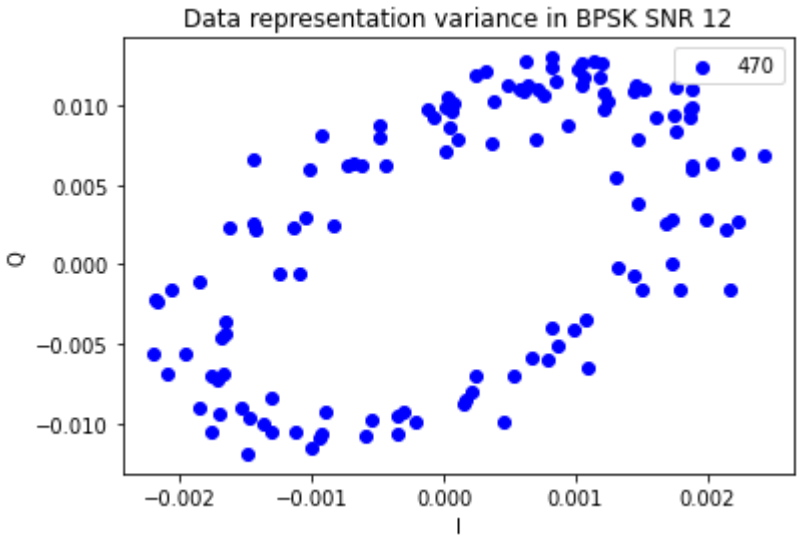
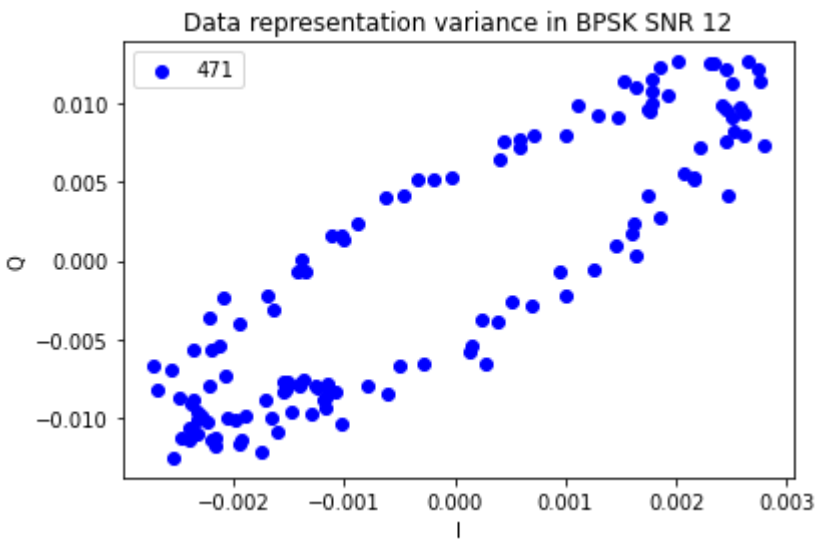
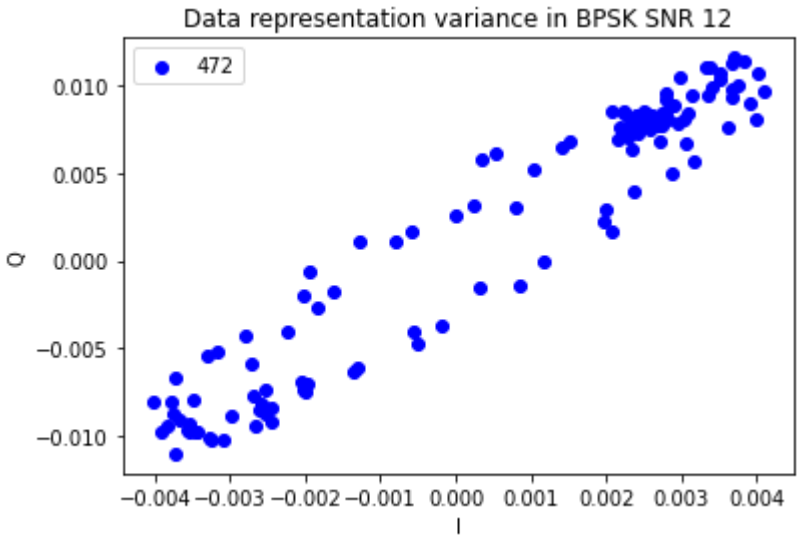
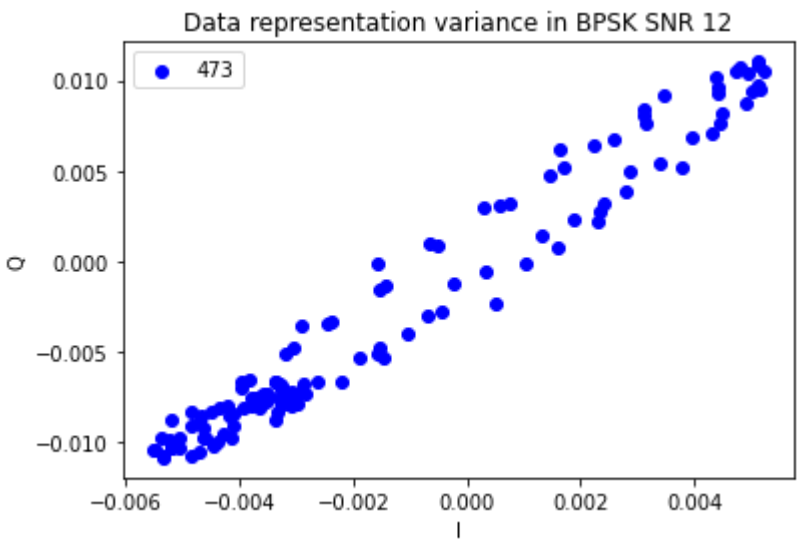
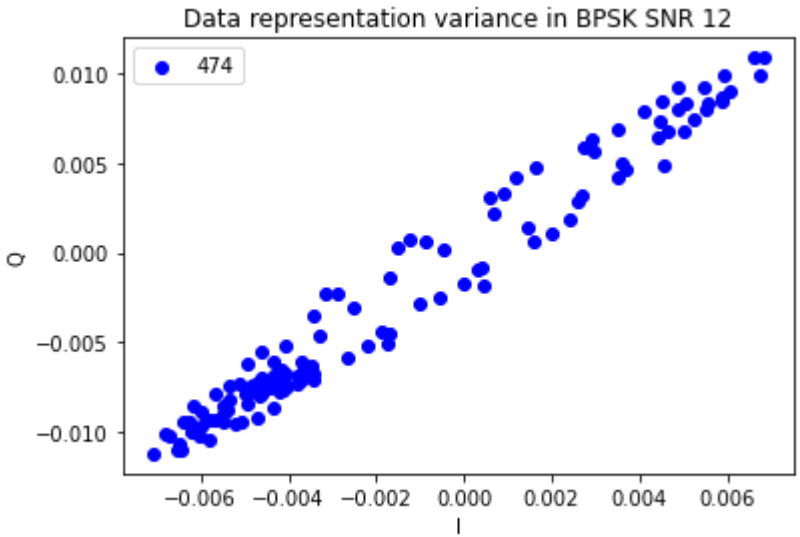
0.0015
0.0020
I

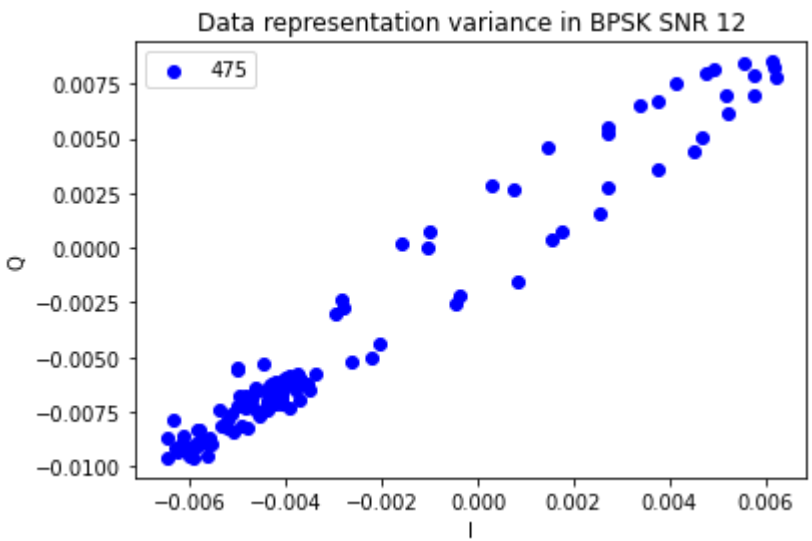

Data representation variance in BPSK SNR 12
470
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
471
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
472
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I


Data representation variance in BPSK SNR 12
473
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004
I


Data representation variance in BPSK SNR 12
474
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
475
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
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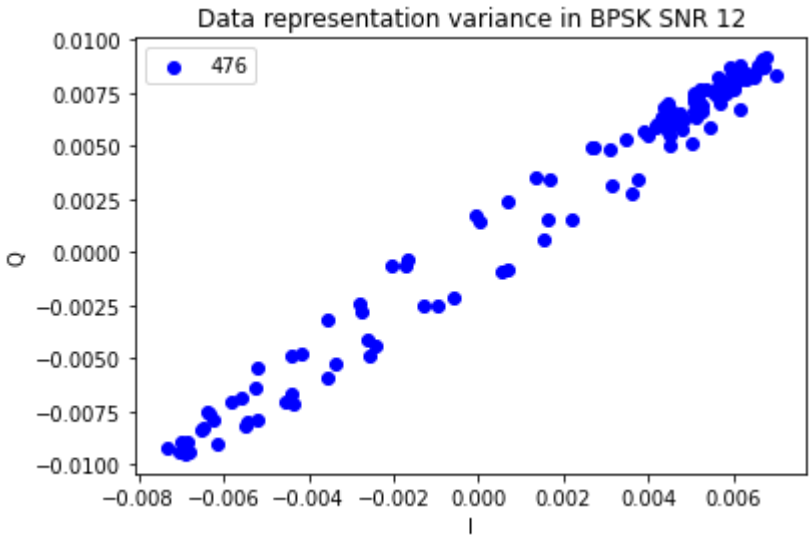
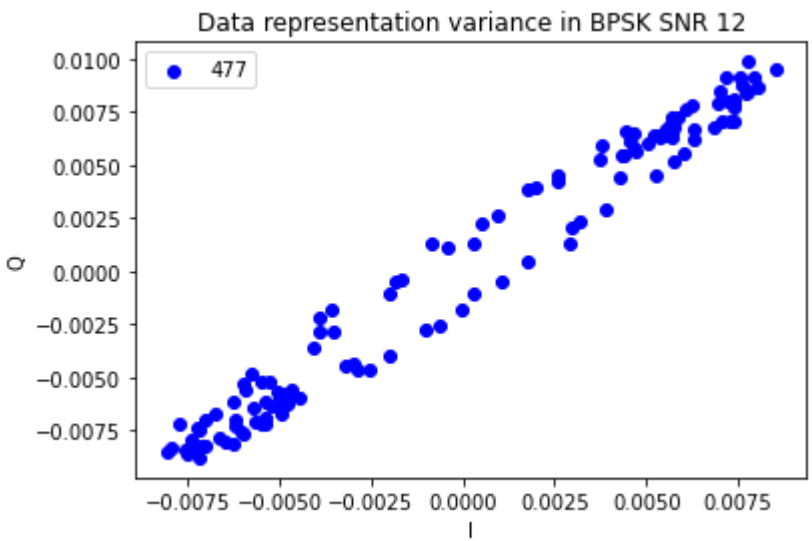
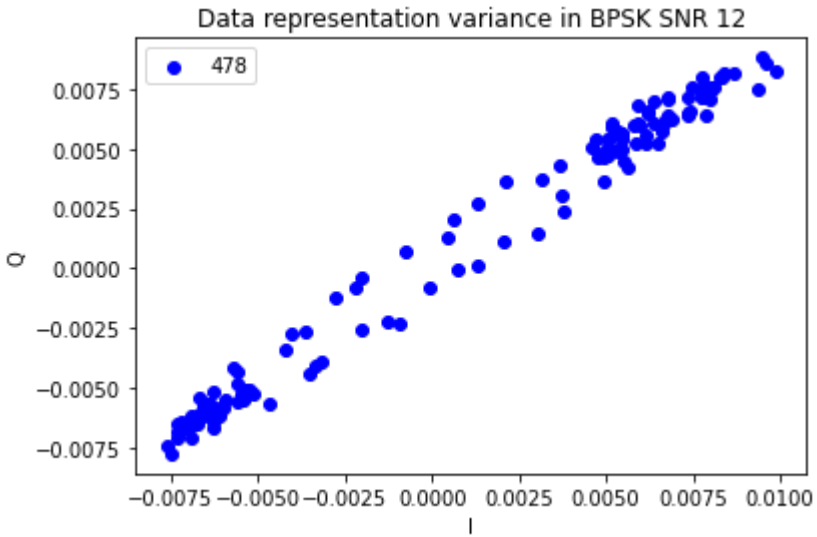
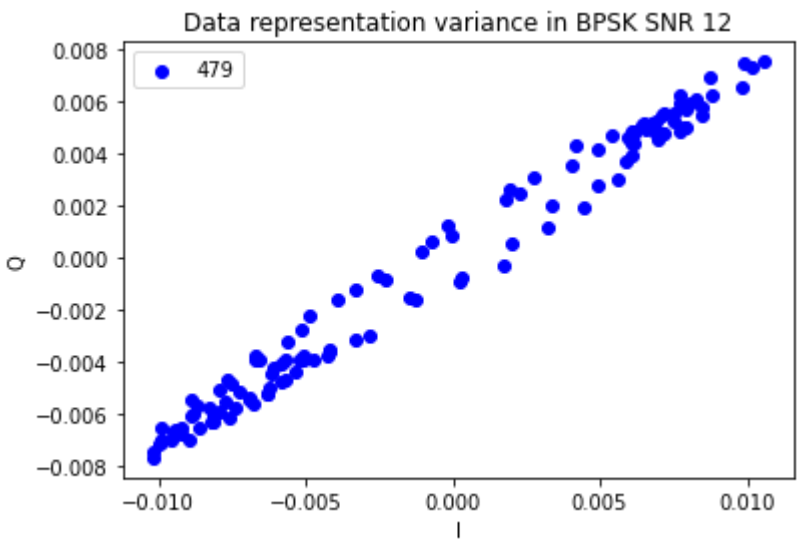
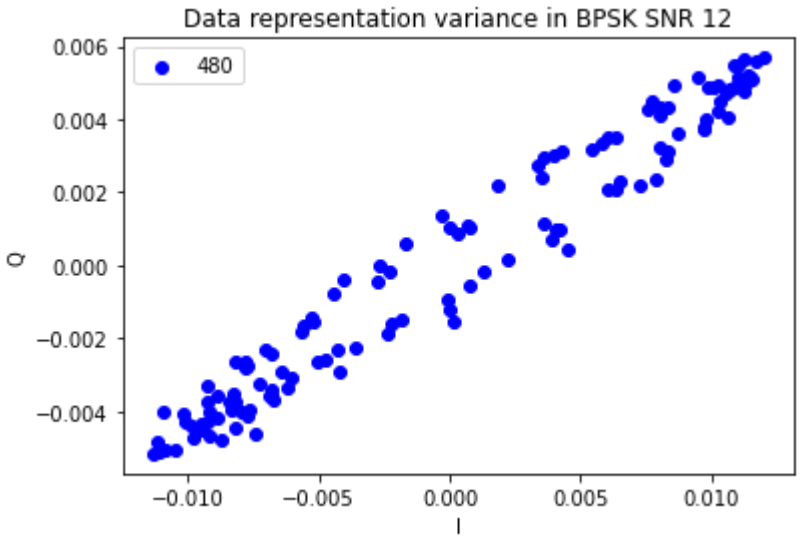
0.006
I

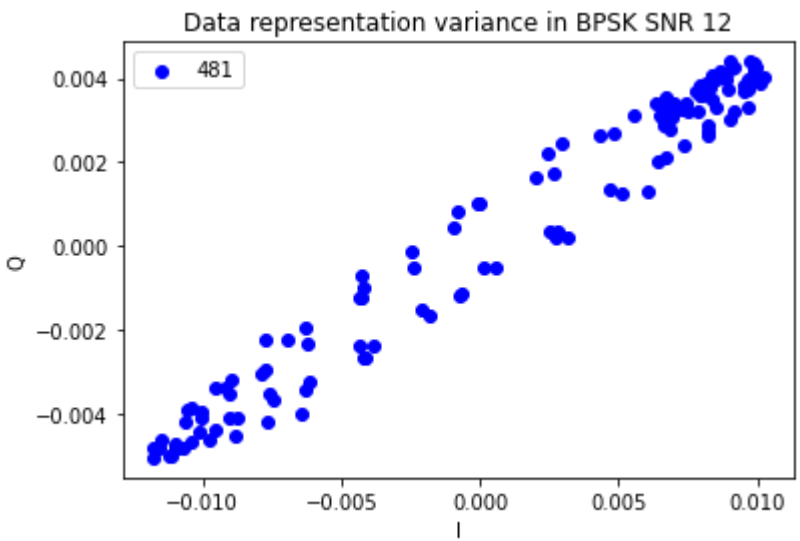

Data representation variance in BPSK SNR 12
476
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

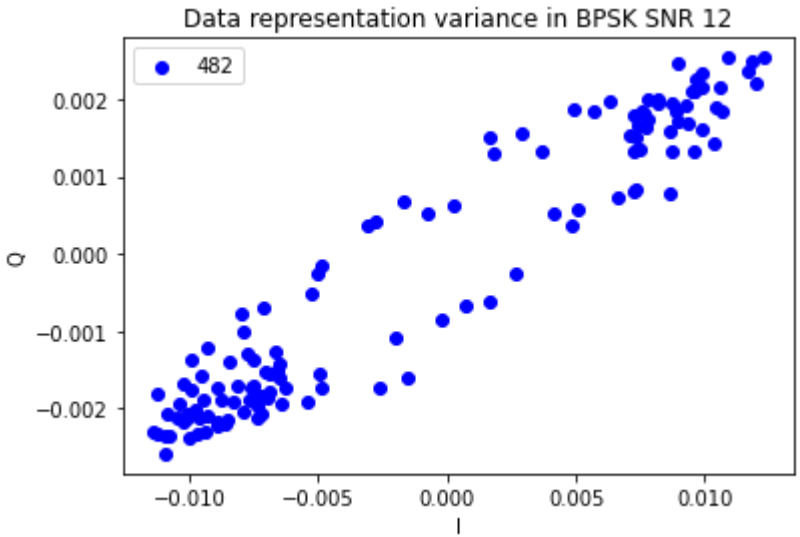

Data representation variance in BPSK SNR 12
477
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
I

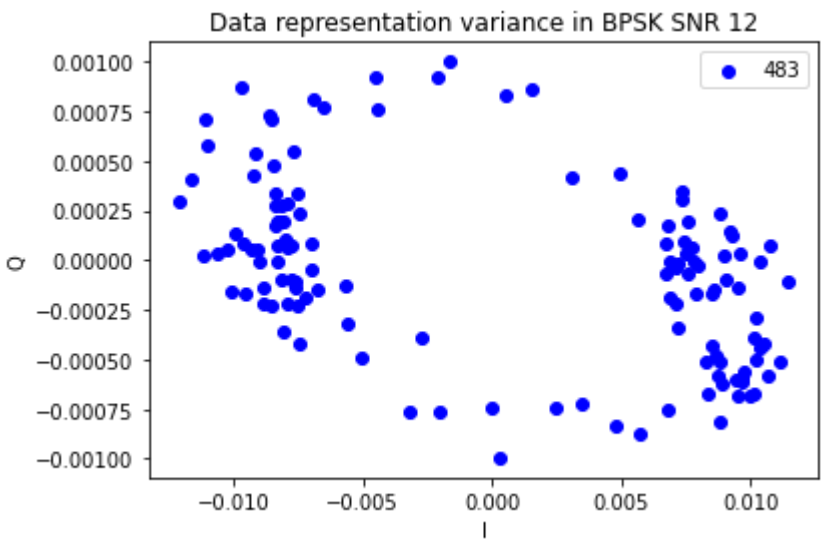

Data representation variance in BPSK SNR 12
478
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

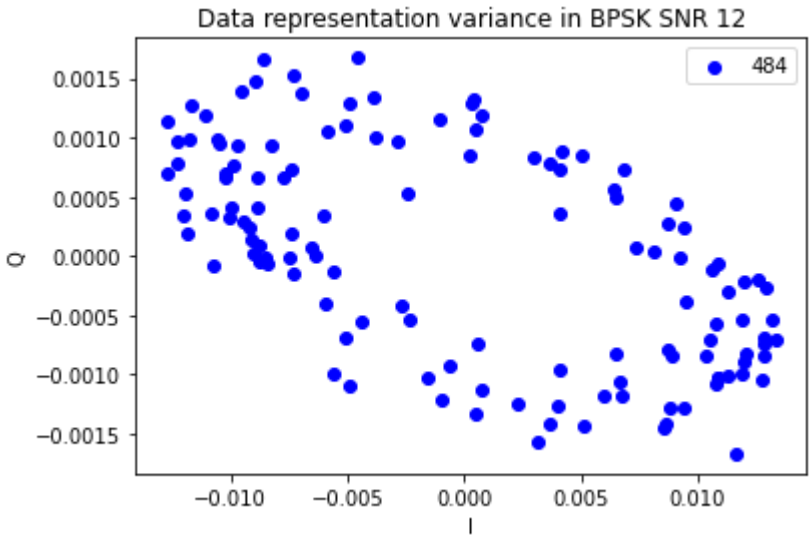

Data representation variance in BPSK SNR 12
479
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010 −0.005 0.000 0.005 0.010
I

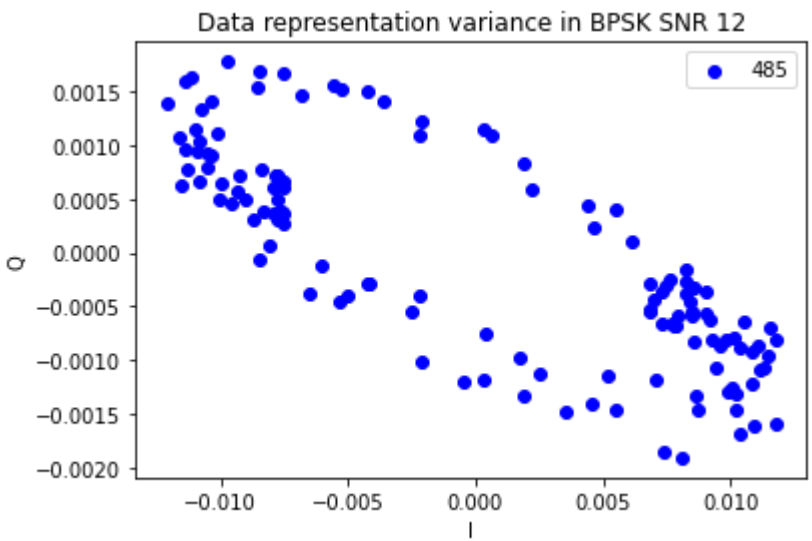

Data representation variance in BPSK SNR 12
480
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

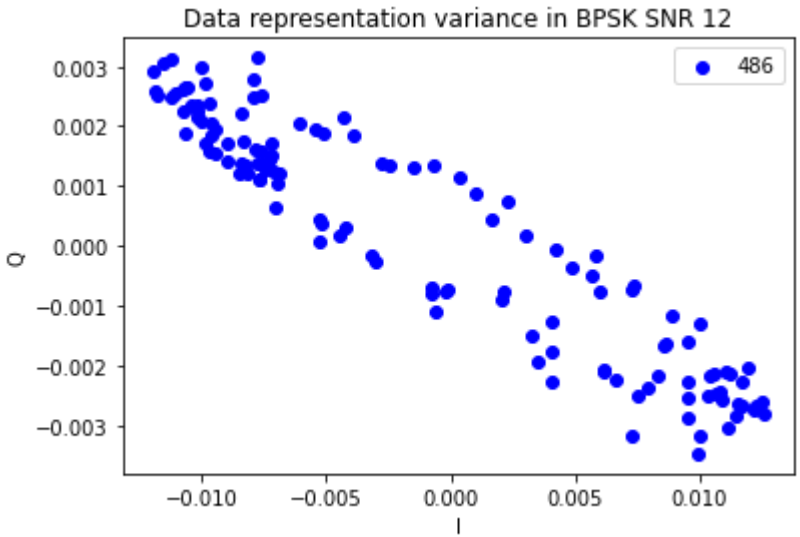

Data representation variance in BPSK SNR 12
481
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

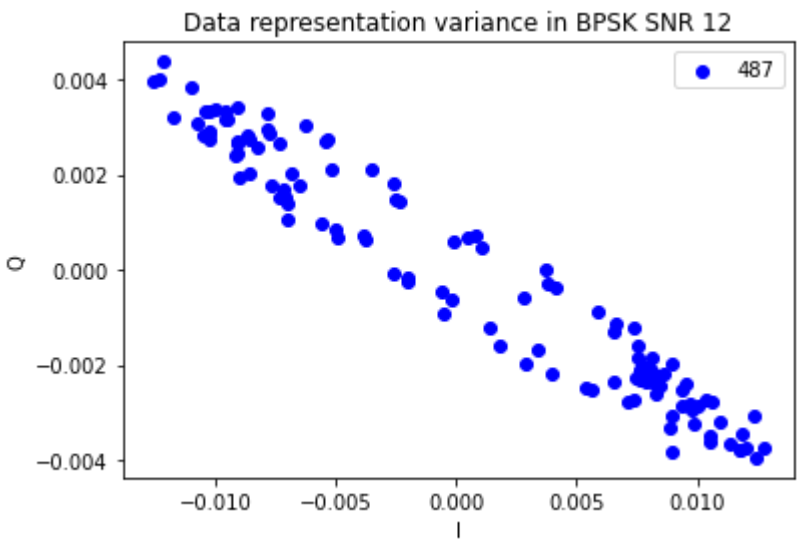

Data representation variance in BPSK SNR 12
482
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

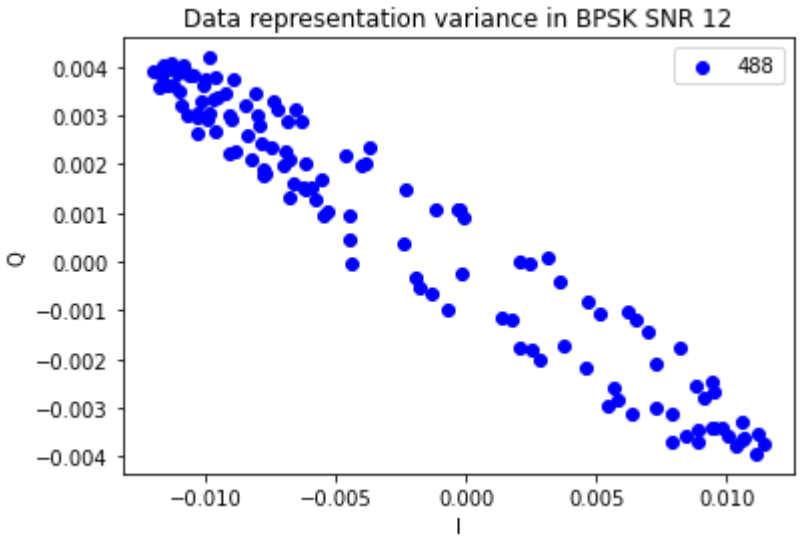

Data representation variance in BPSK SNR 12
483
0.00100
0.00075
0.00050
0.00025
0.00000
−0.00025
−0.00050
−0.00075
−0.00100
Q
−0.010
−0.005
0.000
0.005
0.010
I

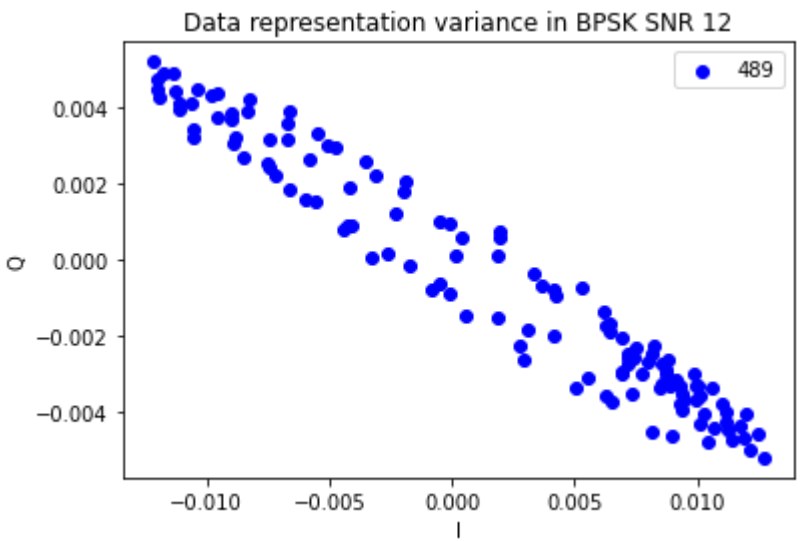

Data representation variance in BPSK SNR 12
484
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
485
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
−0.0020
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
486
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
487
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
488
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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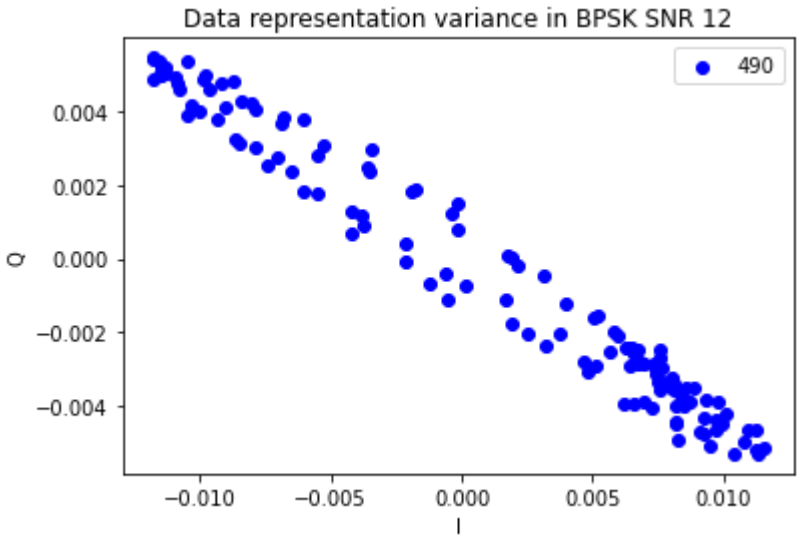
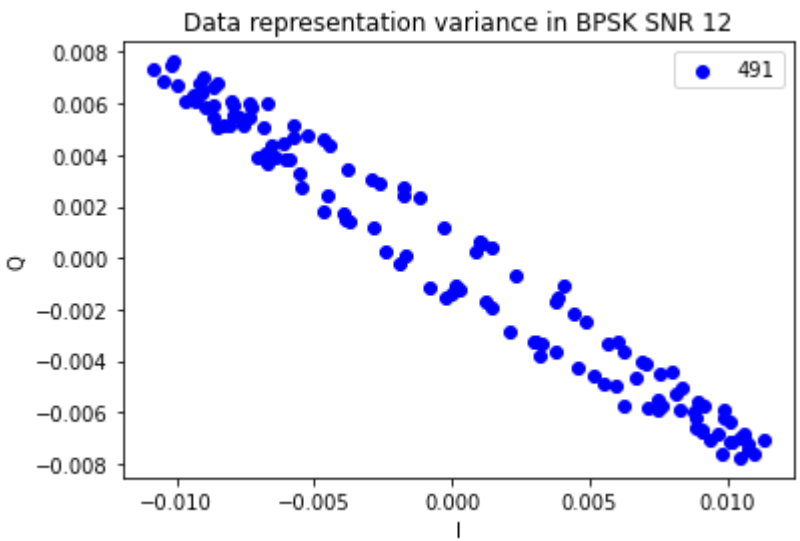
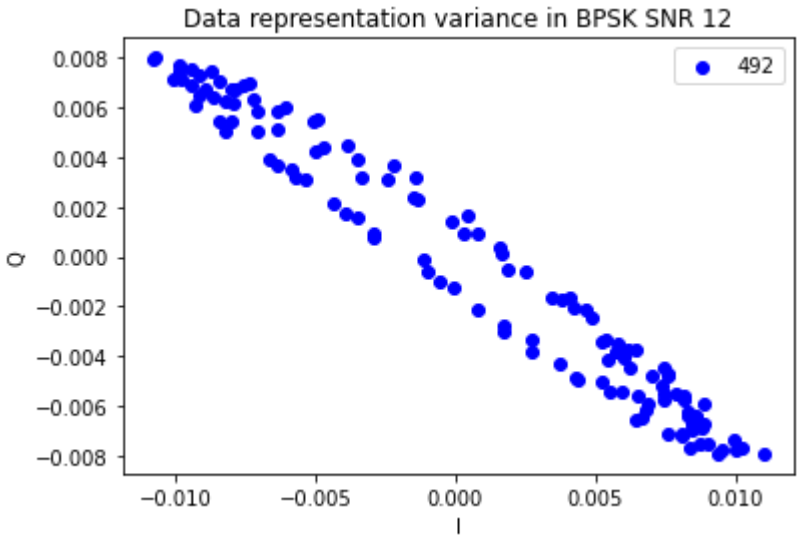
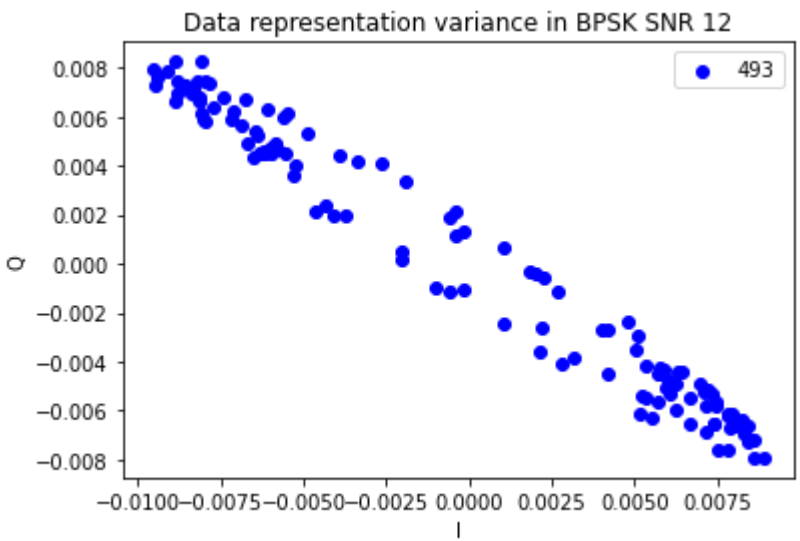
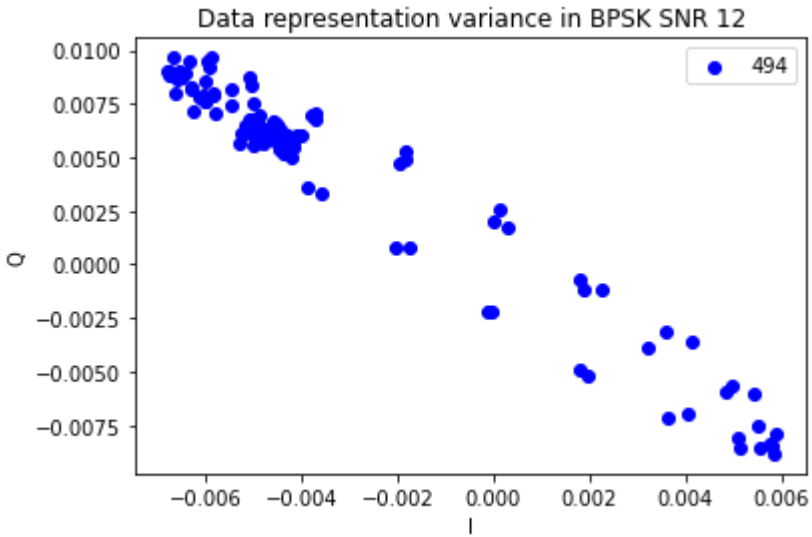
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

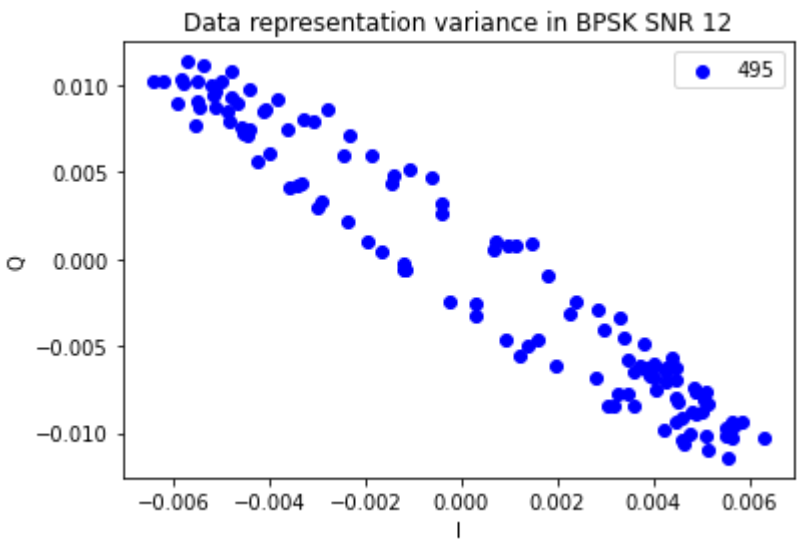

Data representation variance in BPSK SNR 12
490
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

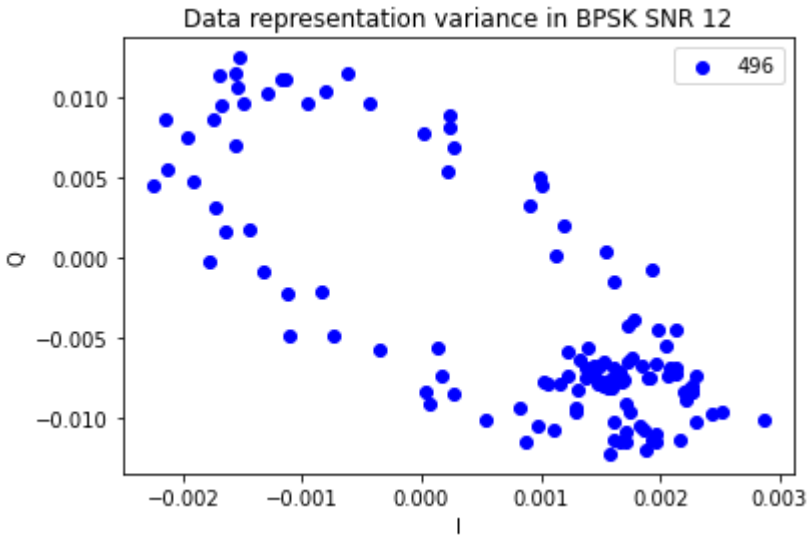

Data representation variance in BPSK SNR 12
491
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010
−0.005
0.000
0.005
0.010
I

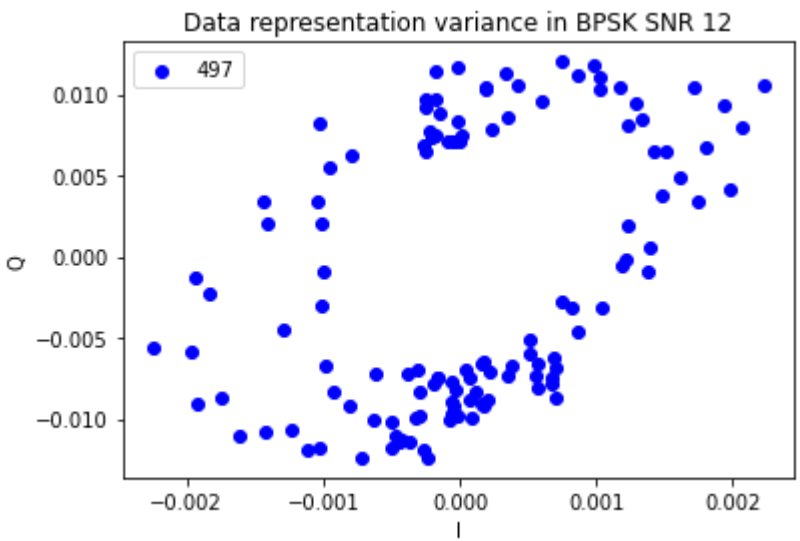

Data representation variance in BPSK SNR 12
492
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.010
−0.005
0.000
0.005
0.010
I

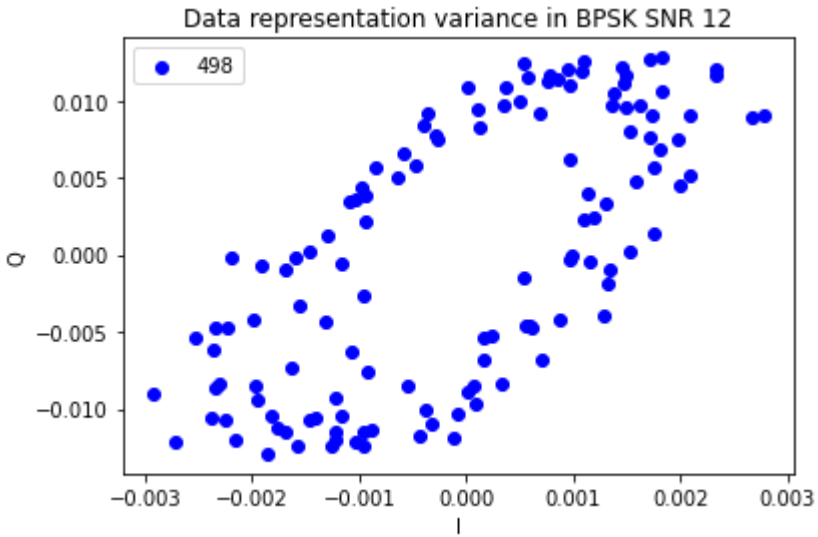

Data representation variance in BPSK SNR 12
493
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
I

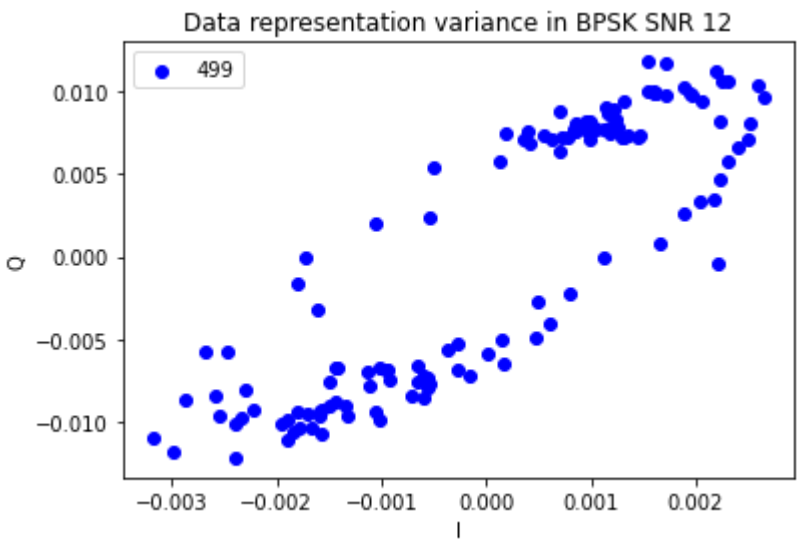

Data representation variance in BPSK SNR 12
494
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

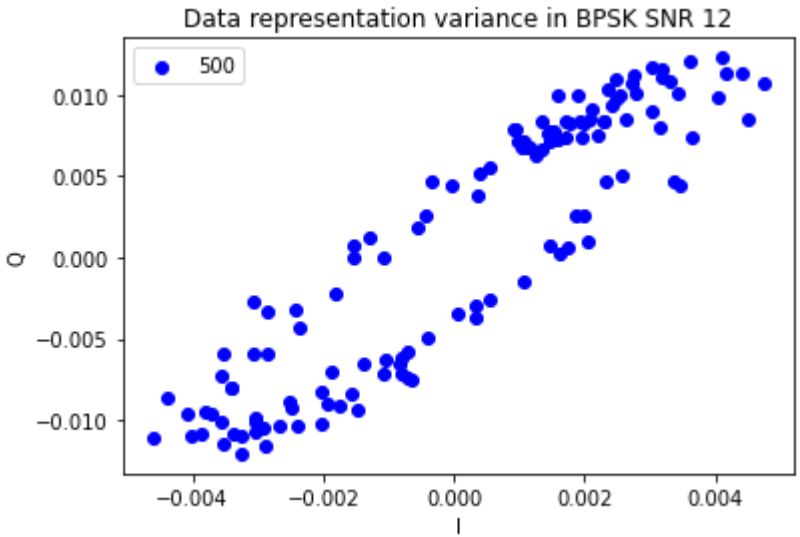

Data representation variance in BPSK SNR 12
495
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
496
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
497
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
498
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
499
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
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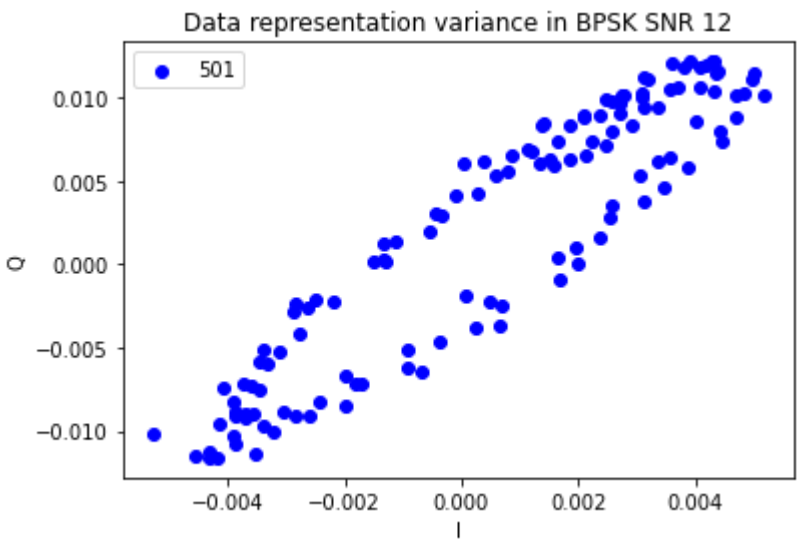
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
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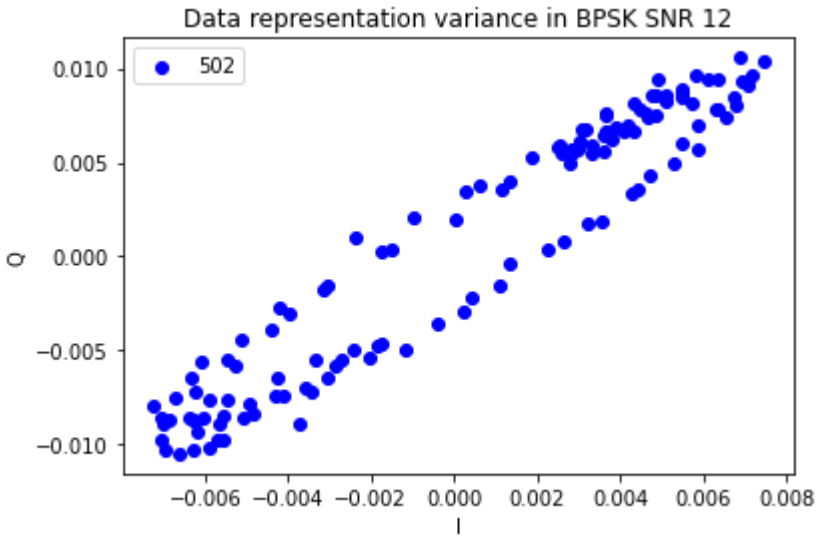
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
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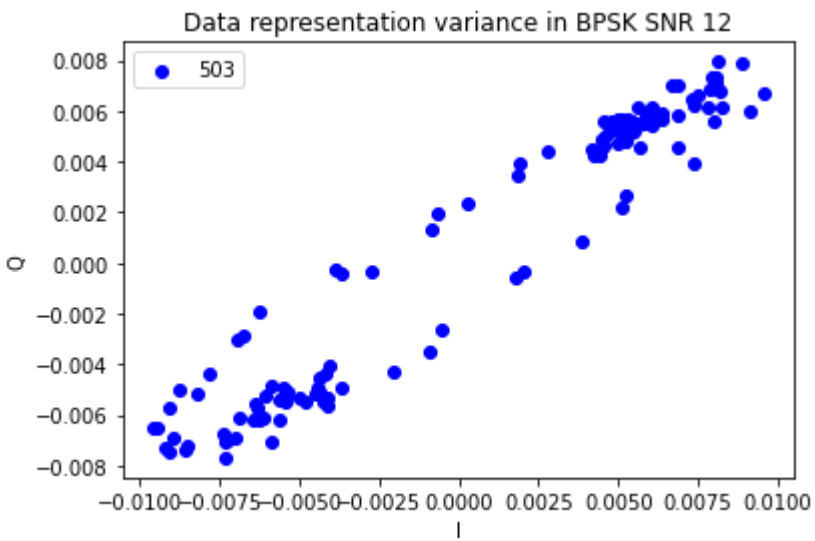
0.005
0.000
−0.005
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I


Data representation variance in BPSK SNR 12
503
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
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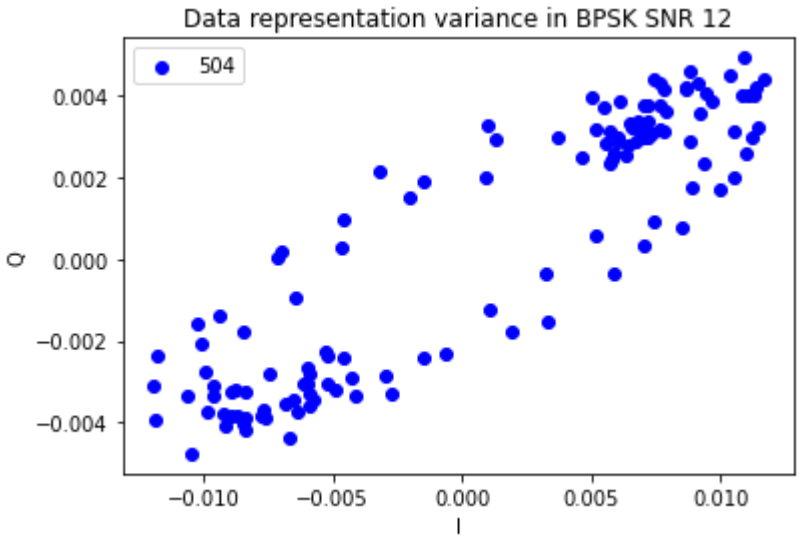
I


Data representation variance in BPSK SNR 12
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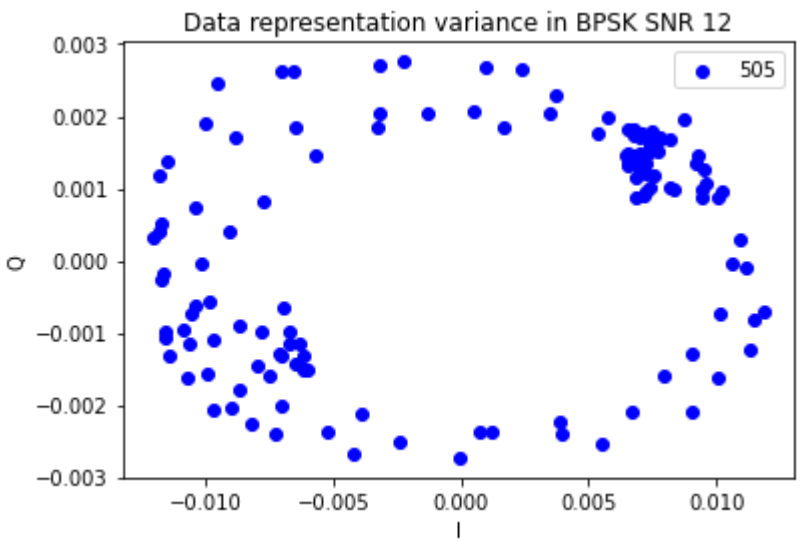
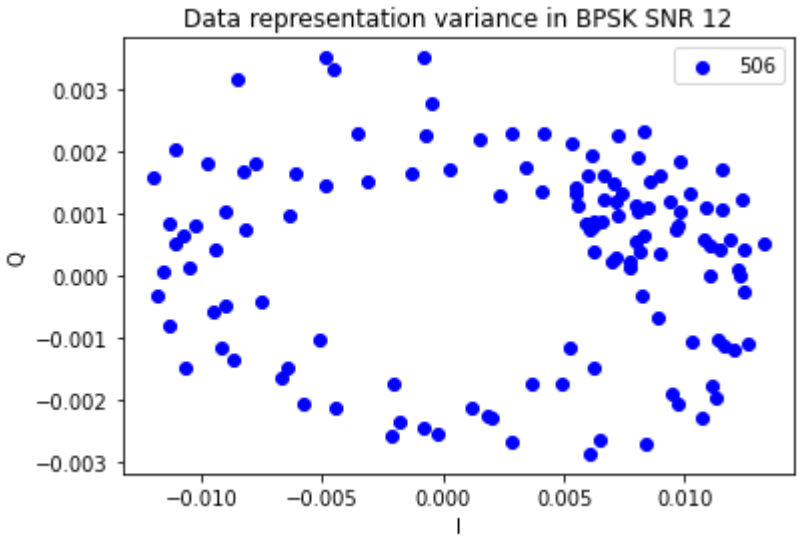
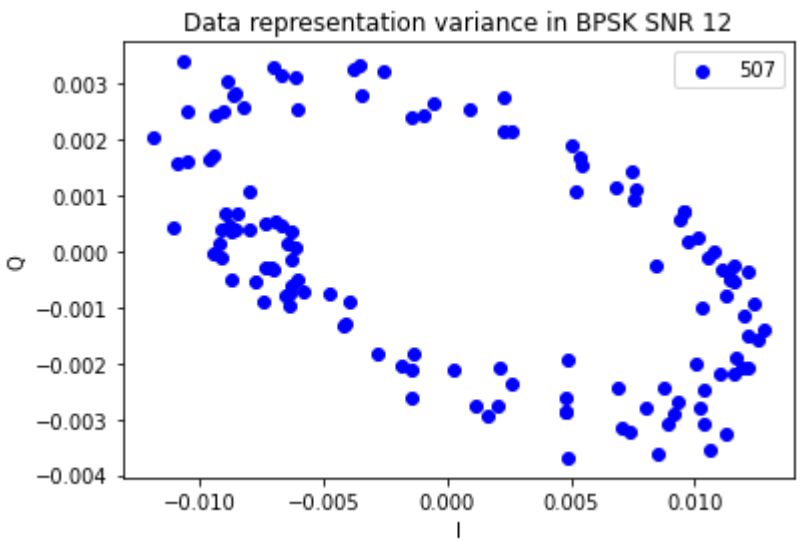
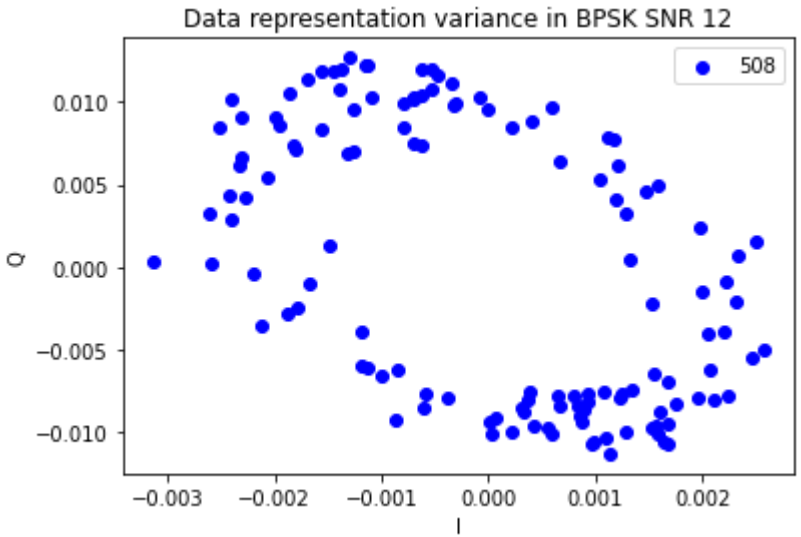
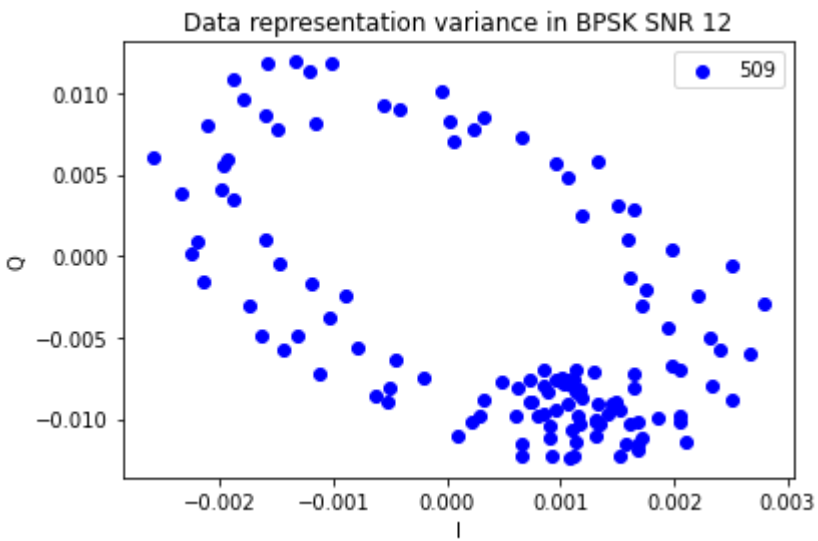
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
505
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
506
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
507
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
508
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
509
0.010
0.005
0.000
−0.005
−0.010
Q
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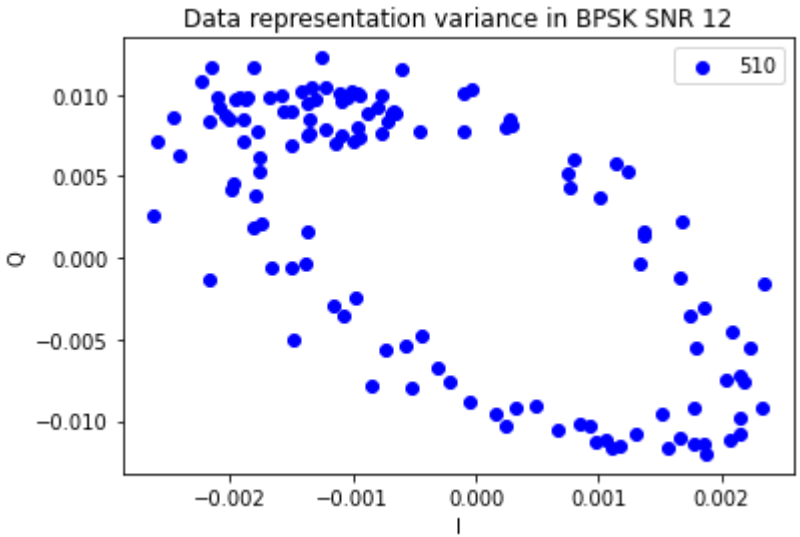
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
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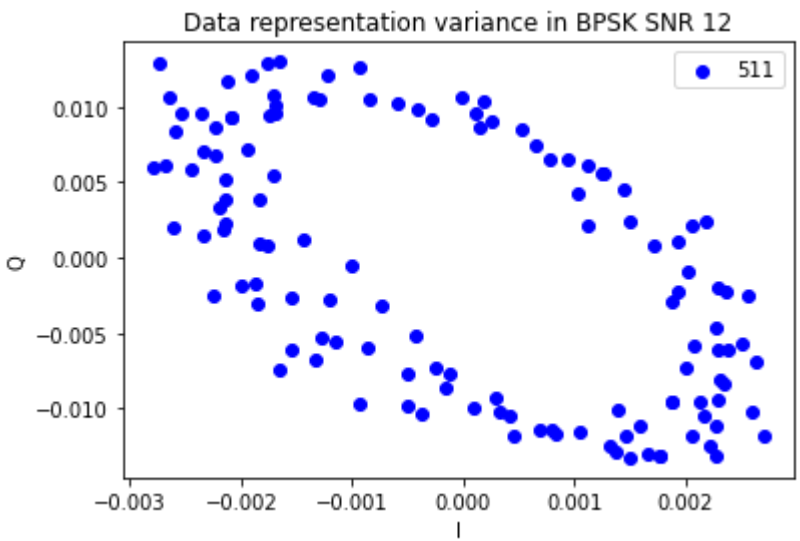
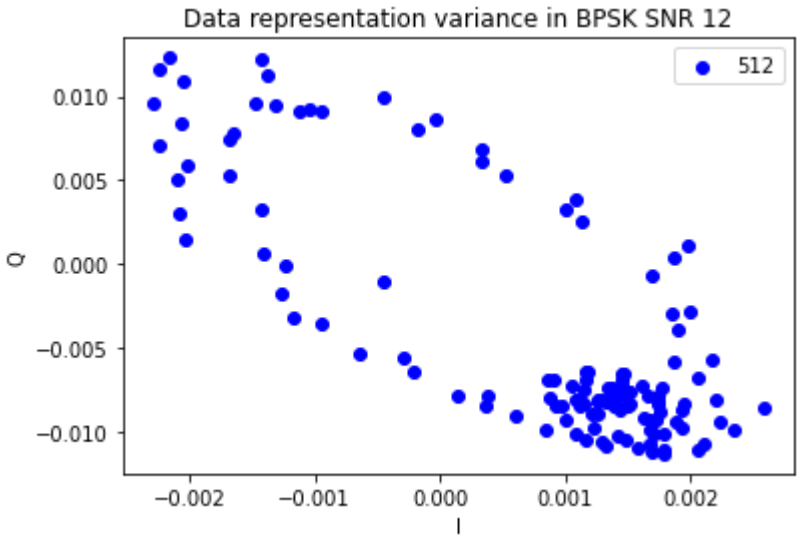
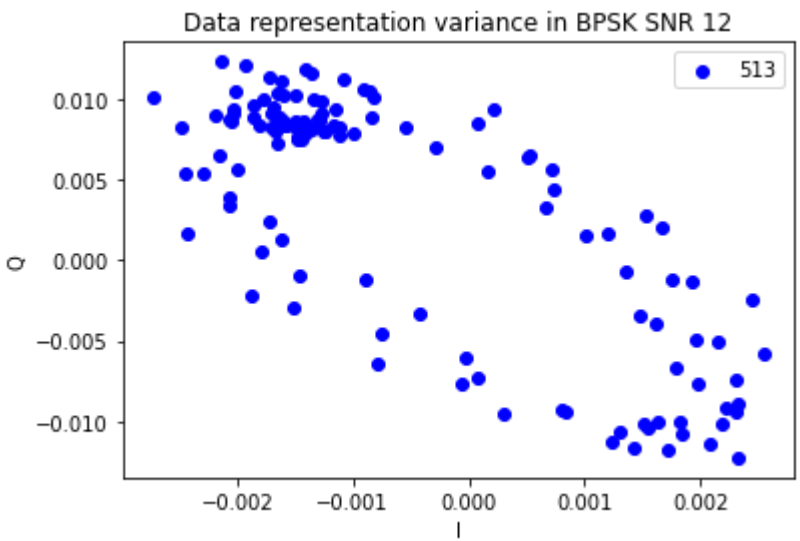
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
511
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
512
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
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−0.005
−0.010
Q
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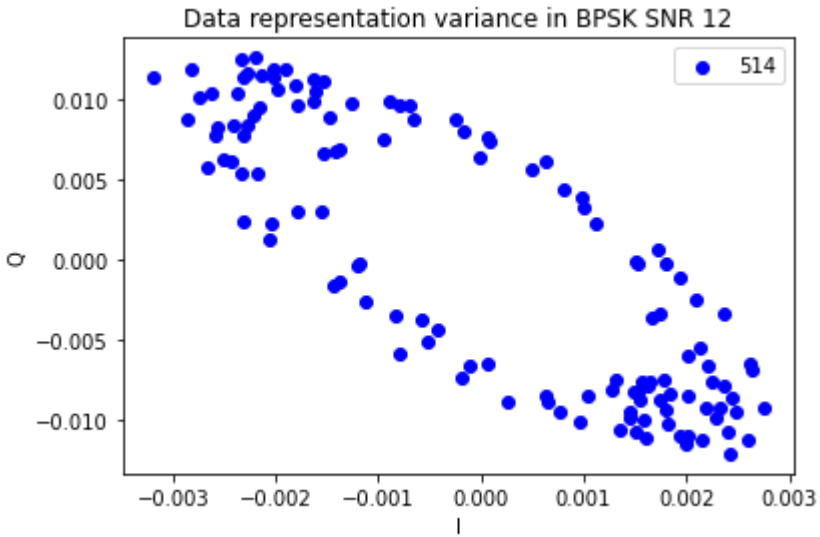
Data representation variance in BPSK SNR 12
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0.005
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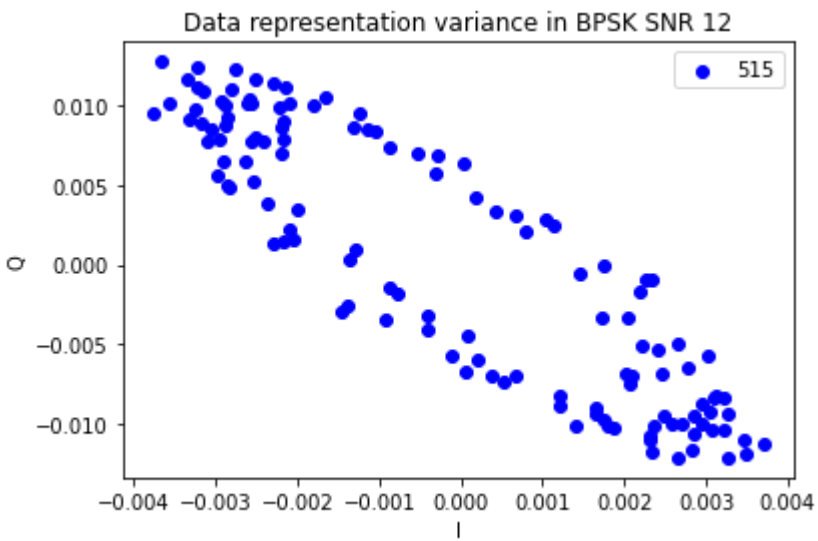
Data representation variance in BPSK SNR 12
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0.000
−0.005
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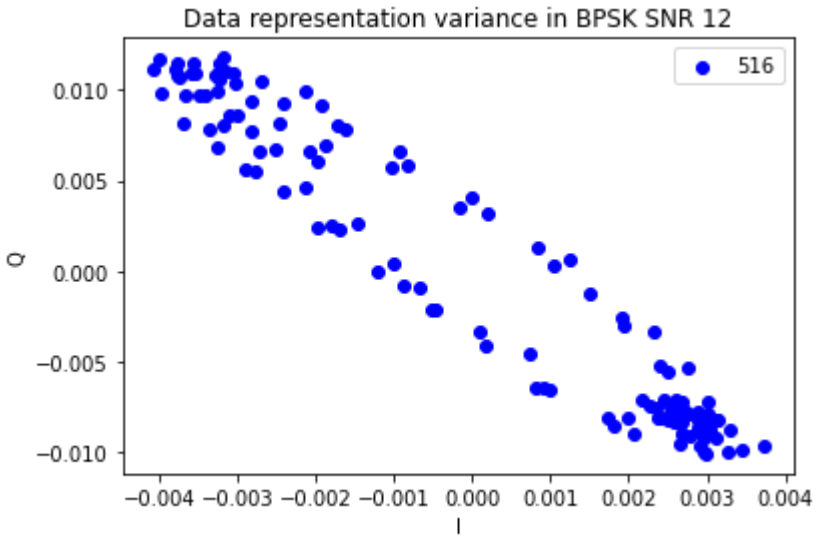
Data representation variance in BPSK SNR 12
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0.010
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−0.010
Q
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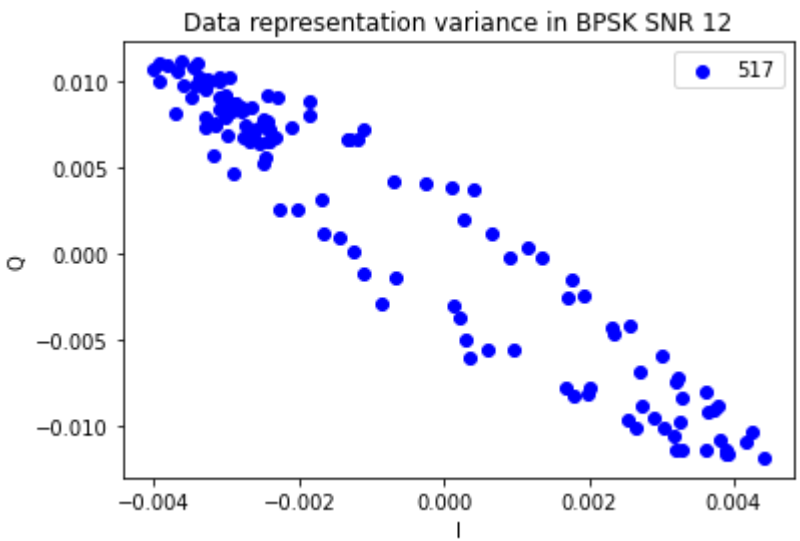
Data representation variance in BPSK SNR 12
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Q
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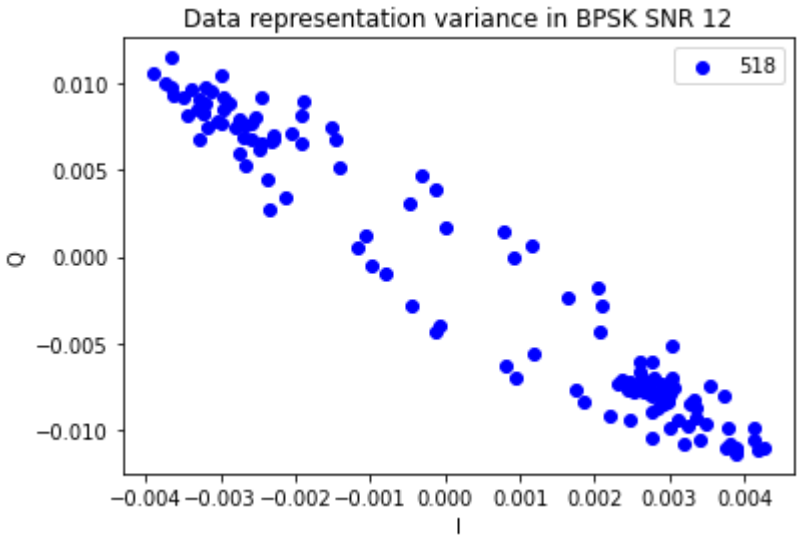
Data representation variance in BPSK SNR 12
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−0.010
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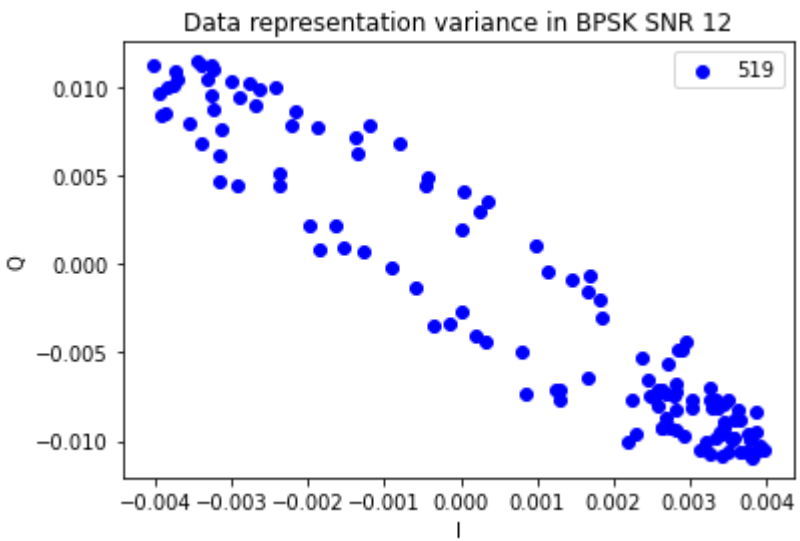
Data representation variance in BPSK SNR 12
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−0.010
Q
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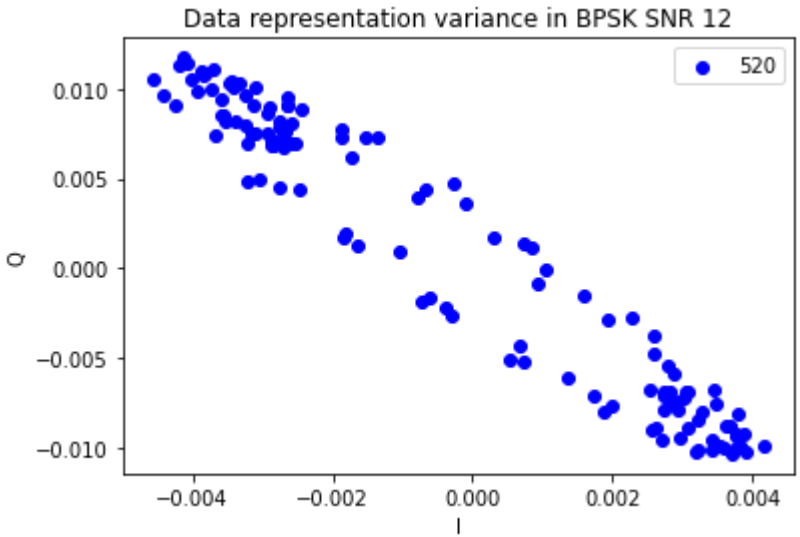
Data representation variance in BPSK SNR 12
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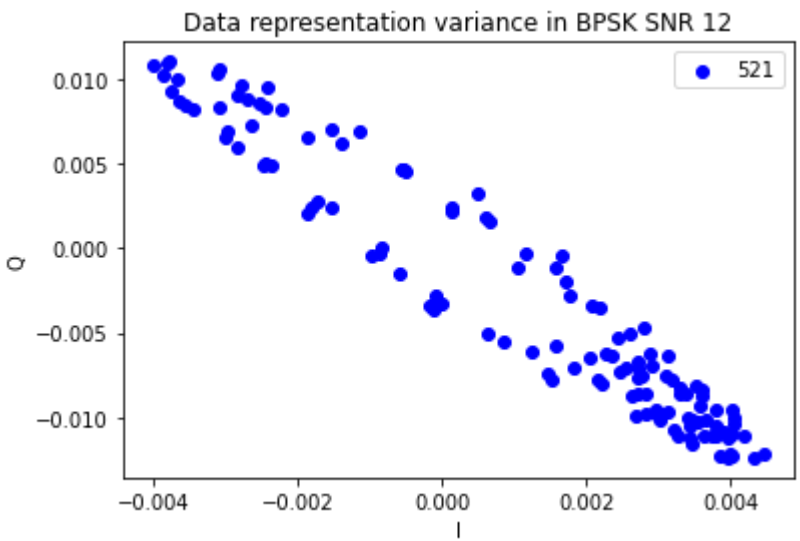
Data representation variance in BPSK SNR 12
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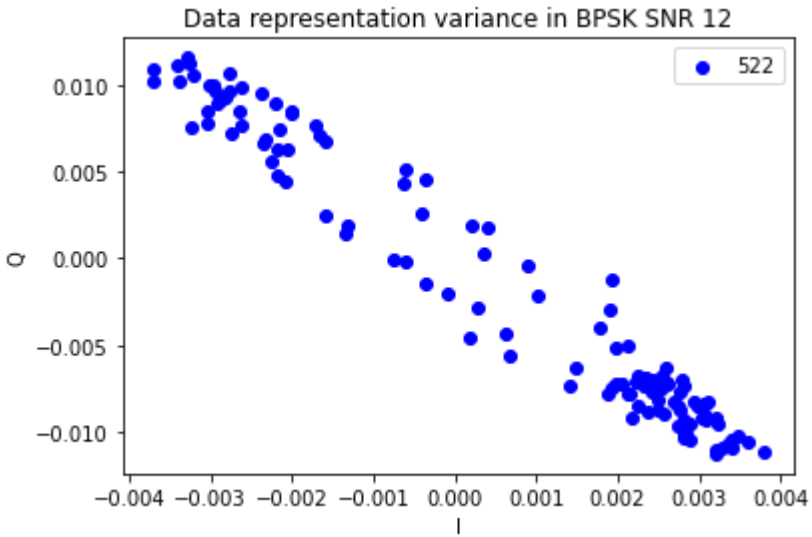
Data representation variance in BPSK SNR 12
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−0.010
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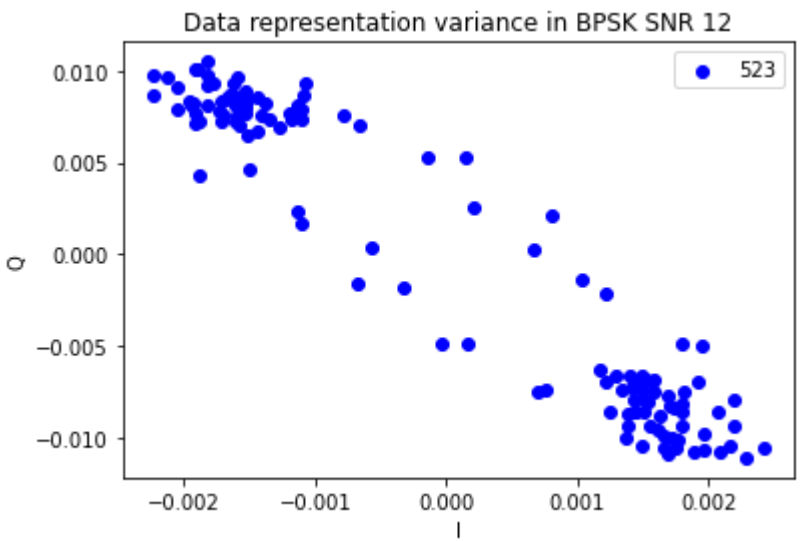
Data representation variance in BPSK SNR 12
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−0.010
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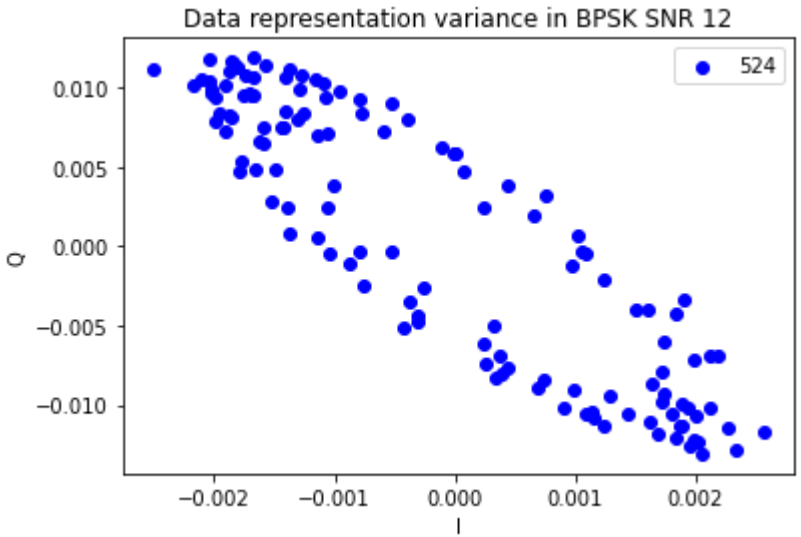
Data representation variance in BPSK SNR 12
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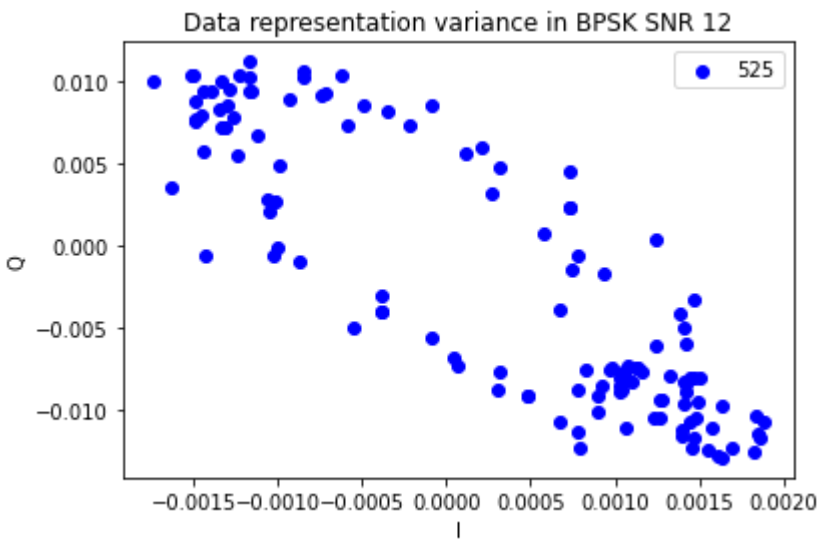
Data representation variance in BPSK SNR 12
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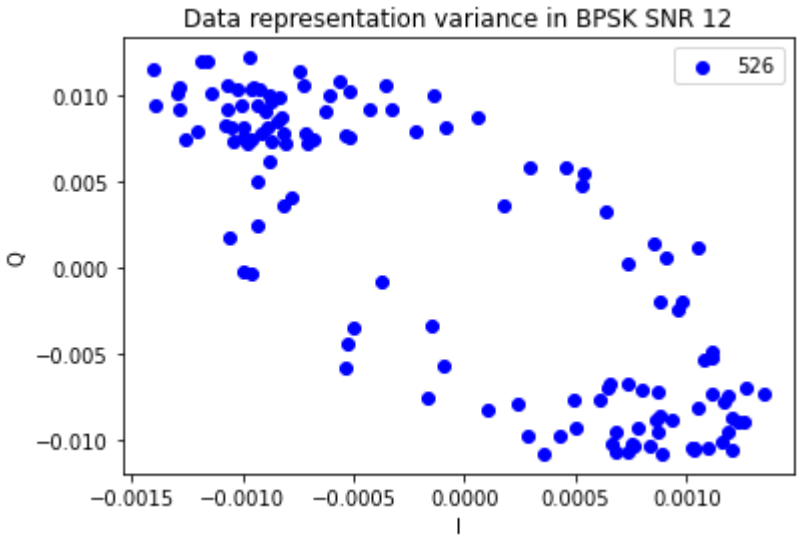
Data representation variance in BPSK SNR 12
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−0.010
Q
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−0.0010
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0.0000
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0.0010
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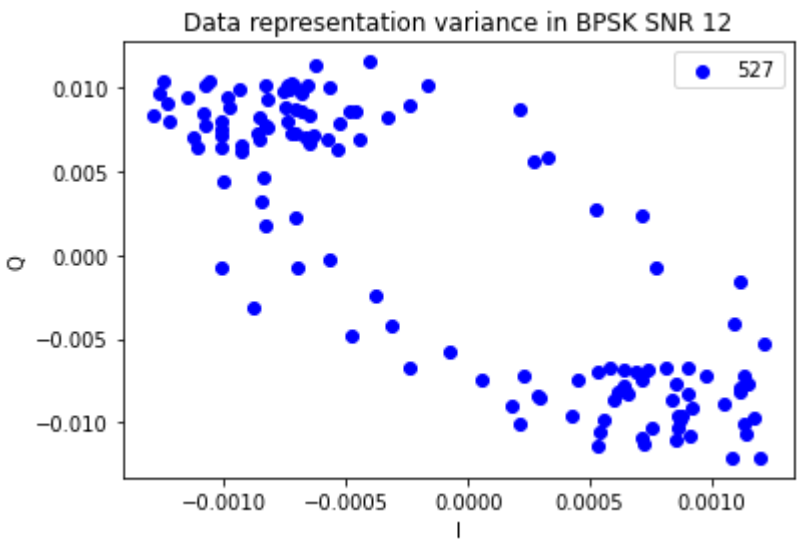
Data representation variance in BPSK SNR 12
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−0.005
−0.010
Q
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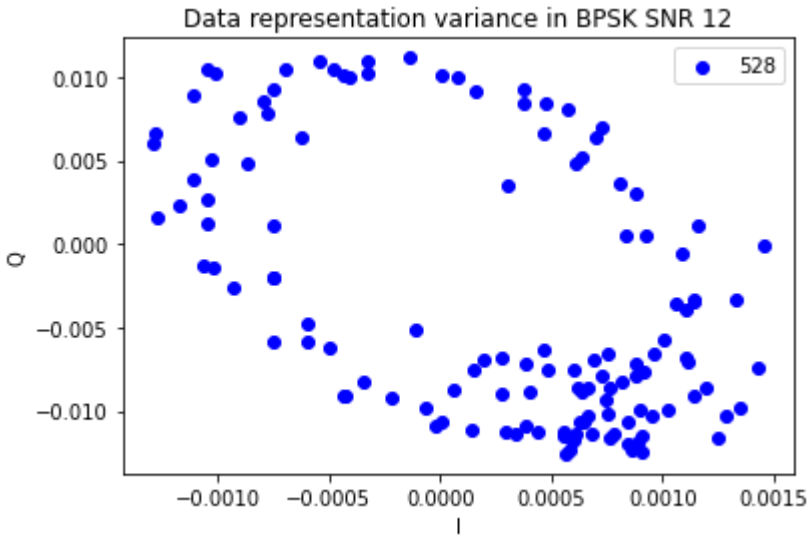
Data representation variance in BPSK SNR 12
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Q
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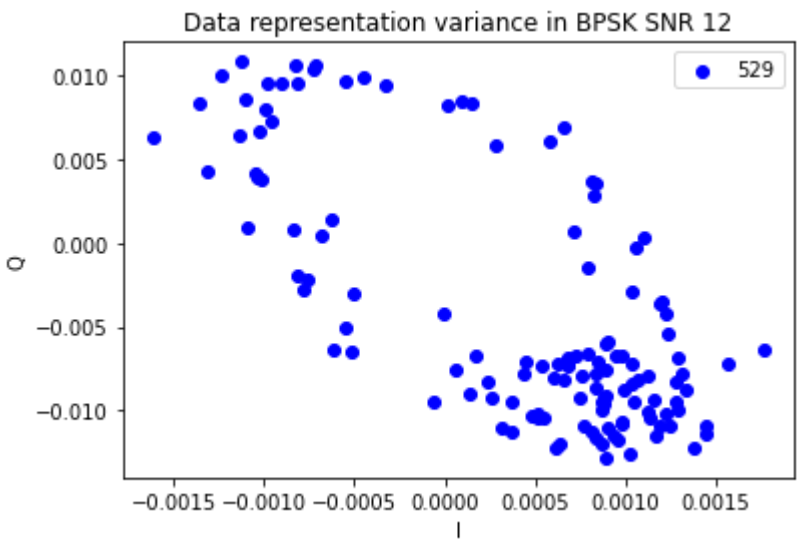
Data representation variance in BPSK SNR 12
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0.005
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−0.010
Q
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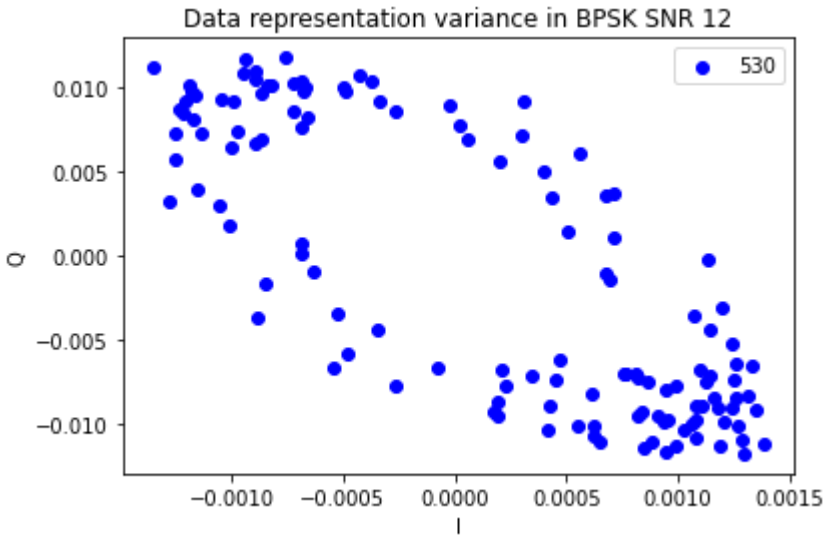
Data representation variance in BPSK SNR 12
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0.010
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0.000
−0.005
−0.010
Q
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−0.0005
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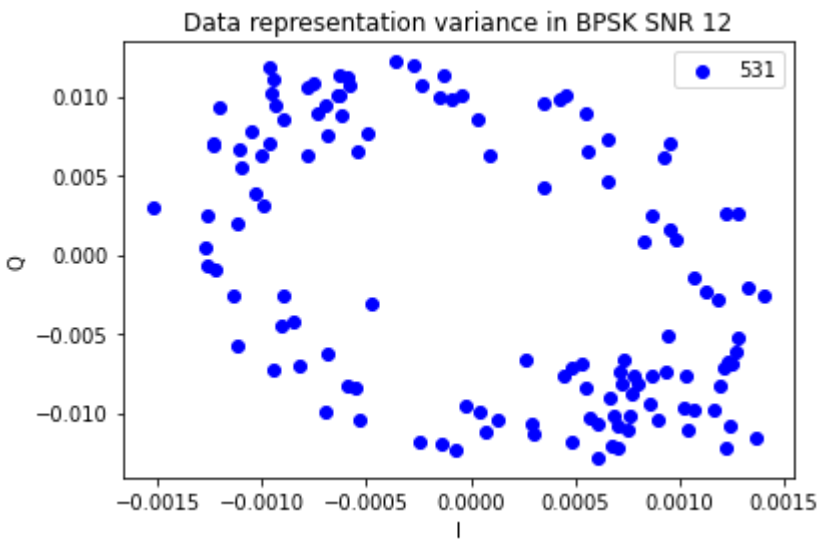
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0.0015
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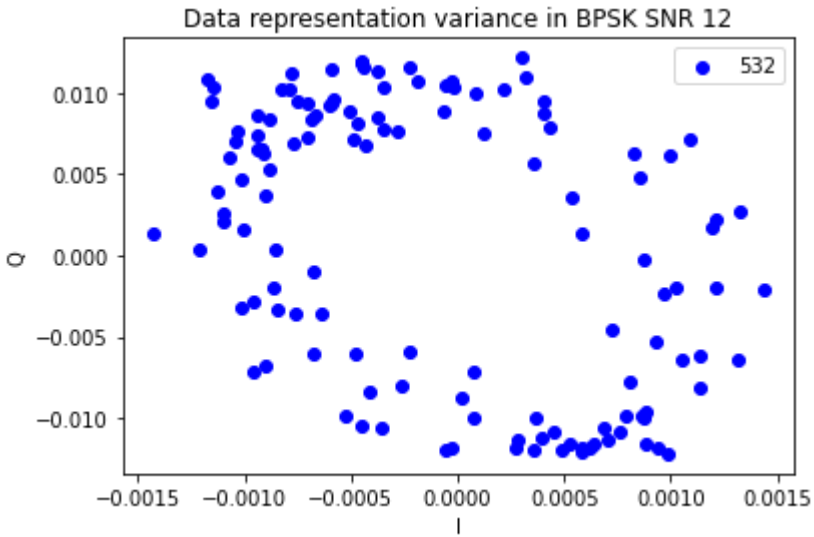
Data representation variance in BPSK SNR 12
532
0.010
0.005
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−0.005
−0.010
Q
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−0.0010
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0.0000
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0.0010
0.0015
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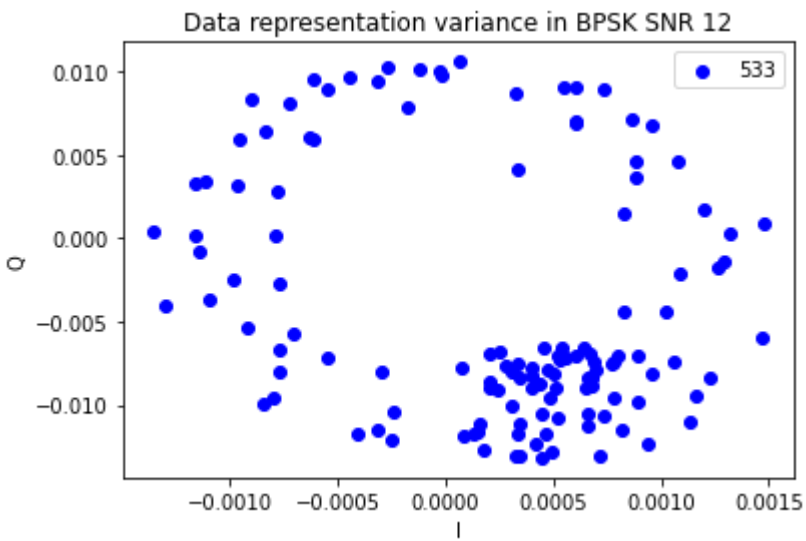
Data representation variance in BPSK SNR 12
533
0.010
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0.000
−0.005
−0.010
Q
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−0.0005
0.0000
0.0005
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0.0015
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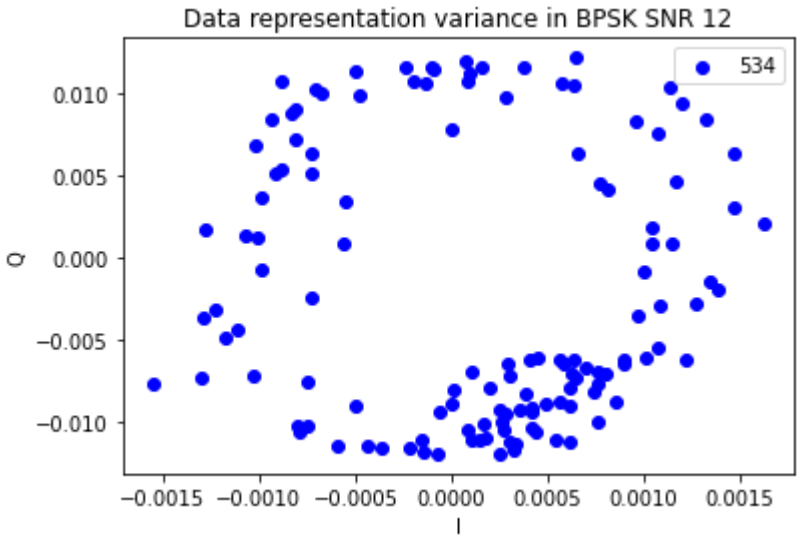
Data representation variance in BPSK SNR 12
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0.005
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Q
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−0.0010
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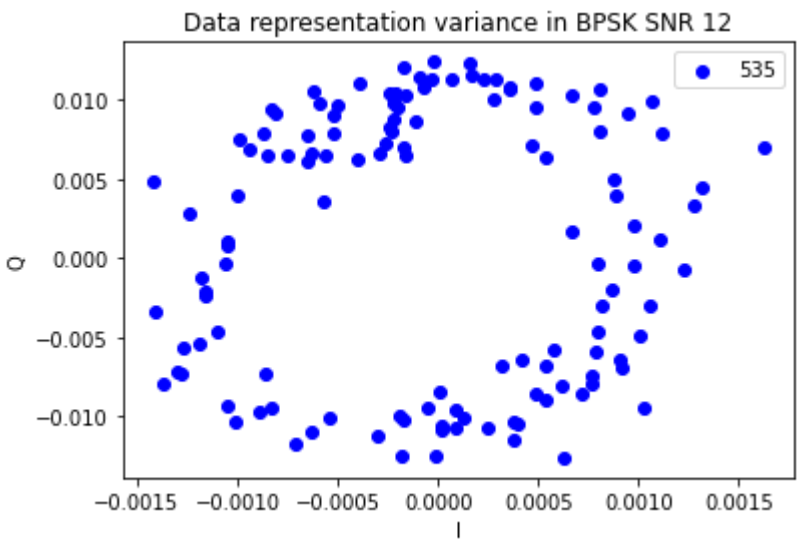
Data representation variance in BPSK SNR 12
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Q
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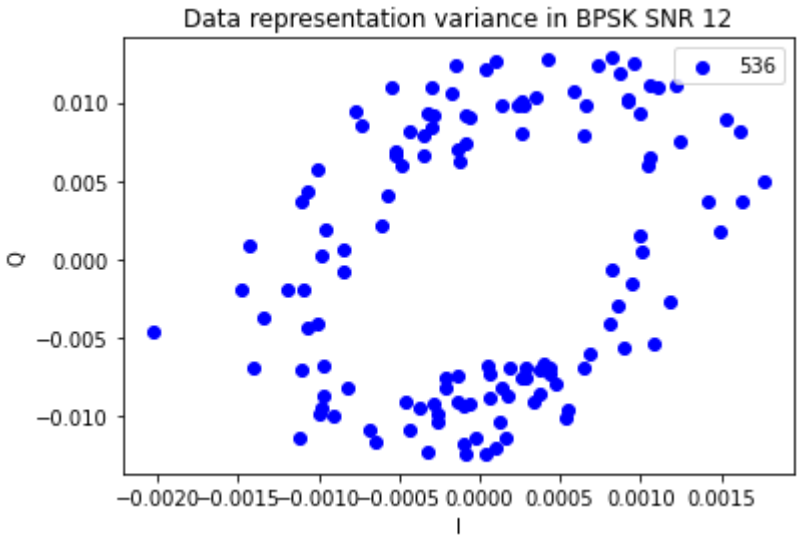
Data representation variance in BPSK SNR 12
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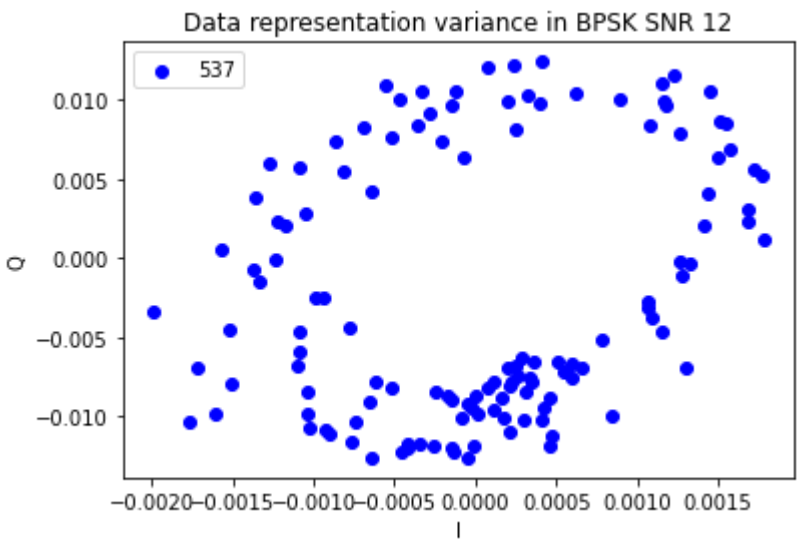
Data representation variance in BPSK SNR 12
537
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−0.005
−0.010
Q
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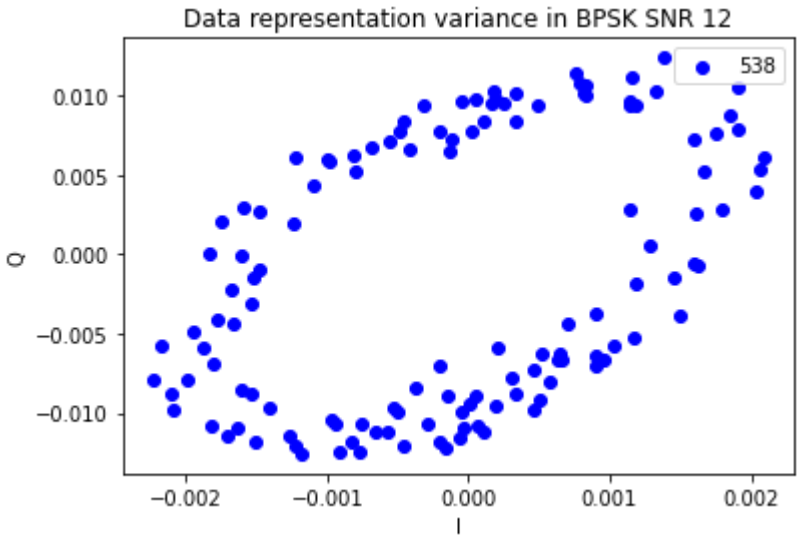
Data representation variance in BPSK SNR 12
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−0.005
−0.010
Q
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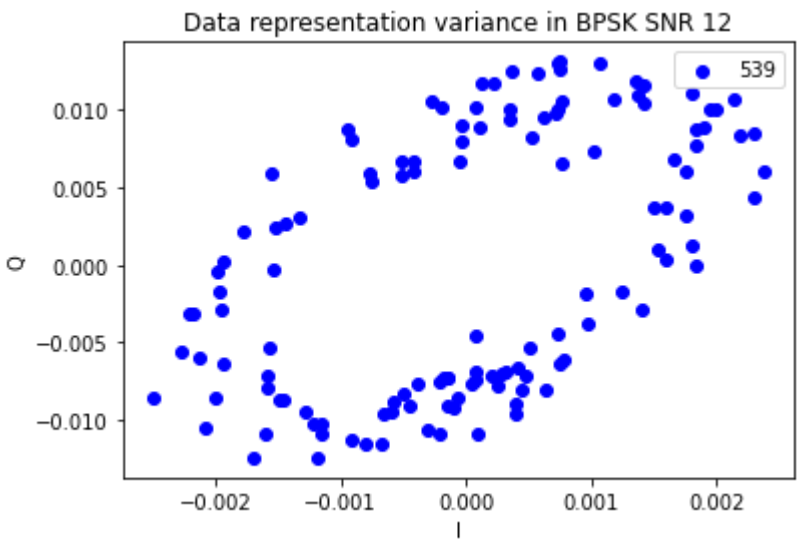
Data representation variance in BPSK SNR 12
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Q
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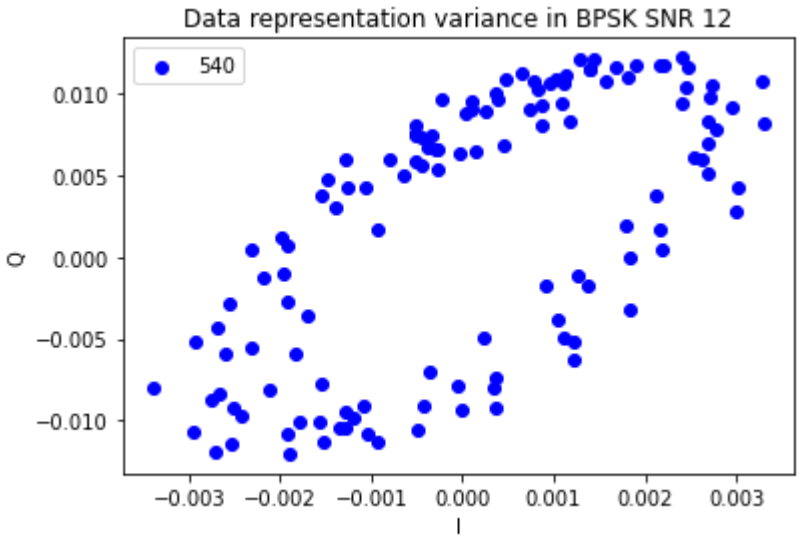
Data representation variance in BPSK SNR 12
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0.010
0.005
0.000
−0.005
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Q
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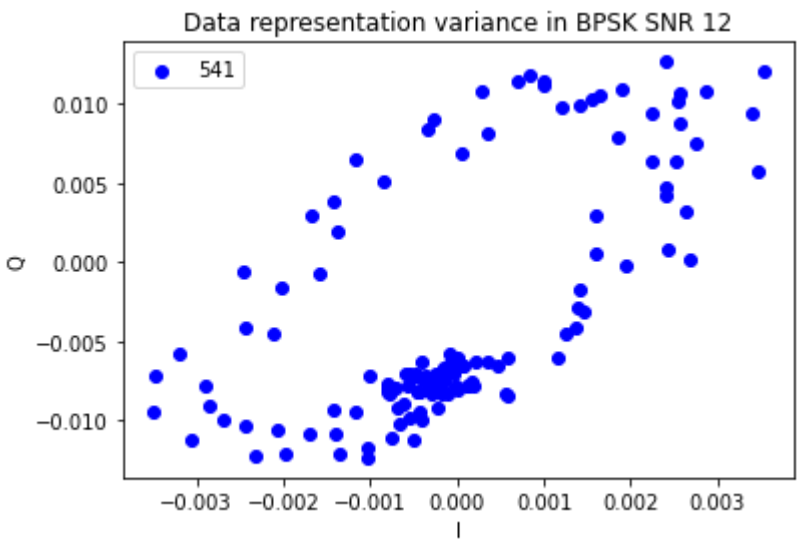
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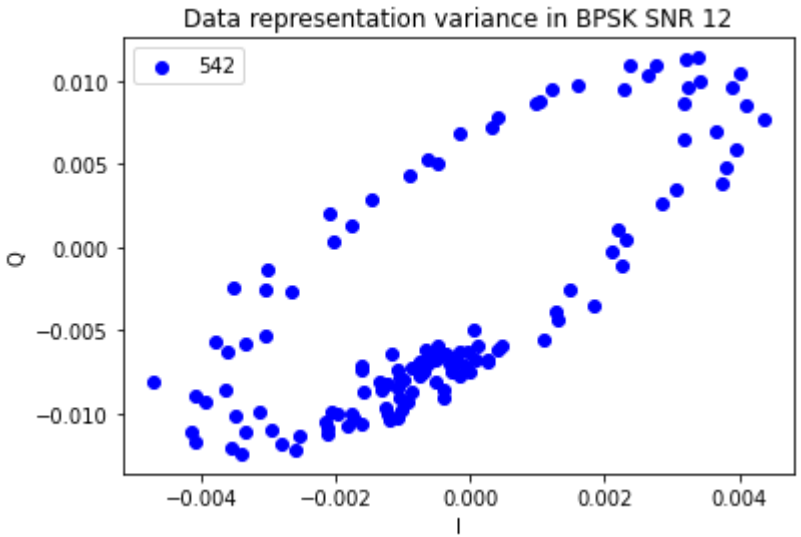
Data representation variance in BPSK SNR 12
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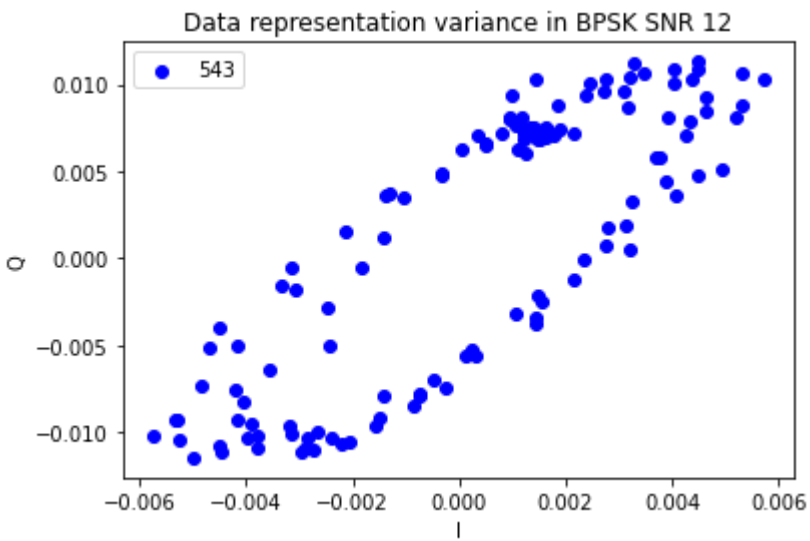
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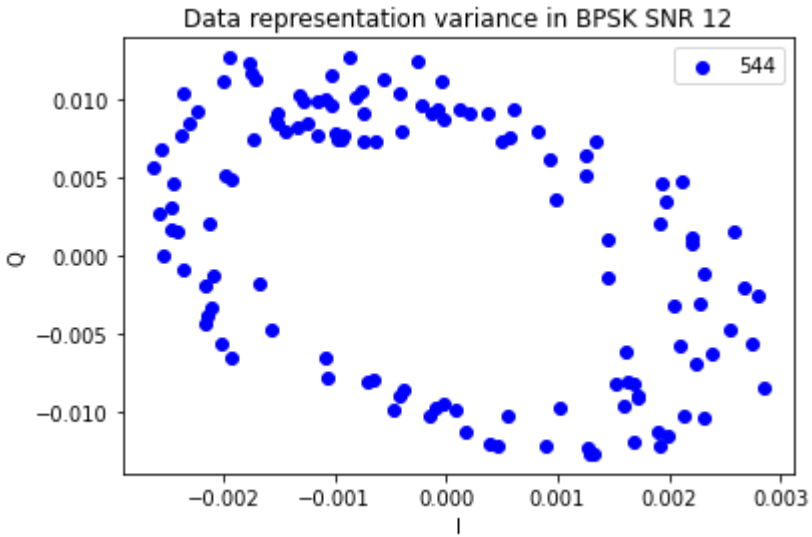
Data representation variance in BPSK SNR 12
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−0.010
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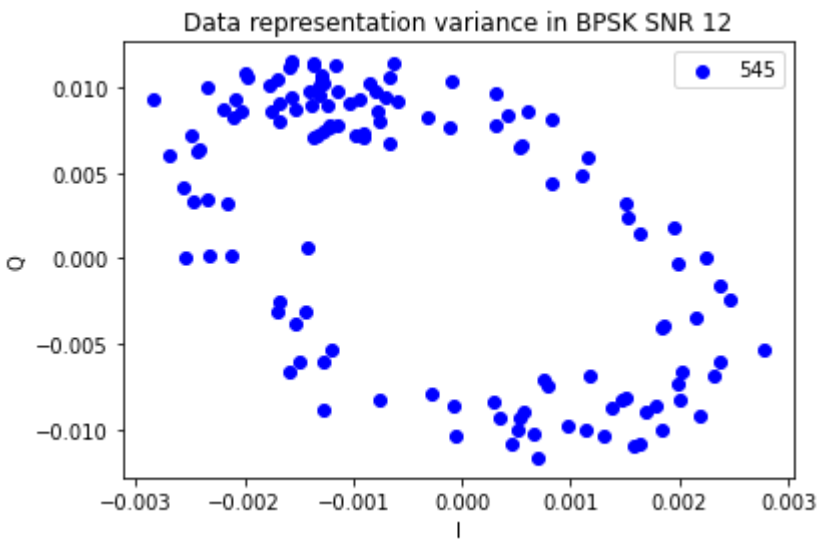
Data representation variance in BPSK SNR 12
545
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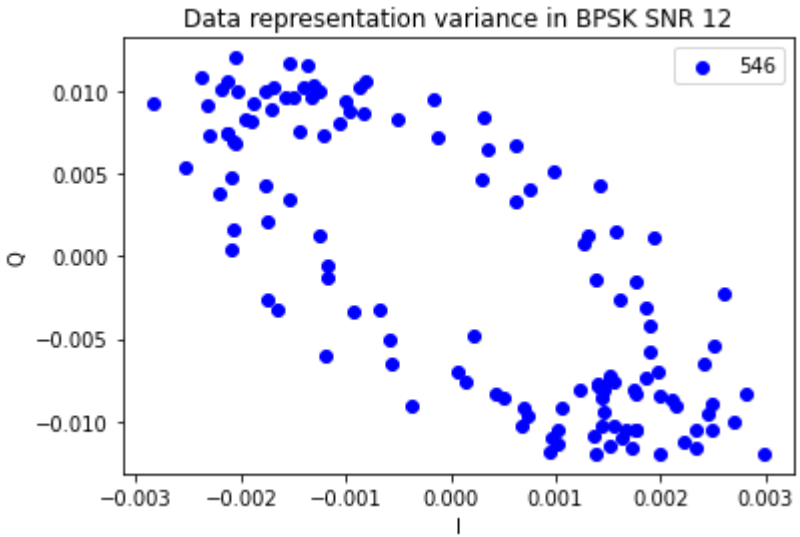
Data representation variance in BPSK SNR 12
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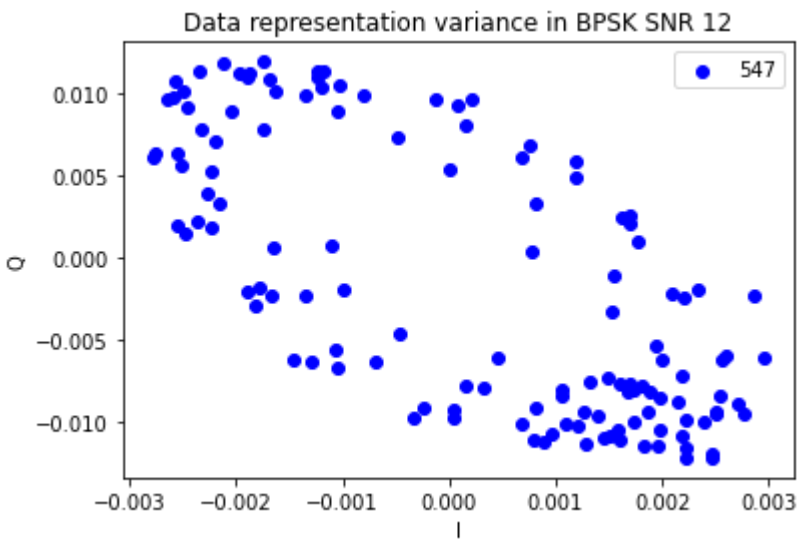
Data representation variance in BPSK SNR 12
547
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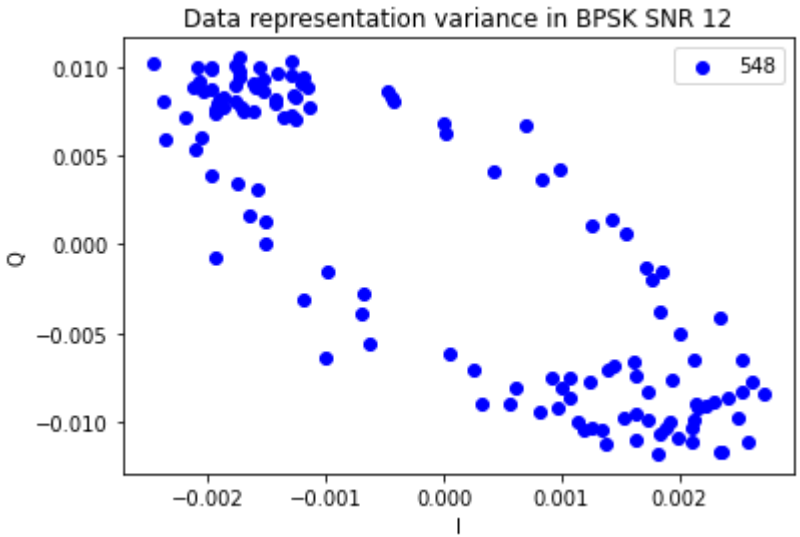
Data representation variance in BPSK SNR 12
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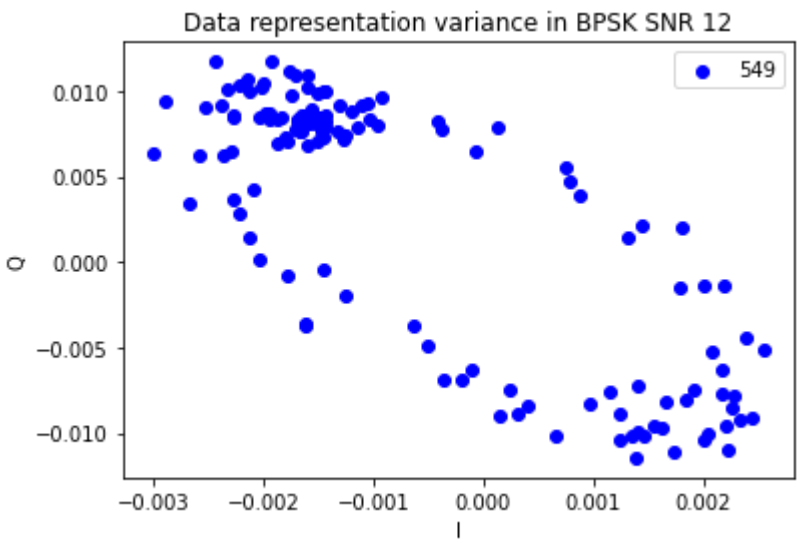
Data representation variance in BPSK SNR 12
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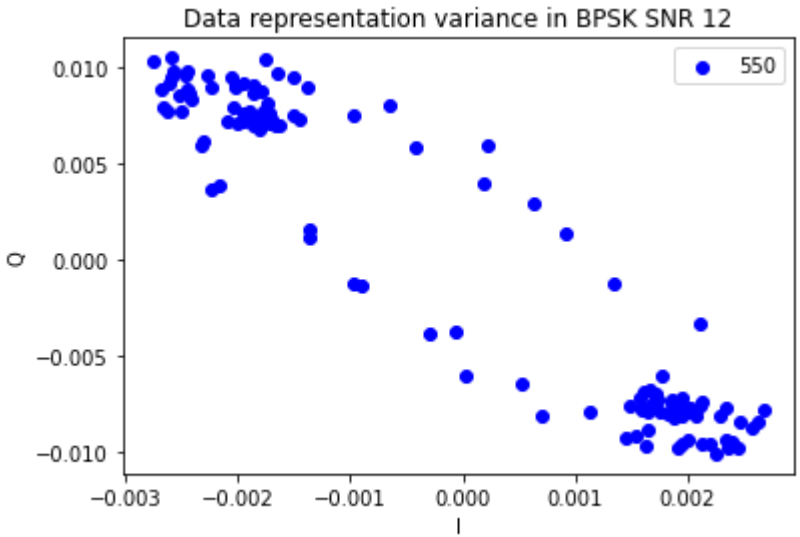
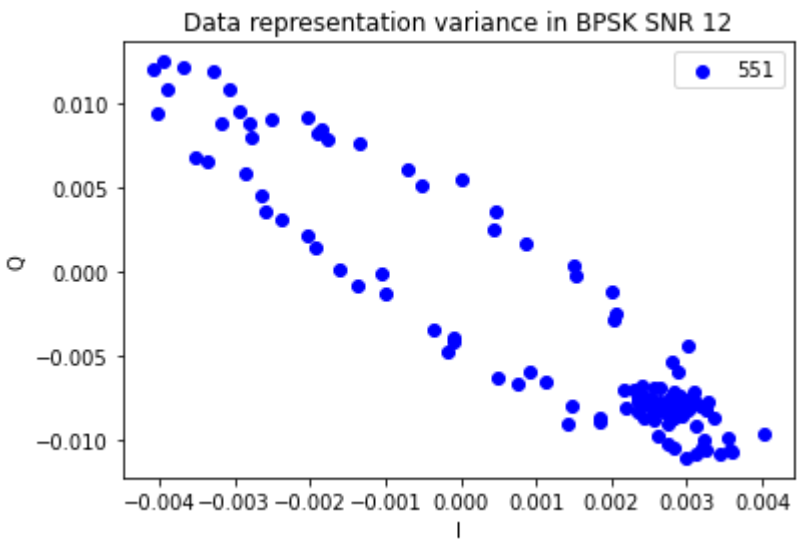
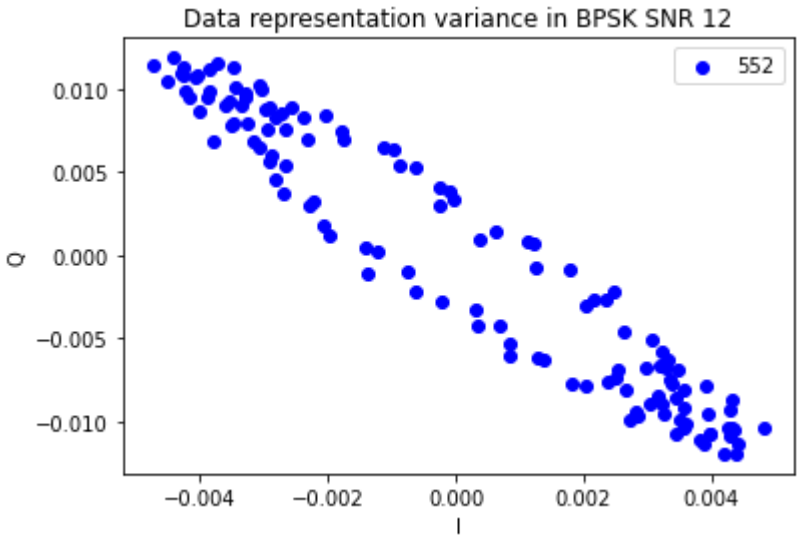
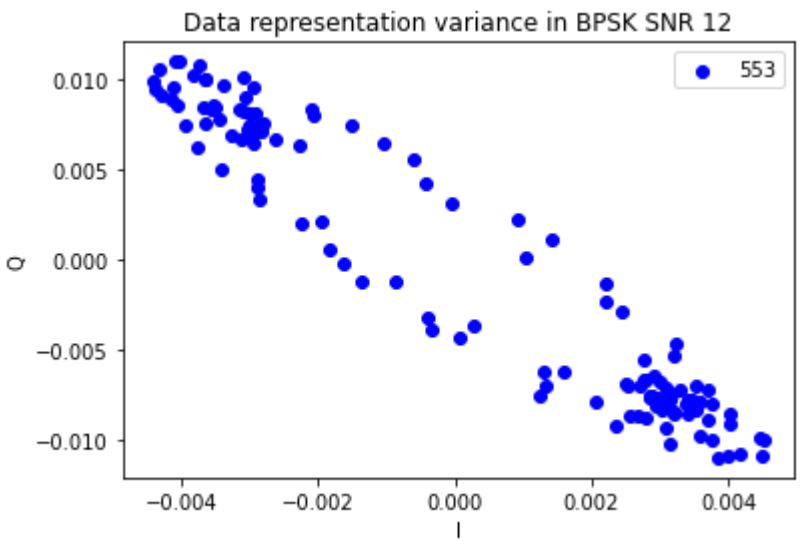
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
550
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
551
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I


Data representation variance in BPSK SNR 12
552
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
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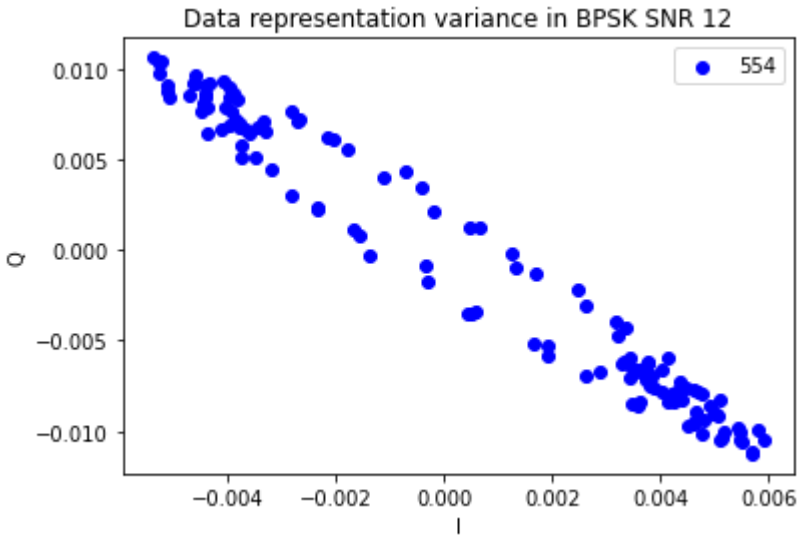
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
554
0.010
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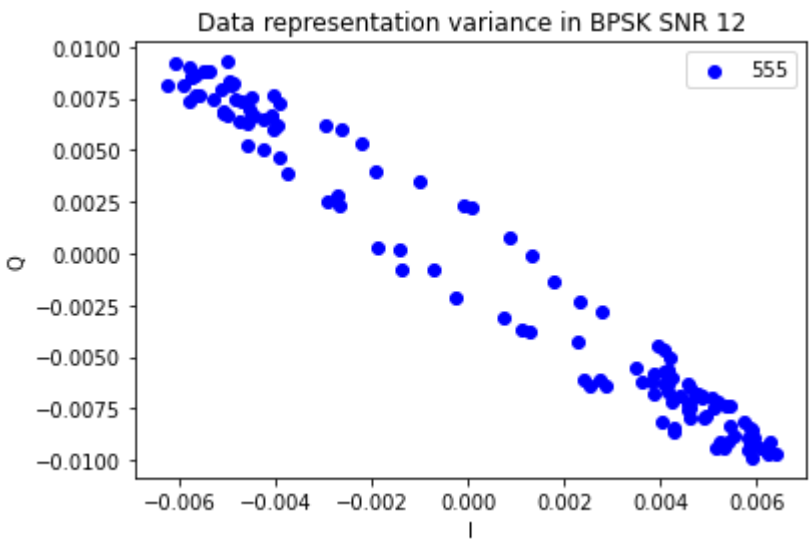
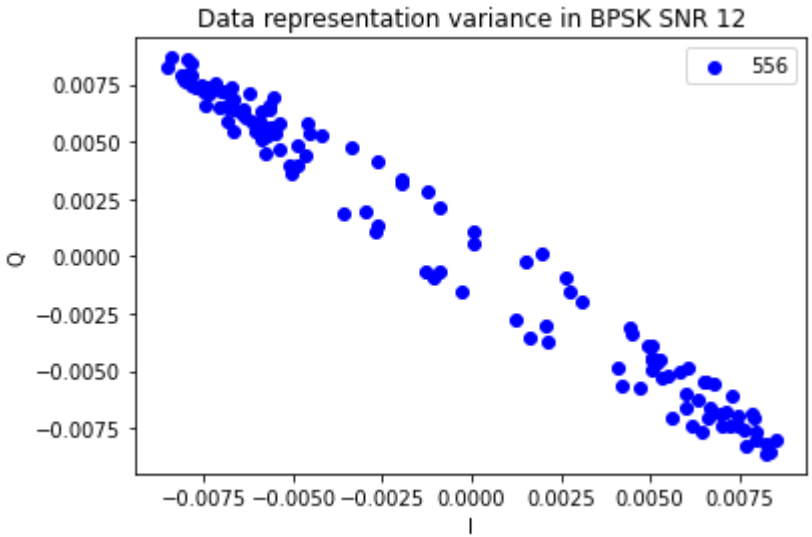
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
555
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
556
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
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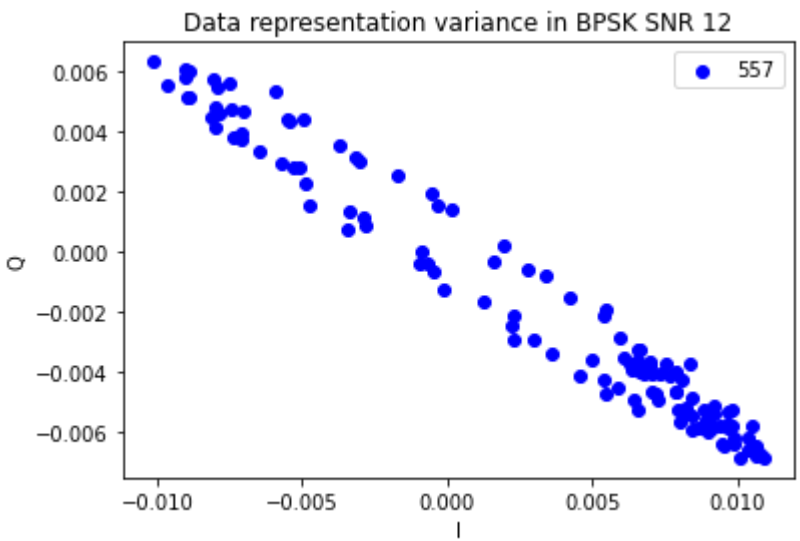
Data representation variance in BPSK SNR 12
557
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010 −0.005 0.000 0.005 0.010
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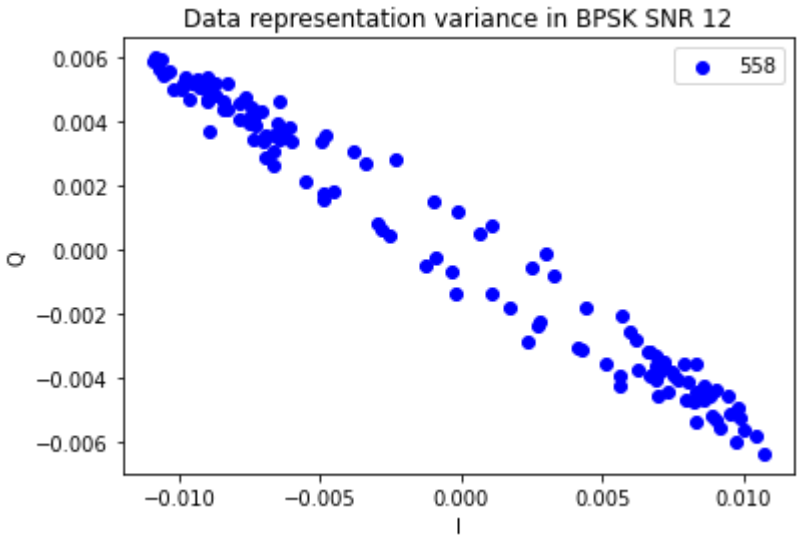
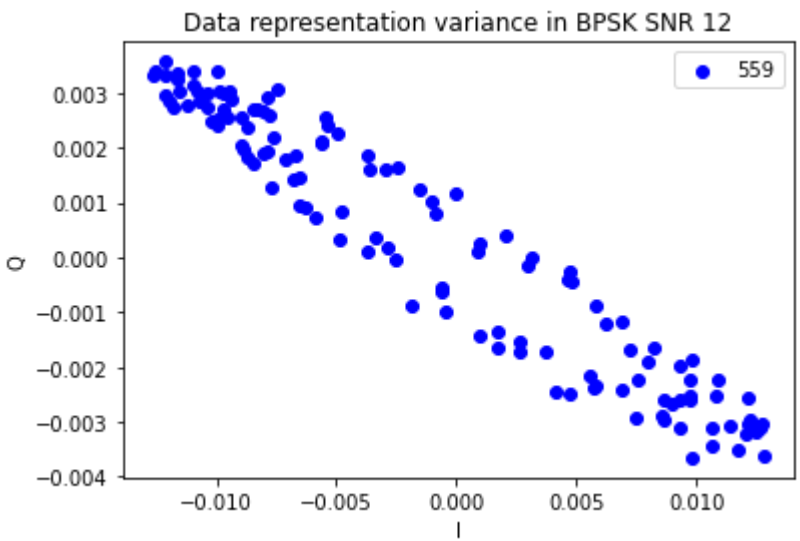
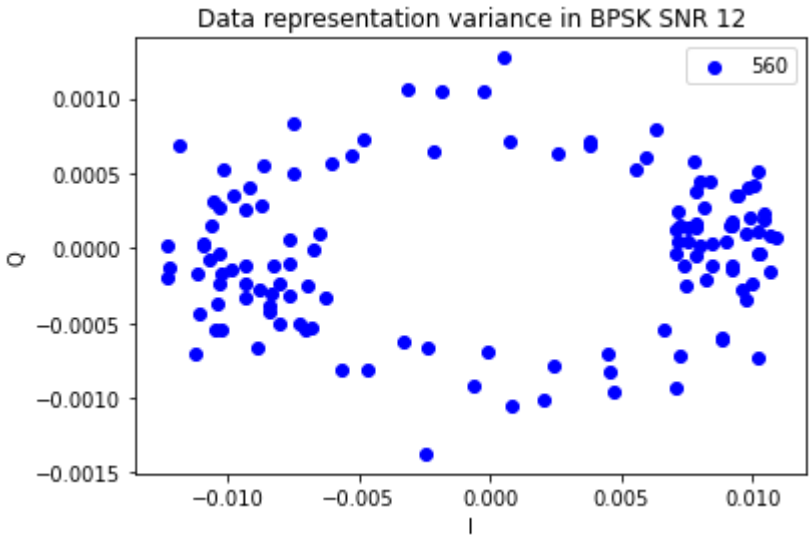
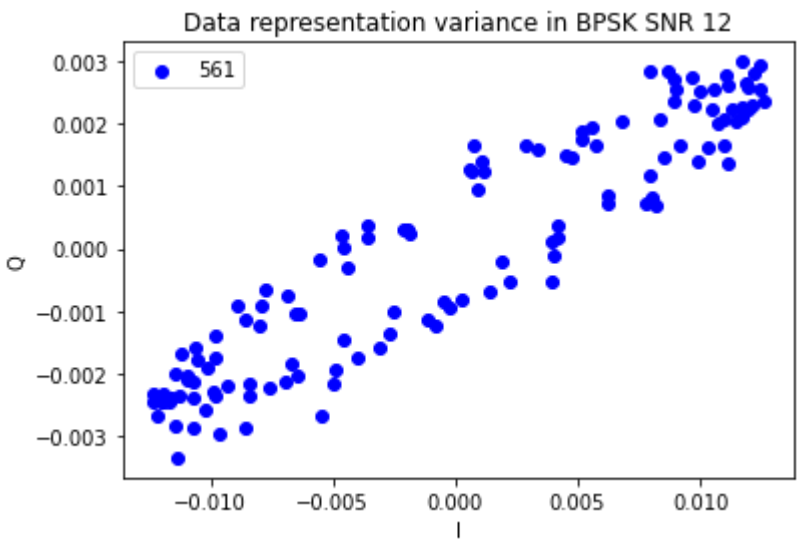
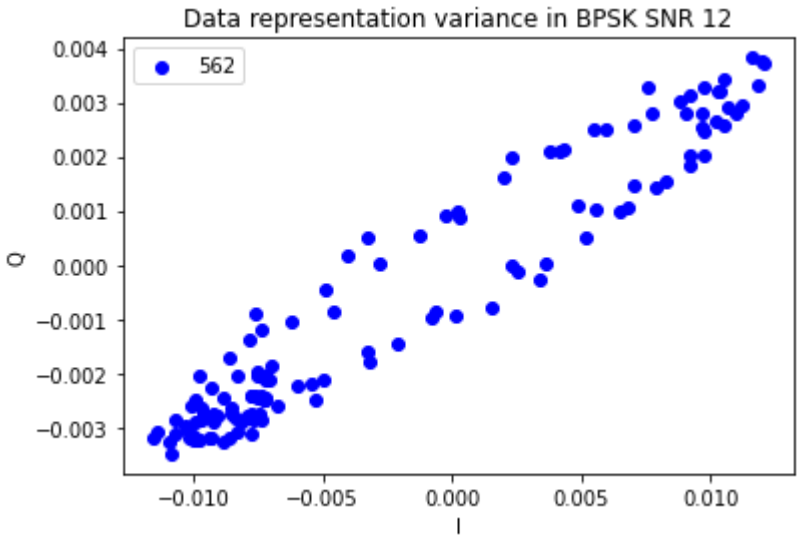
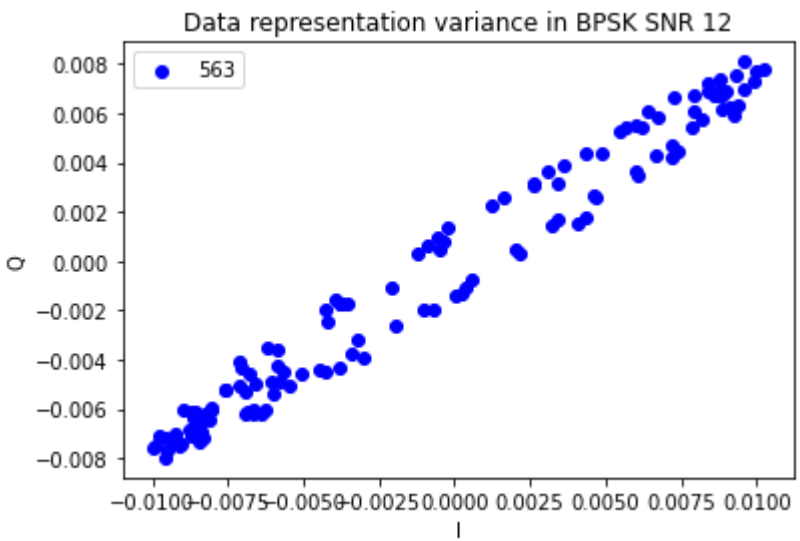

Data representation variance in BPSK SNR 12
558
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
559
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
560
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
561
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
562
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
563
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
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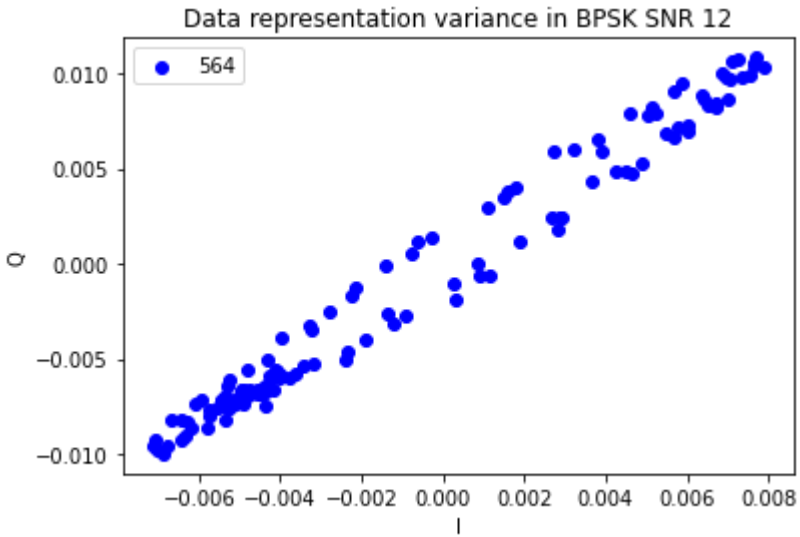
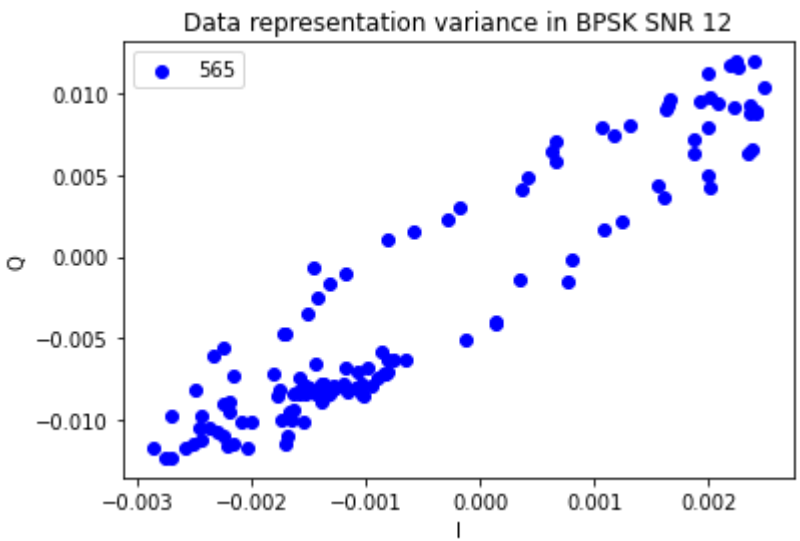
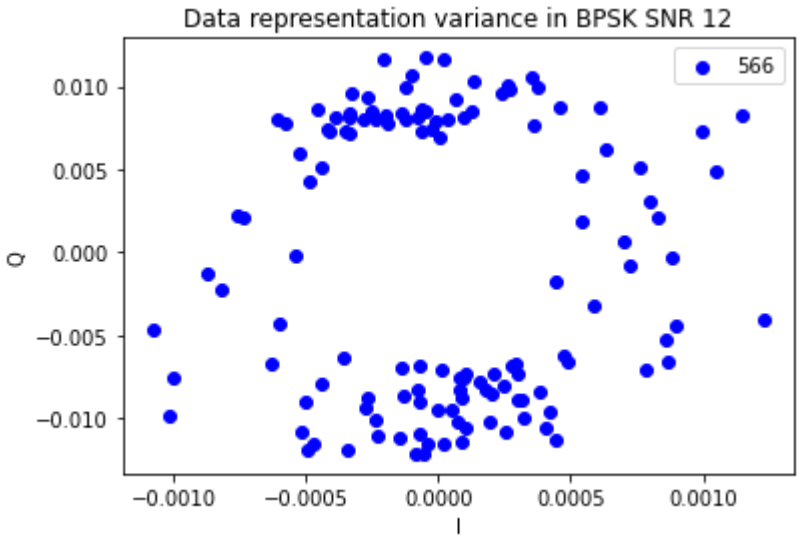
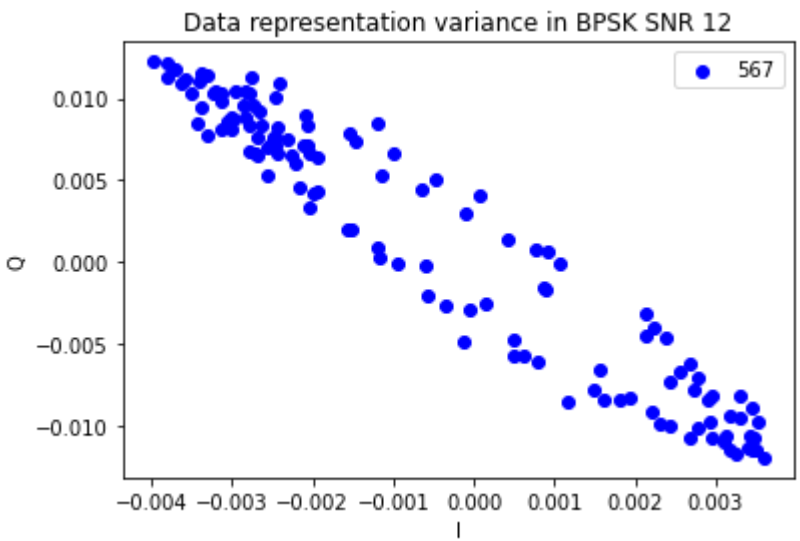
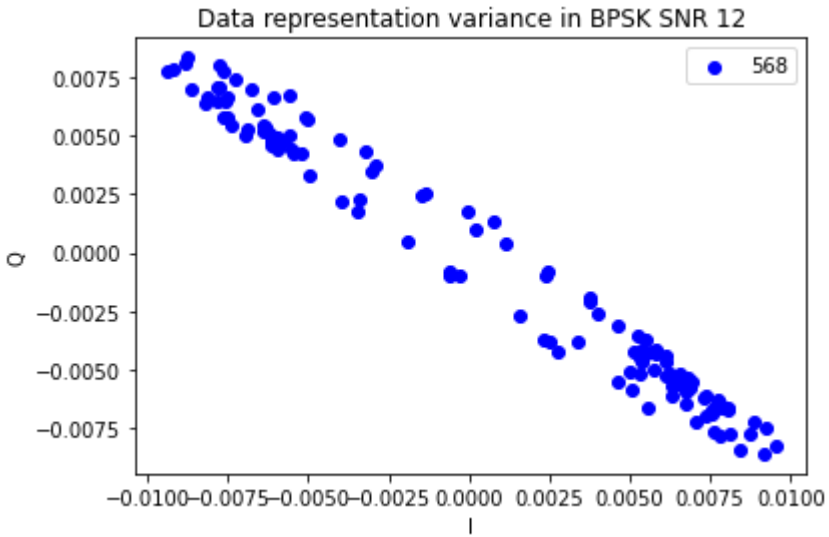
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I


Data representation variance in BPSK SNR 12
564
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I


Data representation variance in BPSK SNR 12
565
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002
I


Data representation variance in BPSK SNR 12
566
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0010
−0.0005
0.0000
0.0005
0.0010
I


Data representation variance in BPSK SNR 12
567
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
568
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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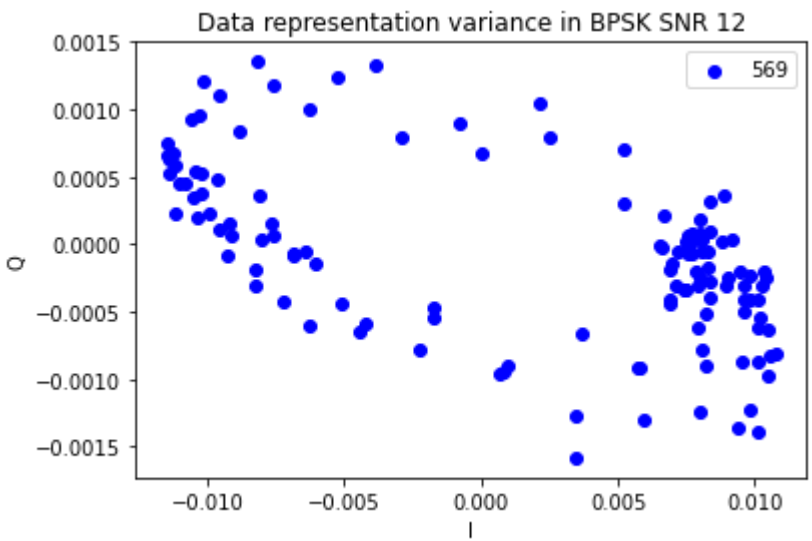
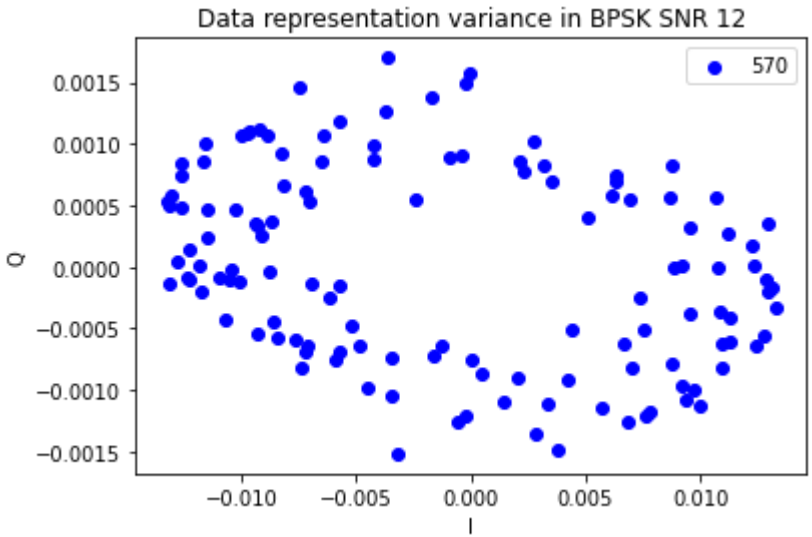
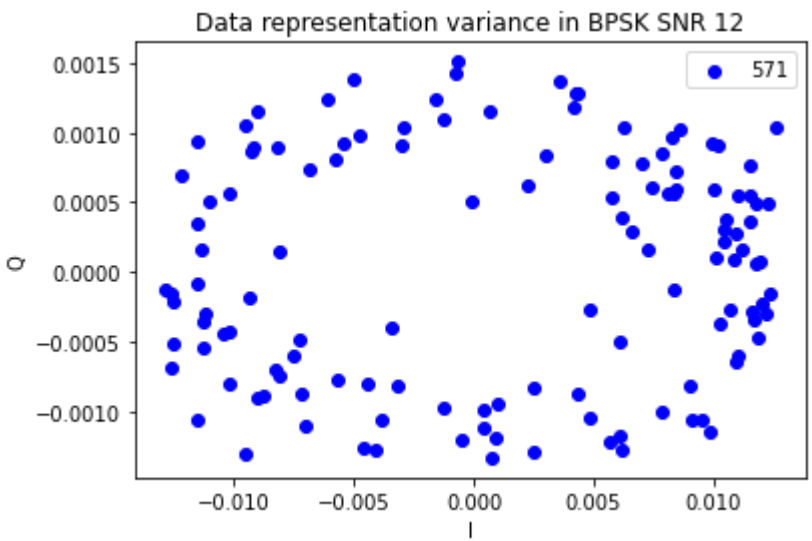
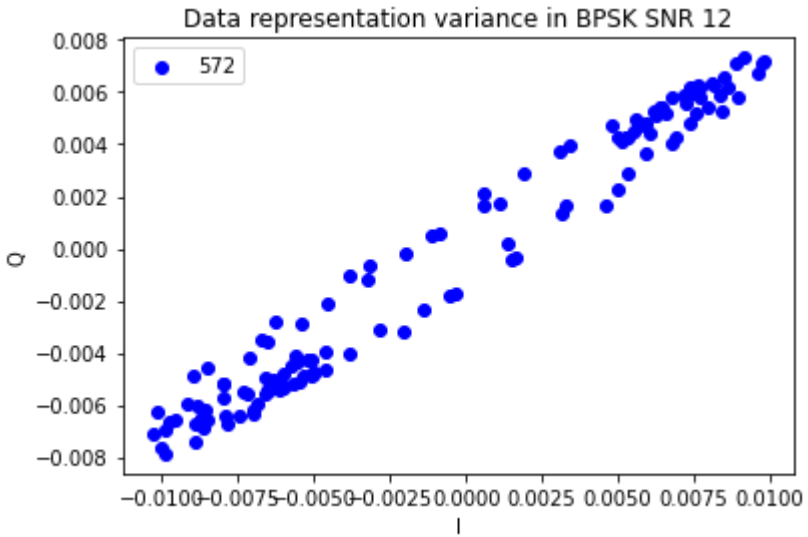

Data representation variance in BPSK SNR 12
569
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010 −0.005 0.000 0.005 0.010
I


Data representation variance in BPSK SNR 12
570
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
571
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
572
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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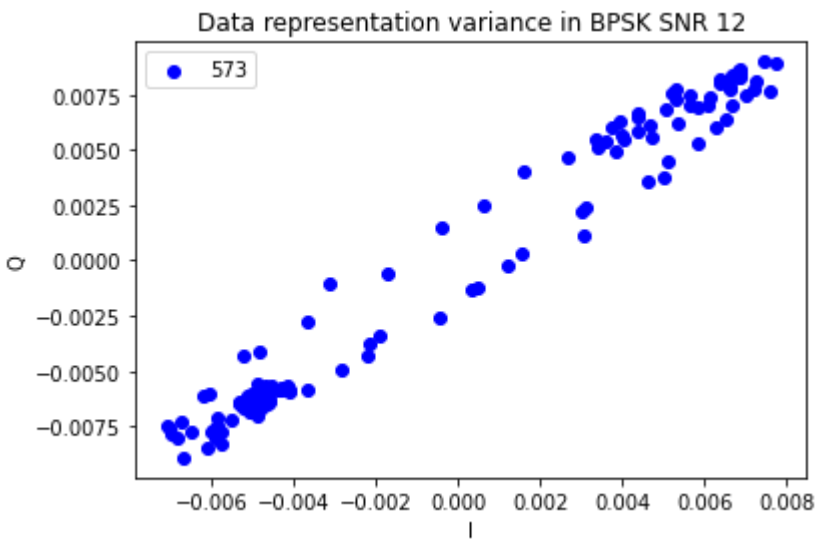
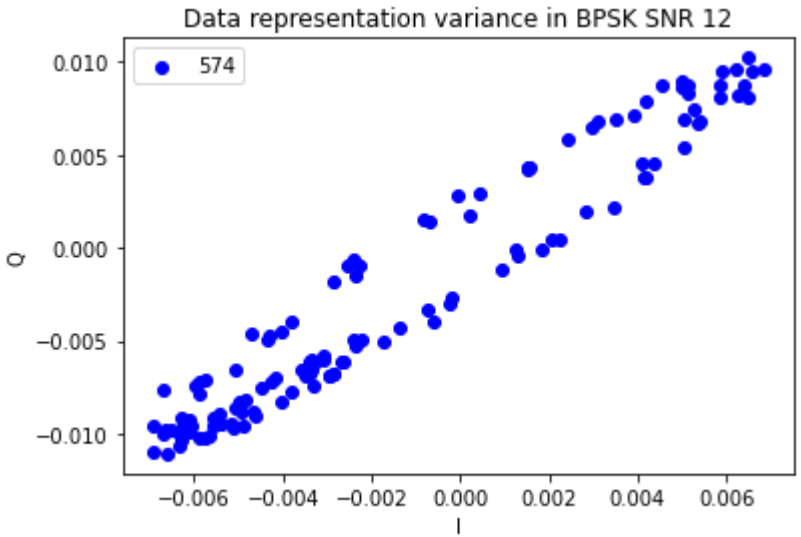
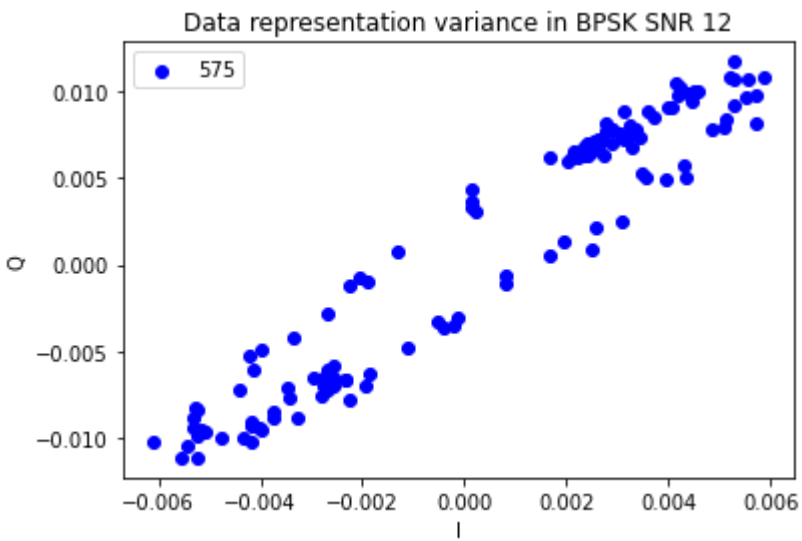
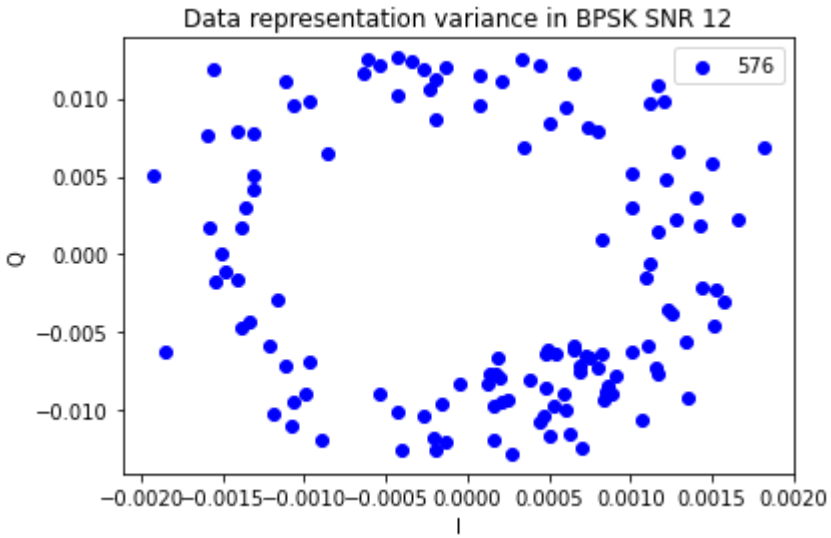
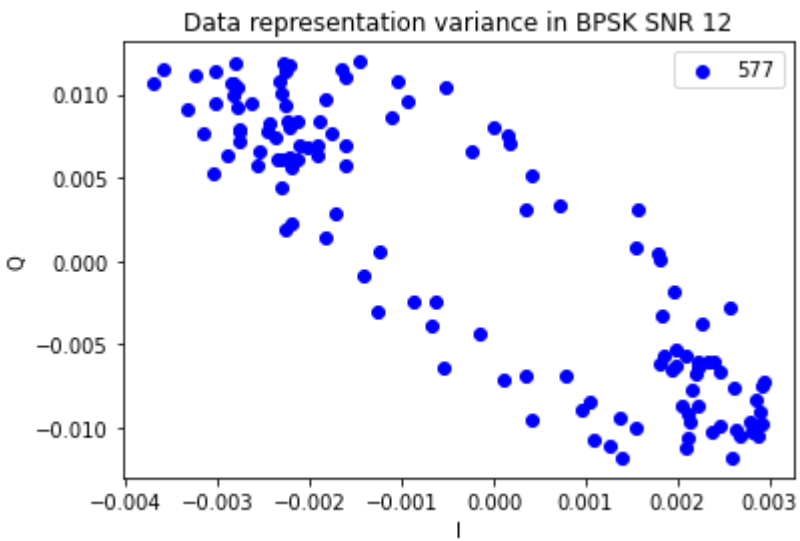
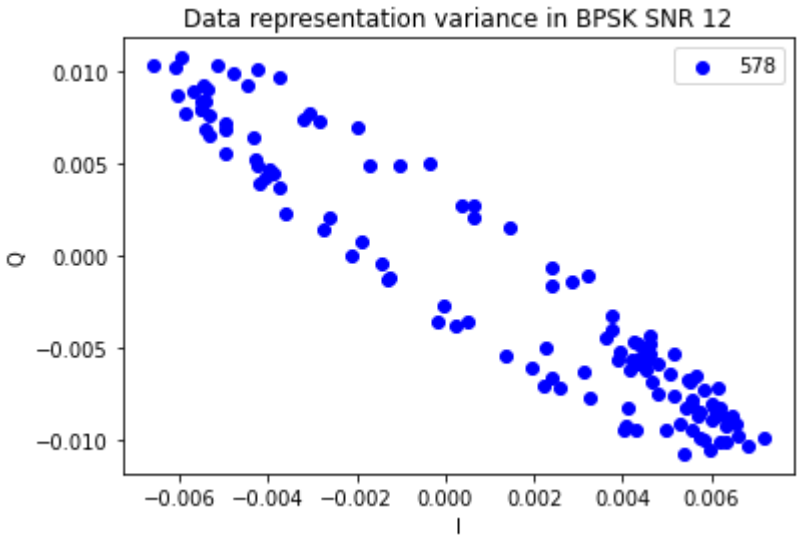

Data representation variance in BPSK SNR 12
573
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

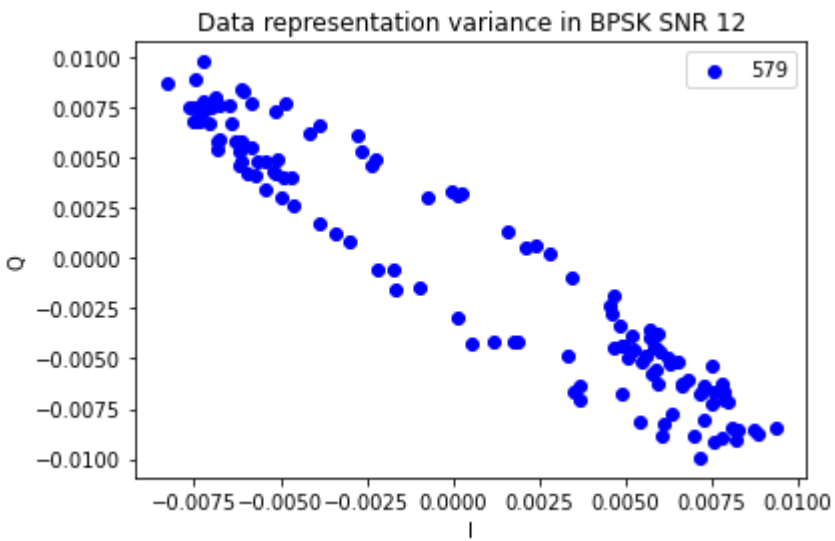

Data representation variance in BPSK SNR 12
574
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

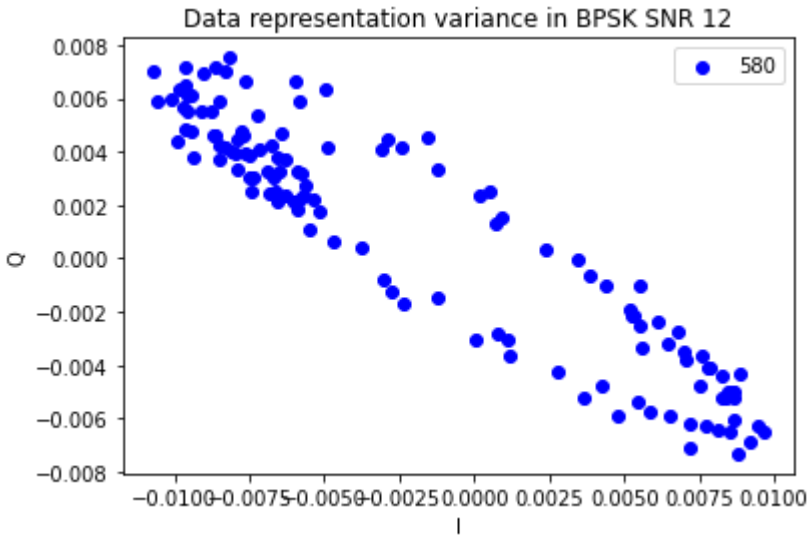

Data representation variance in BPSK SNR 12
575
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

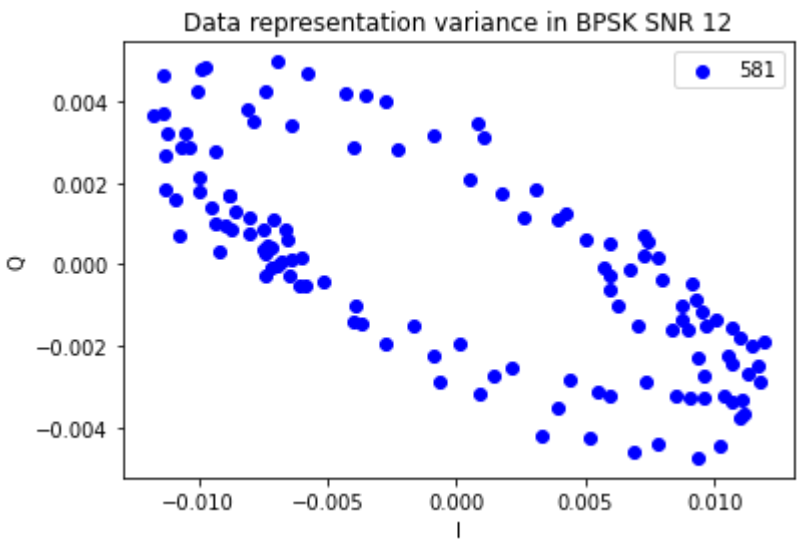

Data representation variance in BPSK SNR 12
576
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
I

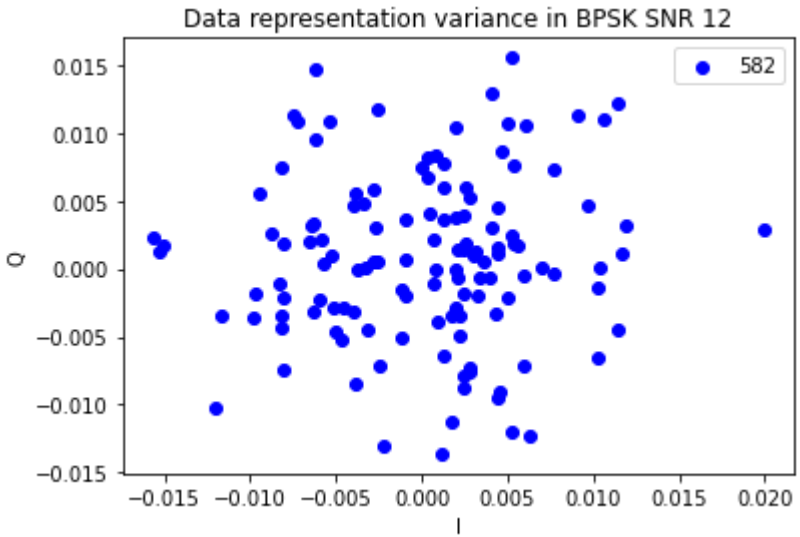

Data representation variance in BPSK SNR 12
577
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003
I

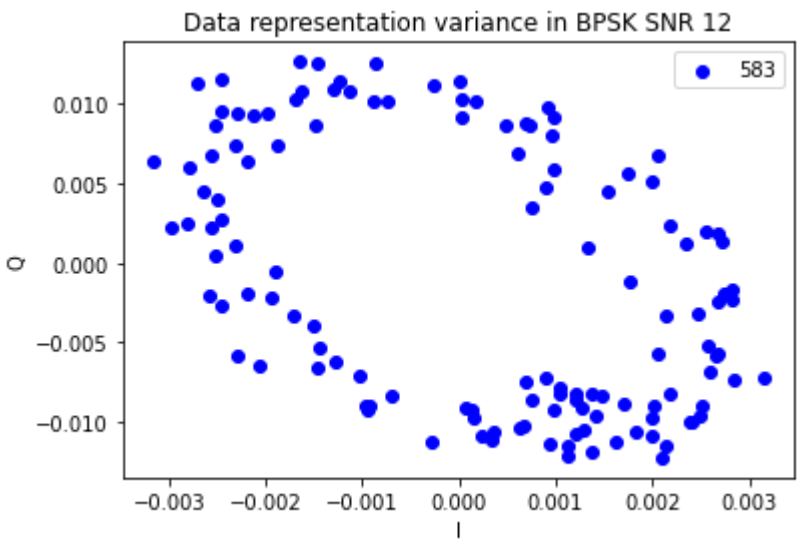

Data representation variance in BPSK SNR 12
578
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

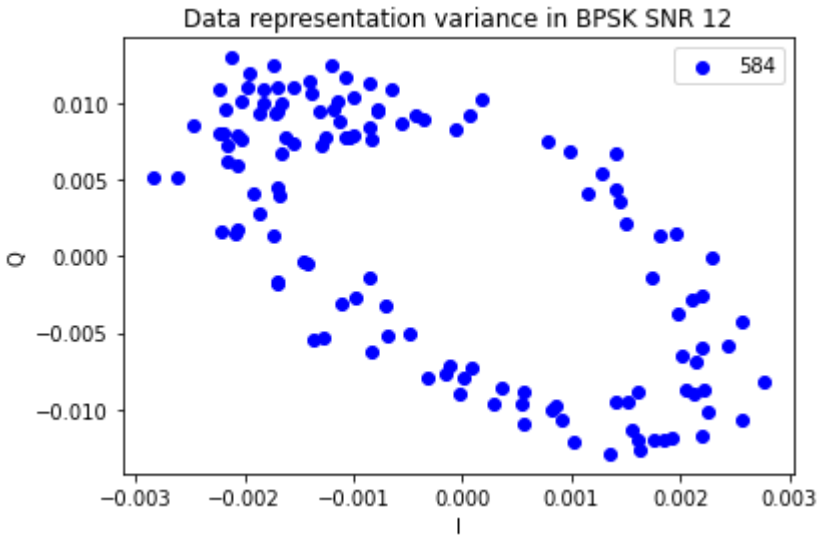

Data representation variance in BPSK SNR 12
579
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I

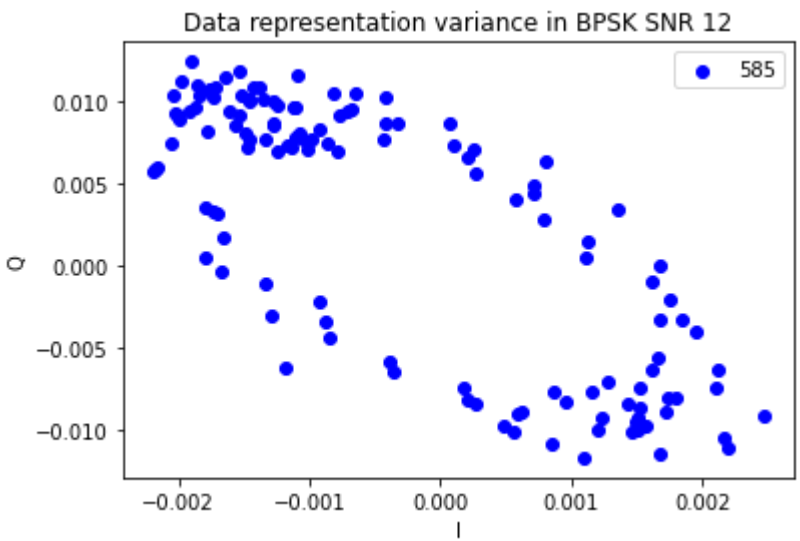

Data representation variance in BPSK SNR 12
580
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

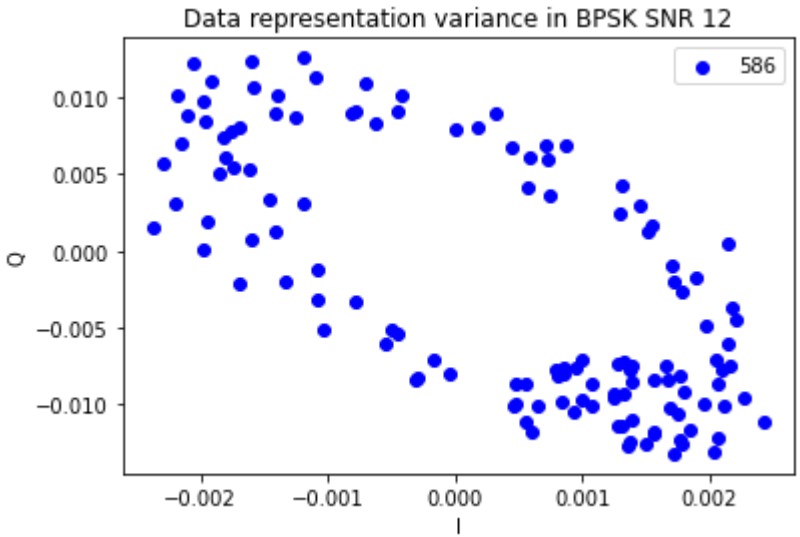

Data representation variance in BPSK SNR 12
581
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010 −0.005 0.000 0.005 0.010
I


Data representation variance in BPSK SNR 12
582
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.015 −0.010 −0.005 0.000 0.005 0.010 0.015 0.020
I


Data representation variance in BPSK SNR 12
583
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002 0.003
I


Data representation variance in BPSK SNR 12
584
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
585
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
586
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
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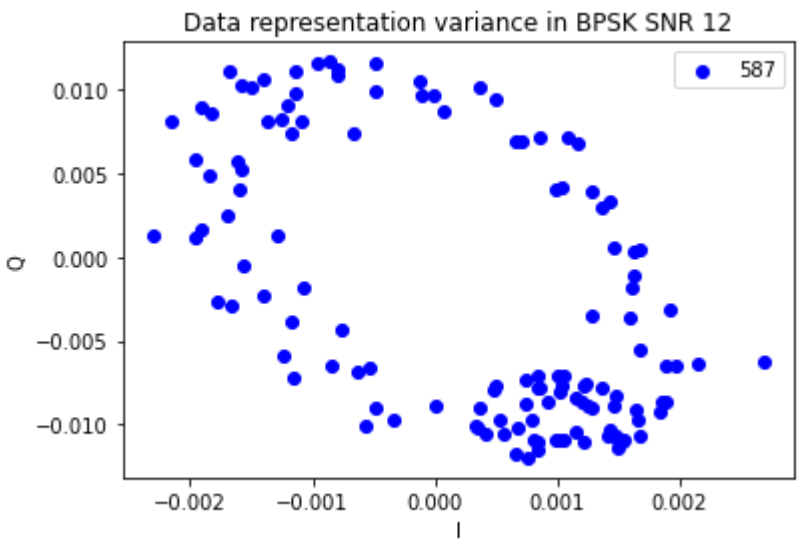
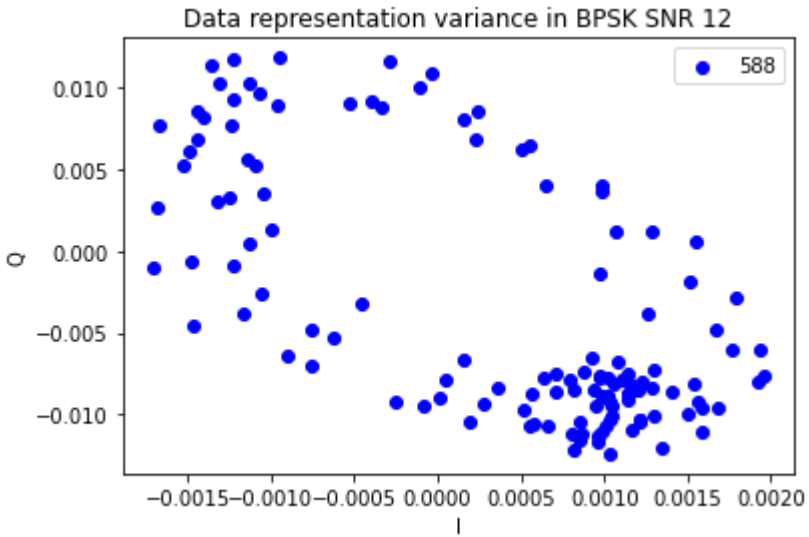

Data representation variance in BPSK SNR 12
587
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
588
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
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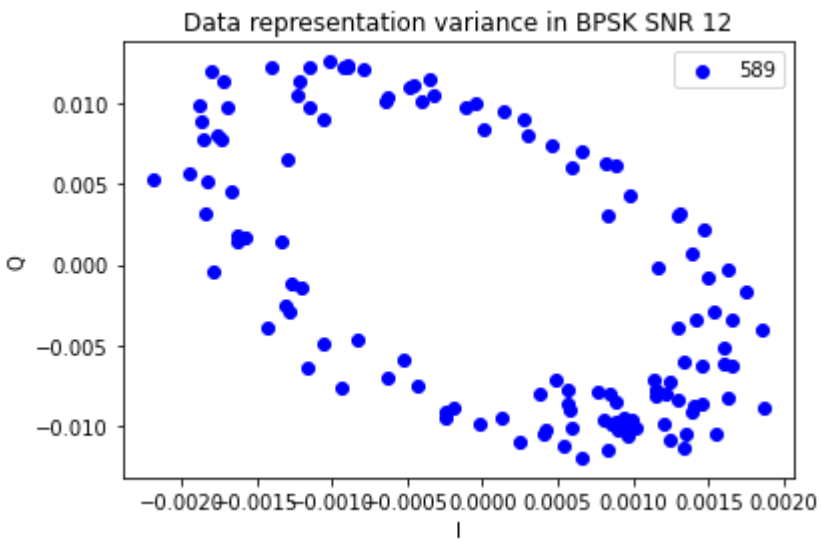
Data representation variance in BPSK SNR 12
589
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
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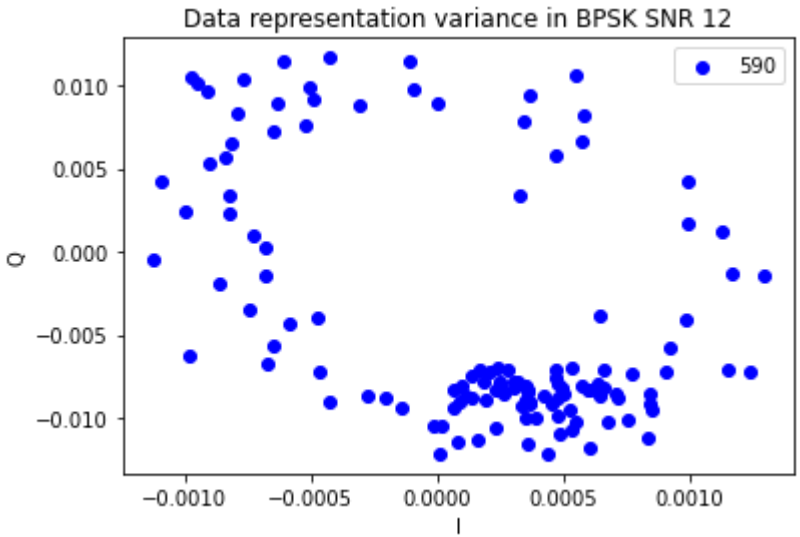
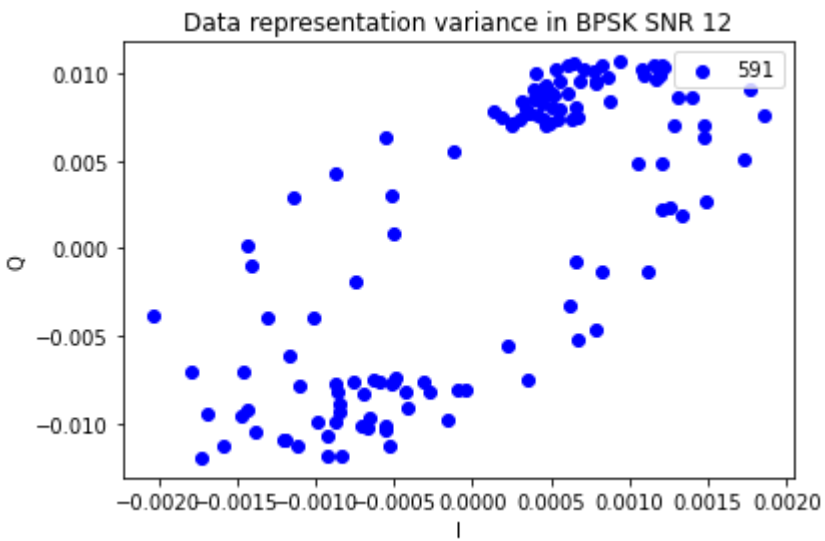

Data representation variance in BPSK SNR 12
590
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0010
−0.0005
0.0000
0.0005
0.0010
I


Data representation variance in BPSK SNR 12
591
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.0015
−0.0010
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0.0015
0.0020
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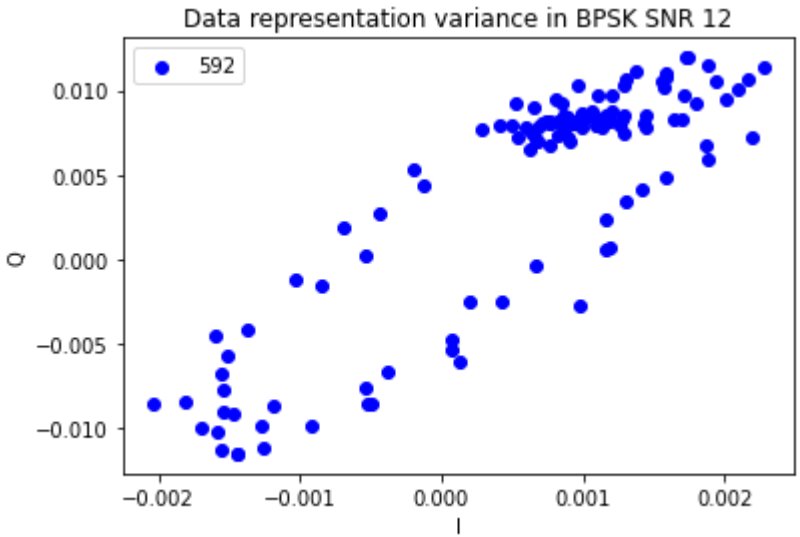
Data representation variance in BPSK SNR 12
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0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
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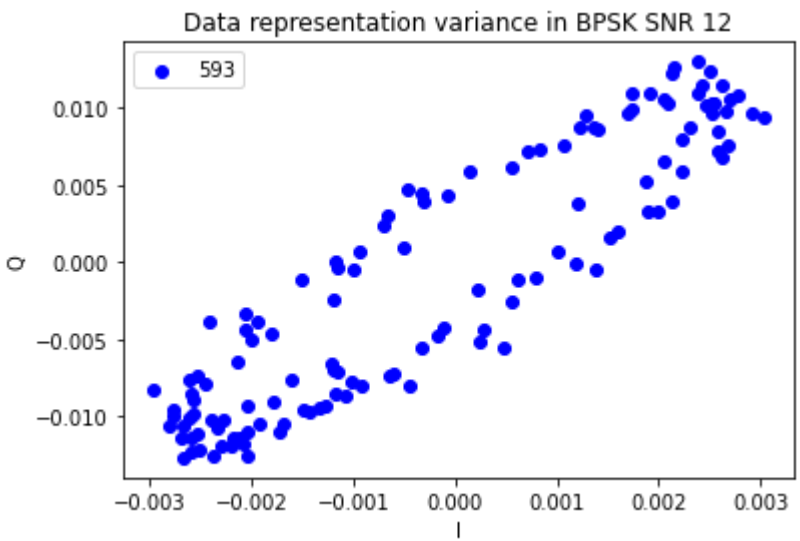
Data representation variance in BPSK SNR 12
593
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
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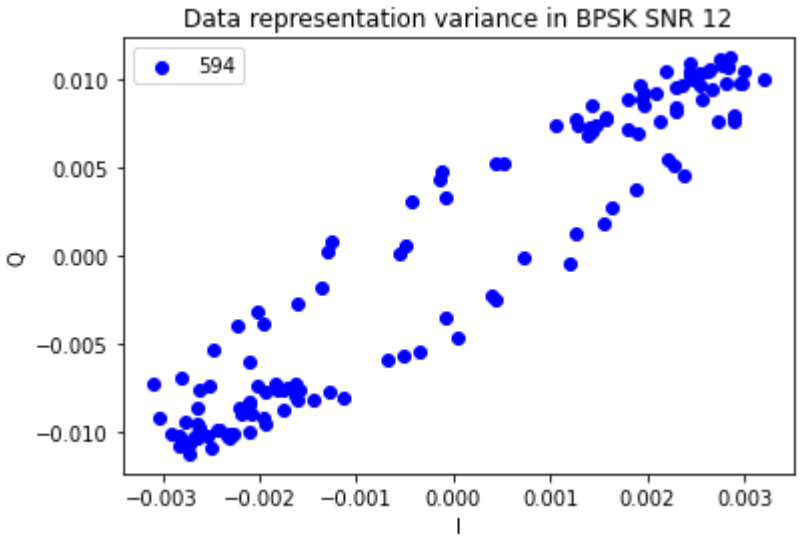
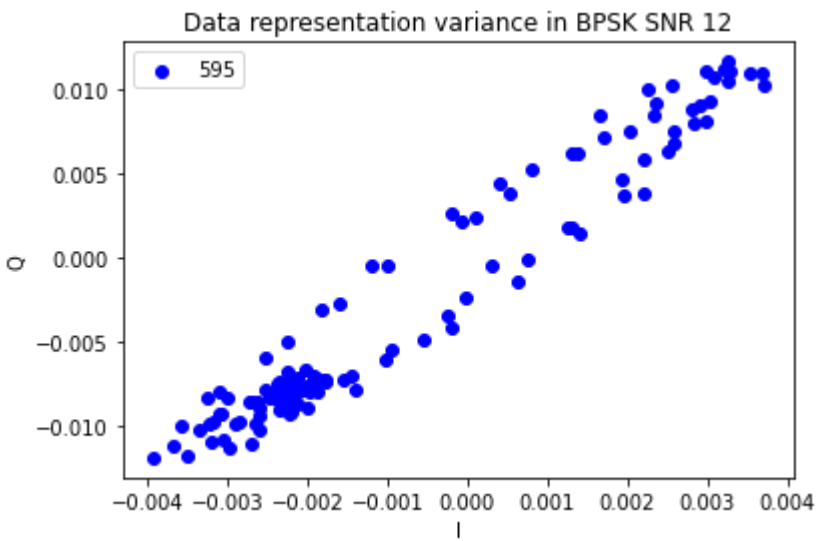

Data representation variance in BPSK SNR 12
594
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
595
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
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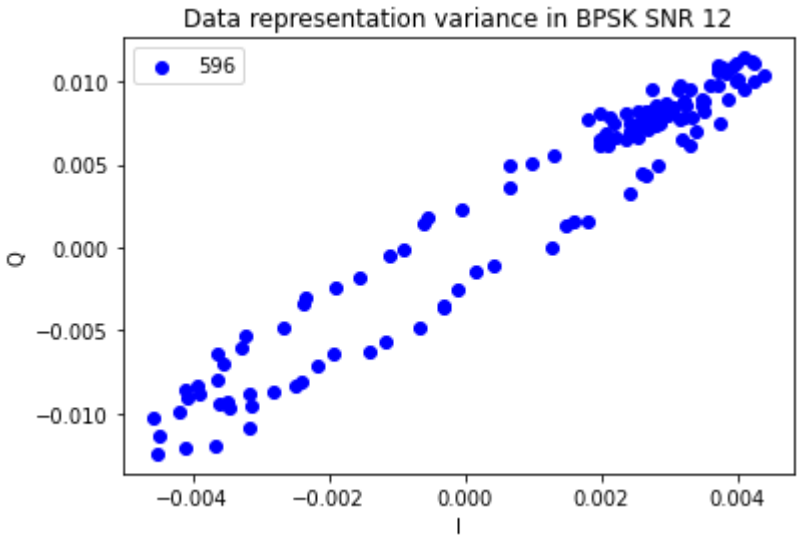
Data representation variance in BPSK SNR 12
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0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
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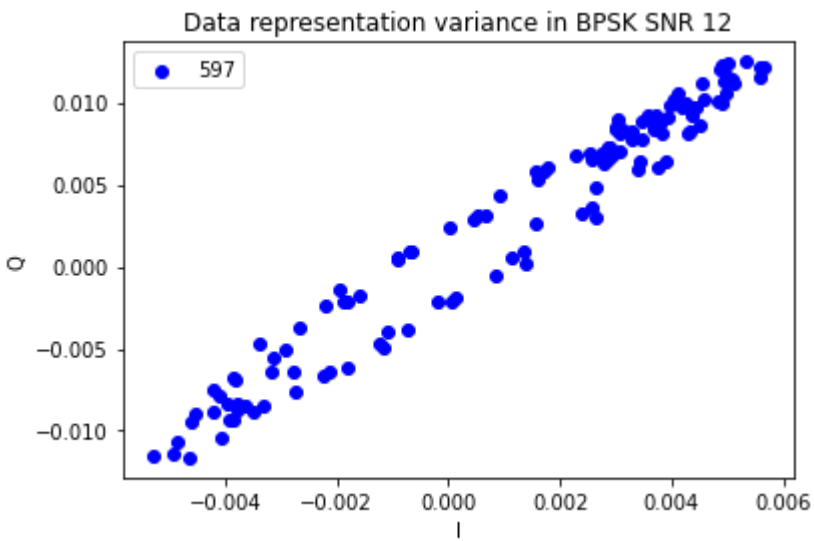
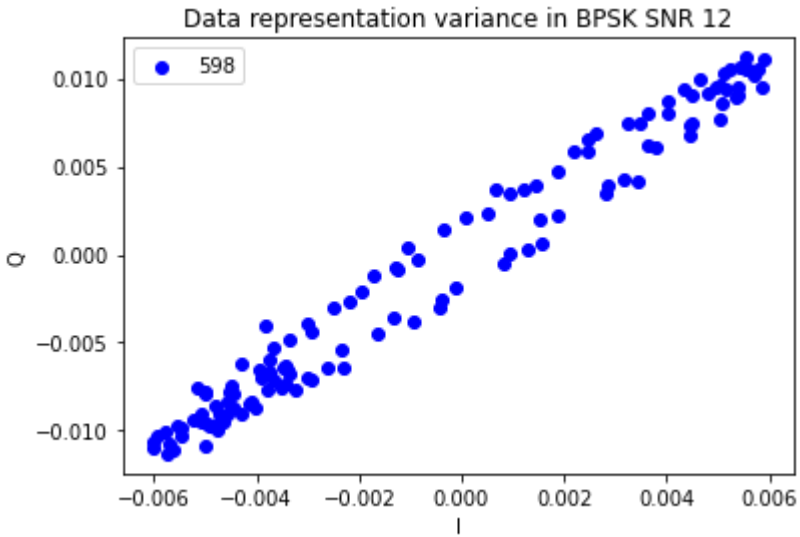
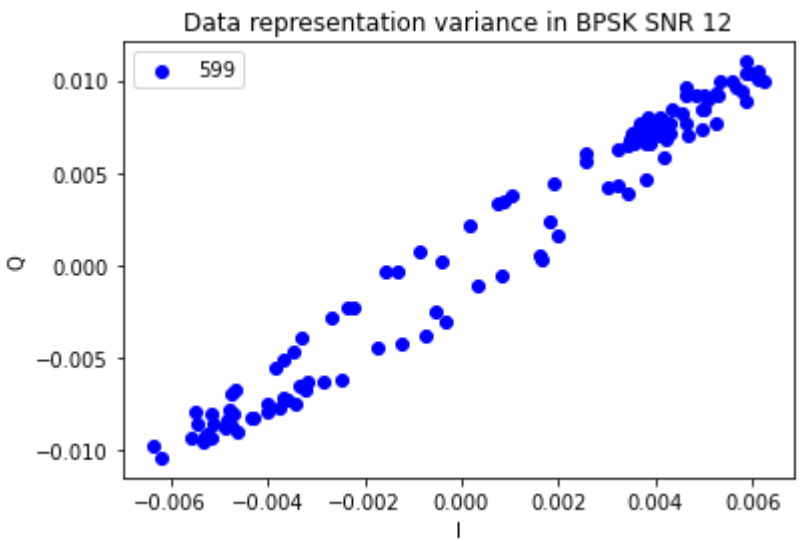
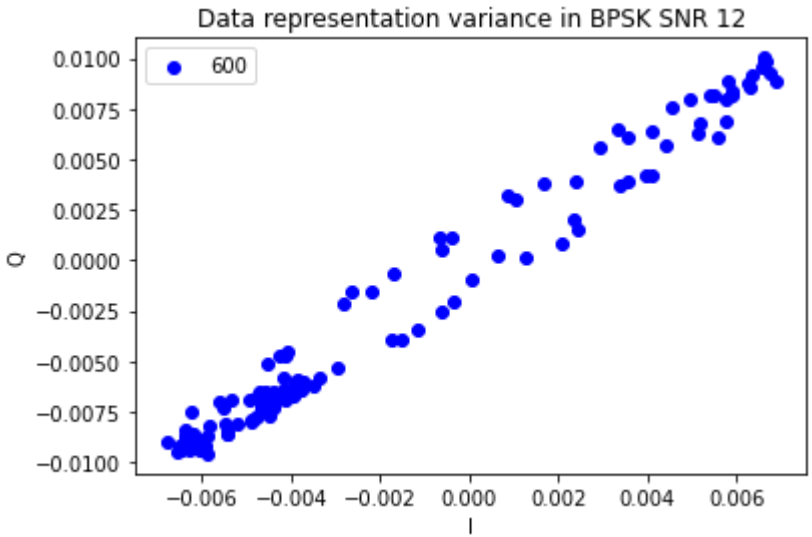
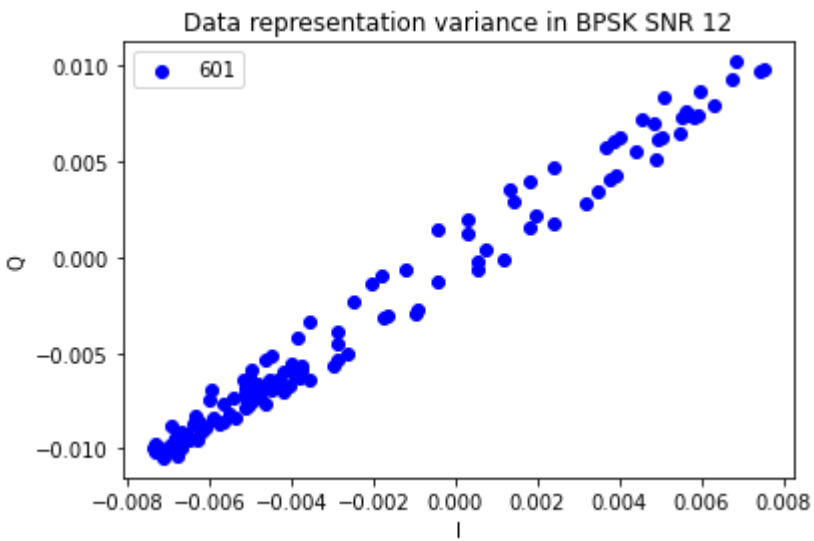

Data representation variance in BPSK SNR 12
597
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
598
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
599
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
600
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
601
0.010
0.005
0.000
−0.005
−0.010
Q
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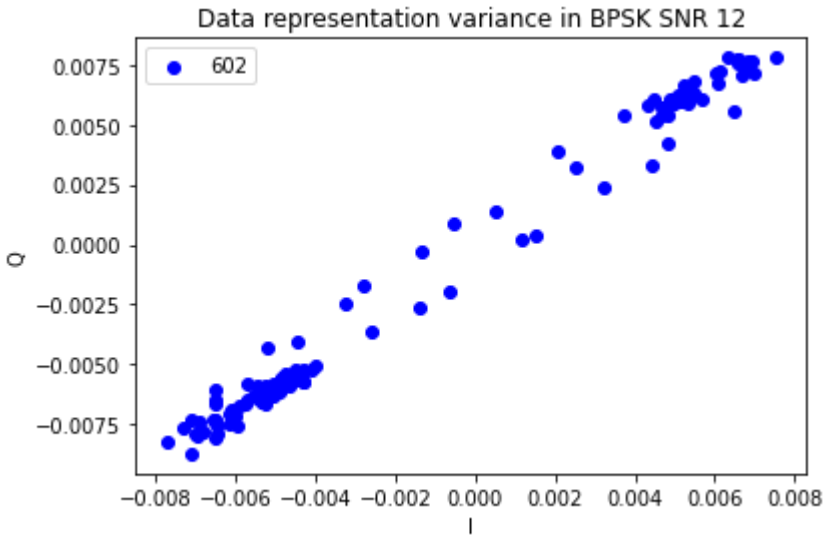
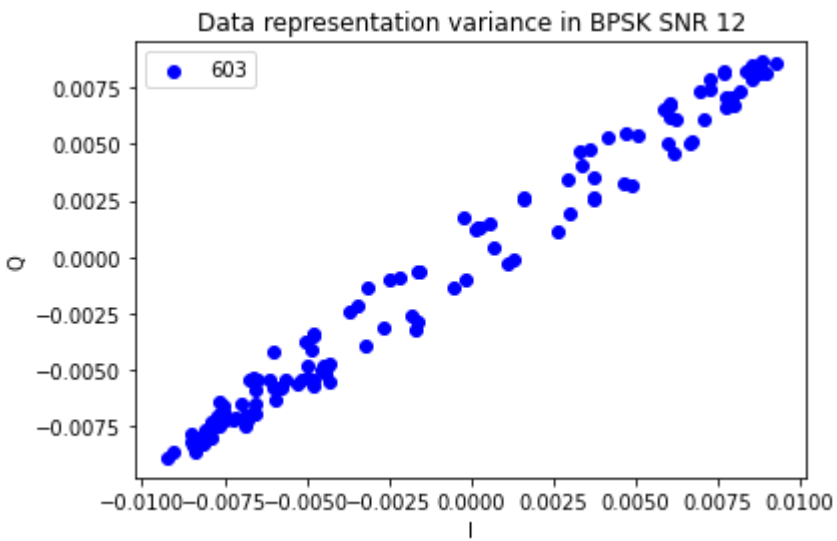
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I


Data representation variance in BPSK SNR 12
602
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I


Data representation variance in BPSK SNR 12
603
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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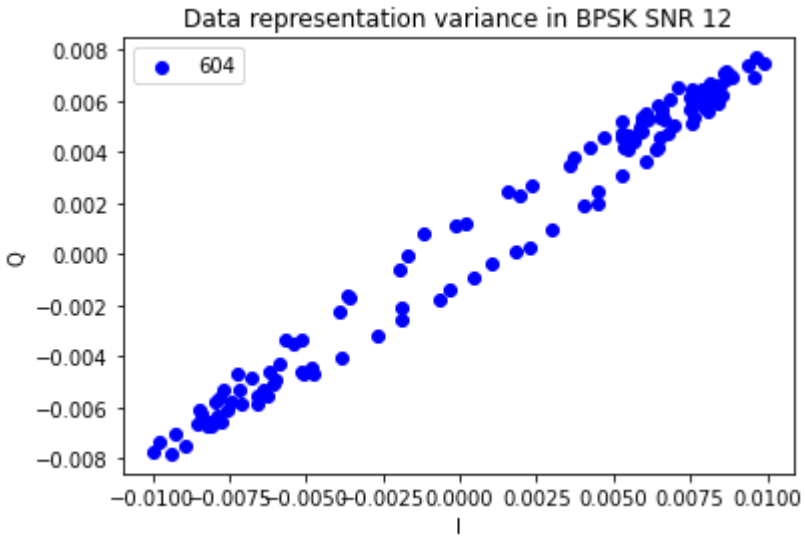
I


Data representation variance in BPSK SNR 12
604
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
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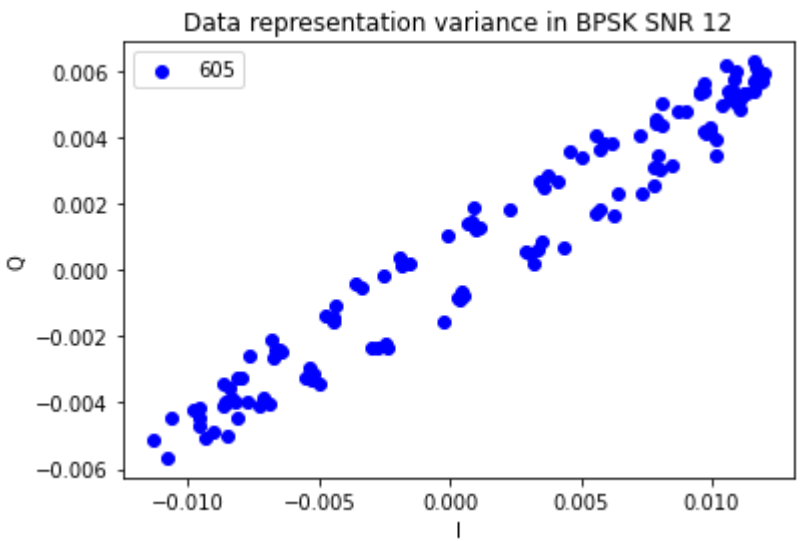
I


Data representation variance in BPSK SNR 12
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0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010 −0.005 0.000 0.005 0.010
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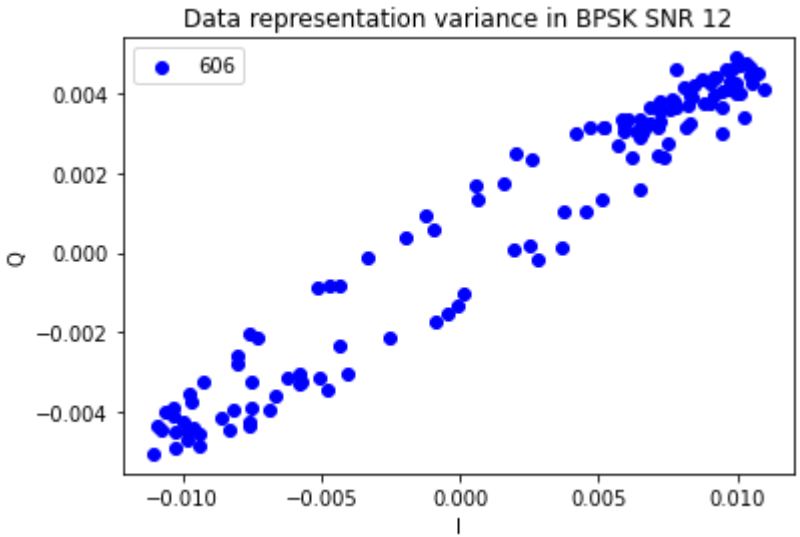
Data representation variance in BPSK SNR 12
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0.002
0.000
−0.002
−0.004
Q
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−0.005
0.000
0.005
0.010
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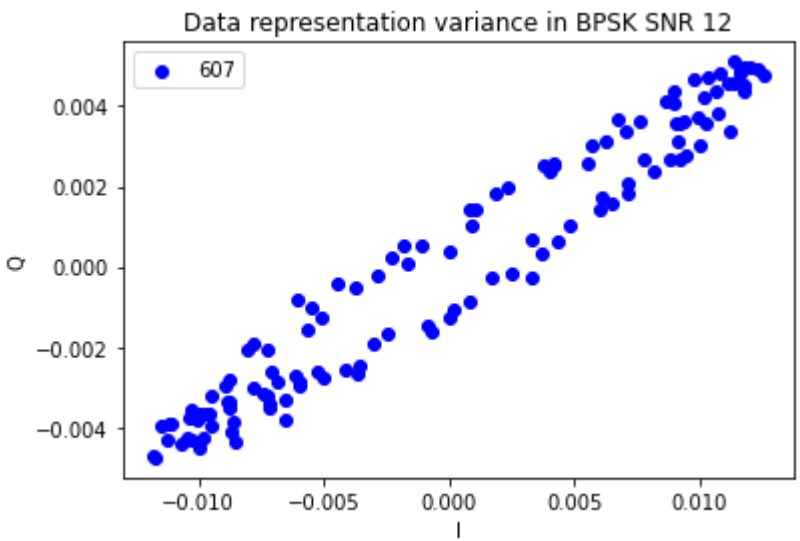
Data representation variance in BPSK SNR 12
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0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
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0.005
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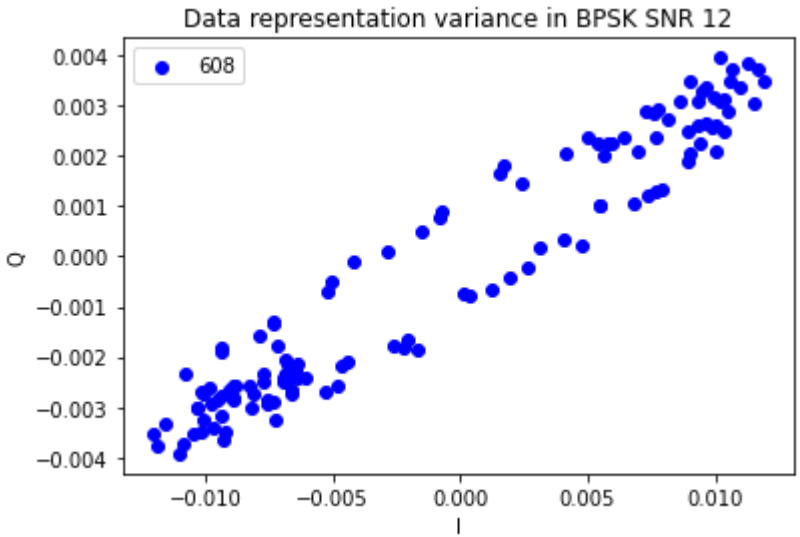
Data representation variance in BPSK SNR 12
608
0.004
0.003
0.002
0.001
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−0.001
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Q
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−0.005
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0.010
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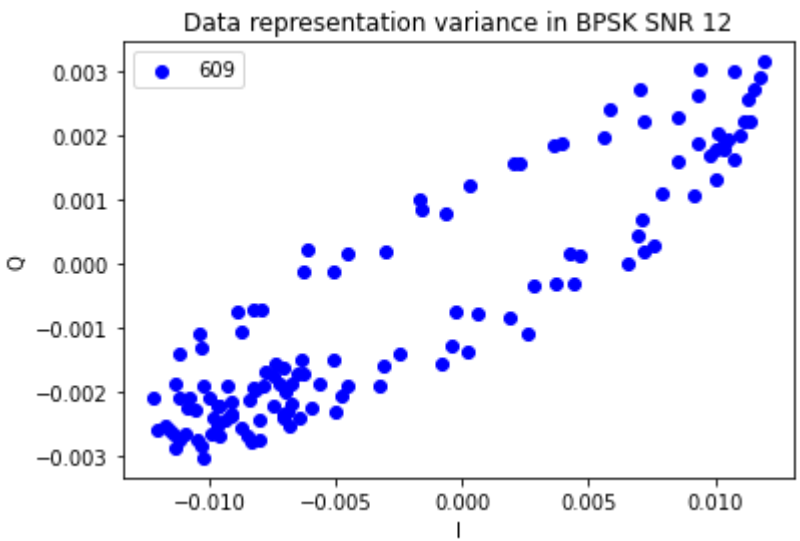
Data representation variance in BPSK SNR 12
609
0.003
0.002
0.001
0.000
−0.001
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−0.003
Q
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−0.005
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0.005
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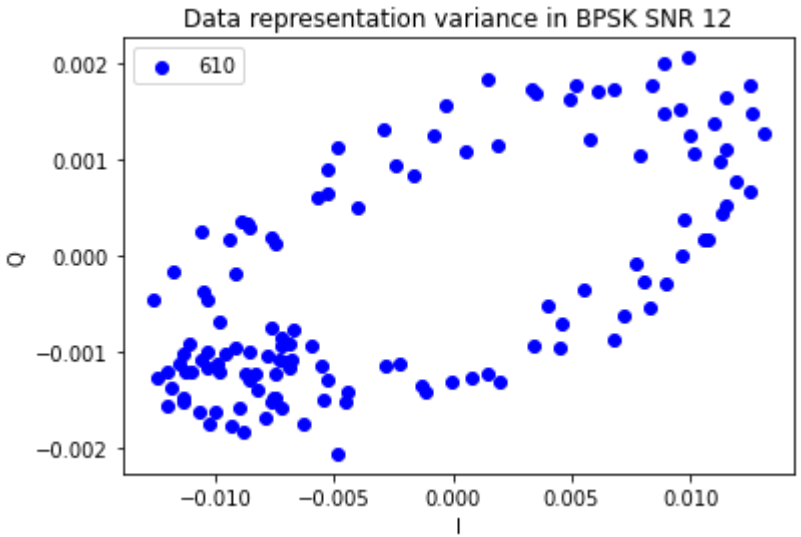
Data representation variance in BPSK SNR 12
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0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
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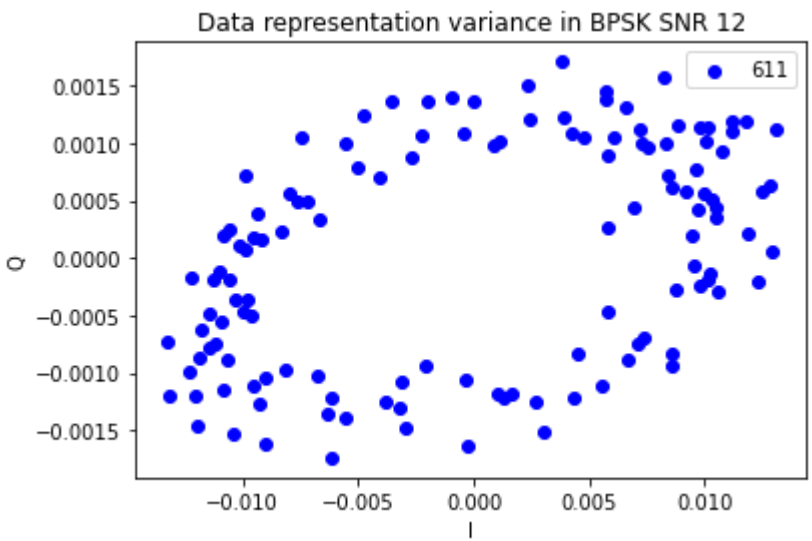
Data representation variance in BPSK SNR 12
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0.0000
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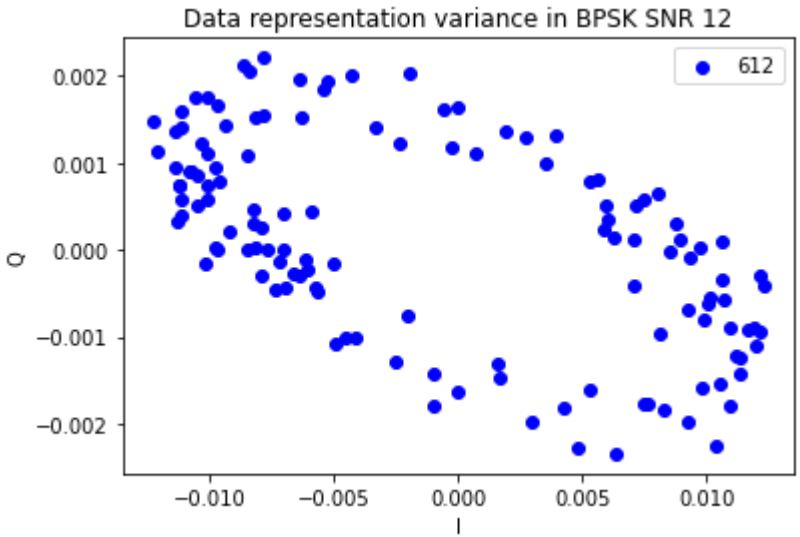
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
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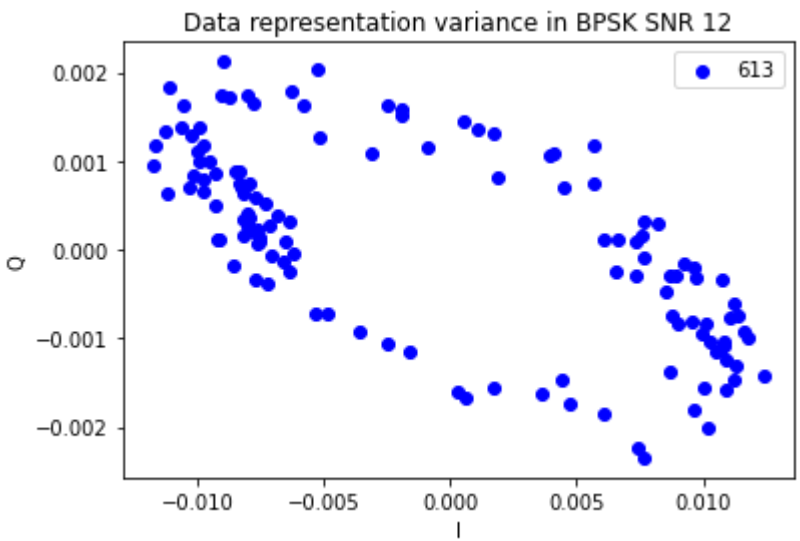
Data representation variance in BPSK SNR 12
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0.002
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−0.001
−0.002
Q
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−0.005
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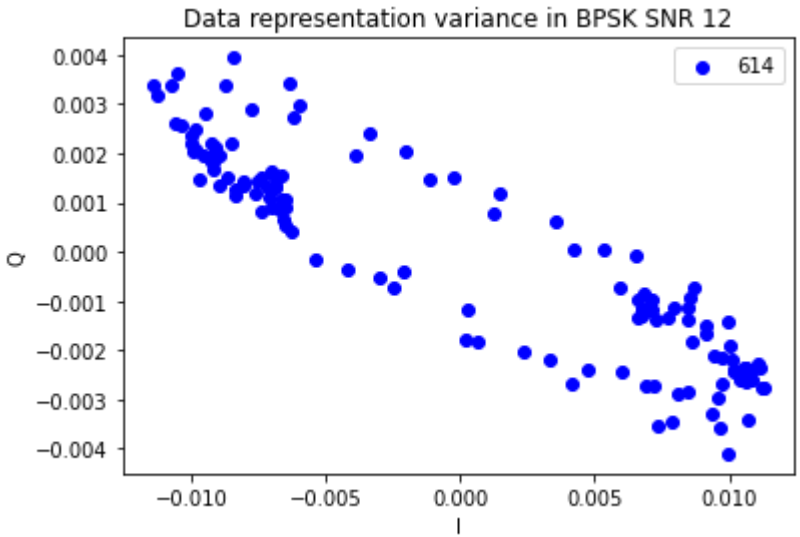
Data representation variance in BPSK SNR 12
614
0.004
0.003
0.002
0.001
0.000
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−0.004
Q
−0.010
−0.005
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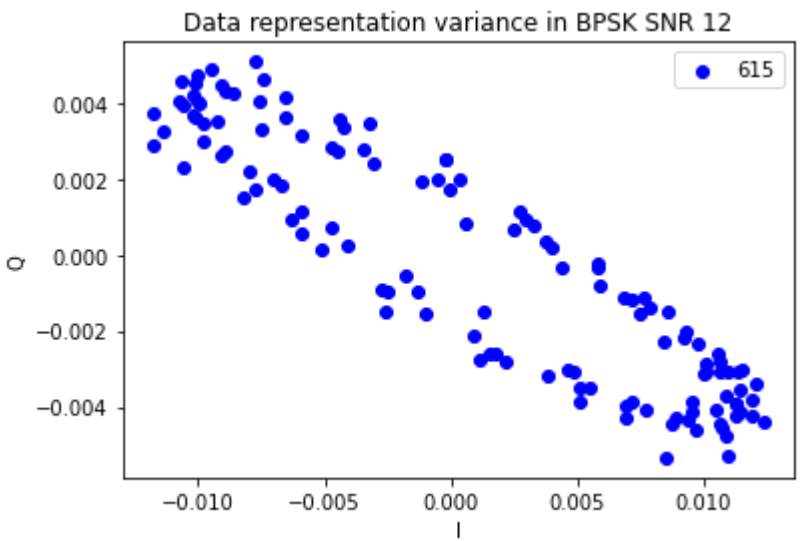
I


Data representation variance in BPSK SNR 12
615
0.004
0.002
0.000
−0.002
−0.004
Q
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−0.005
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0.005
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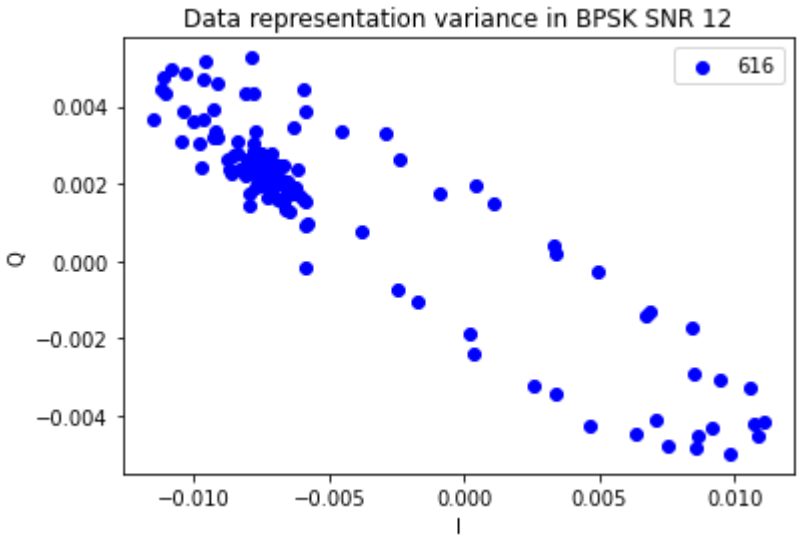
Data representation variance in BPSK SNR 12
616
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
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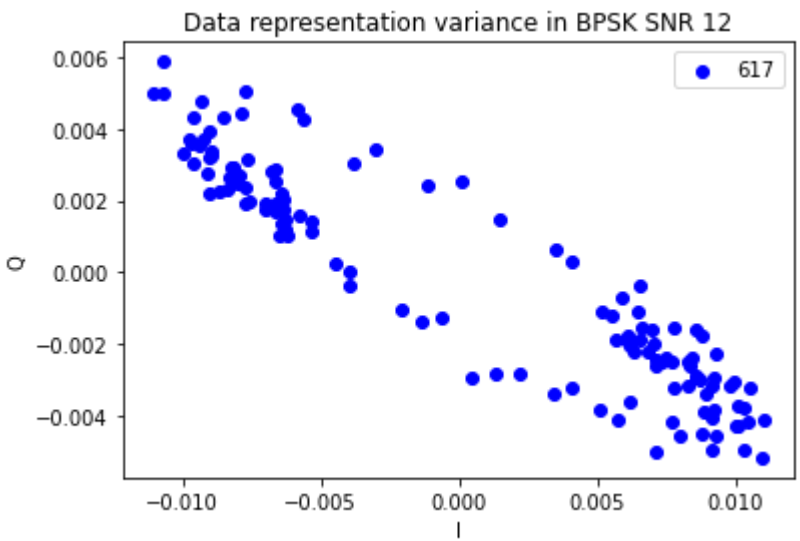
Data representation variance in BPSK SNR 12
617
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
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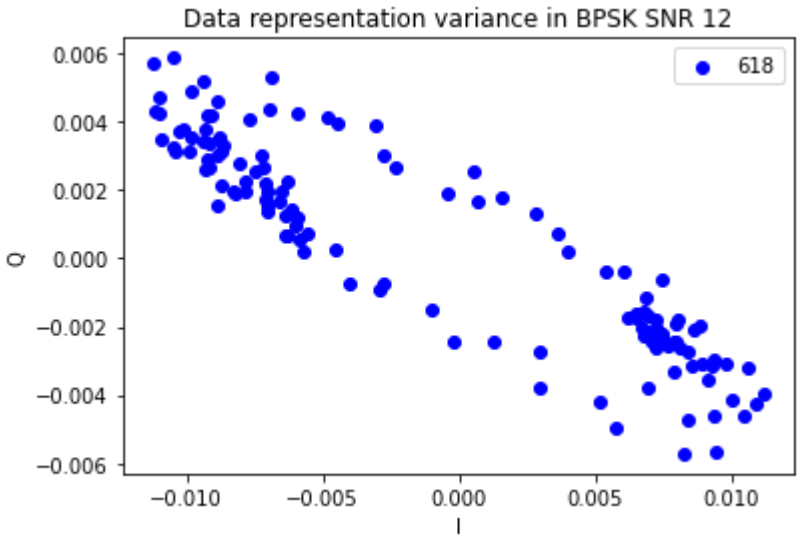
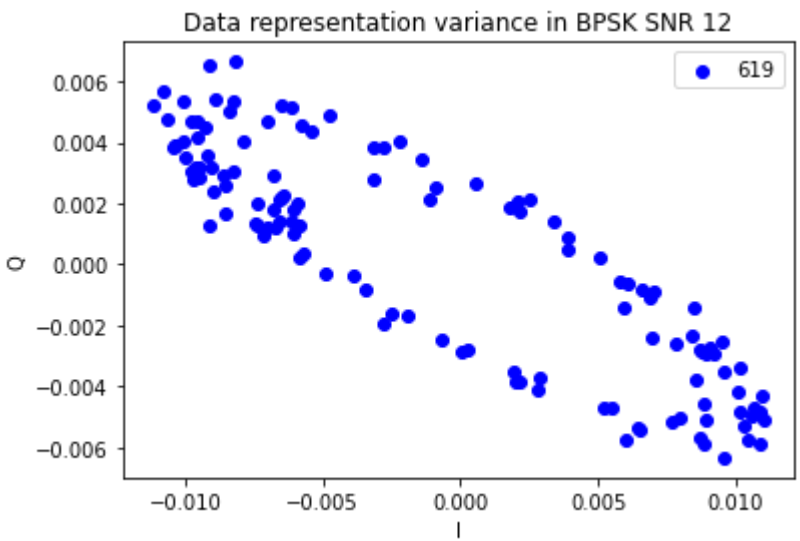

Data representation variance in BPSK SNR 12
618
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
619
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0.002
0.000
−0.002
−0.004
−0.006
Q
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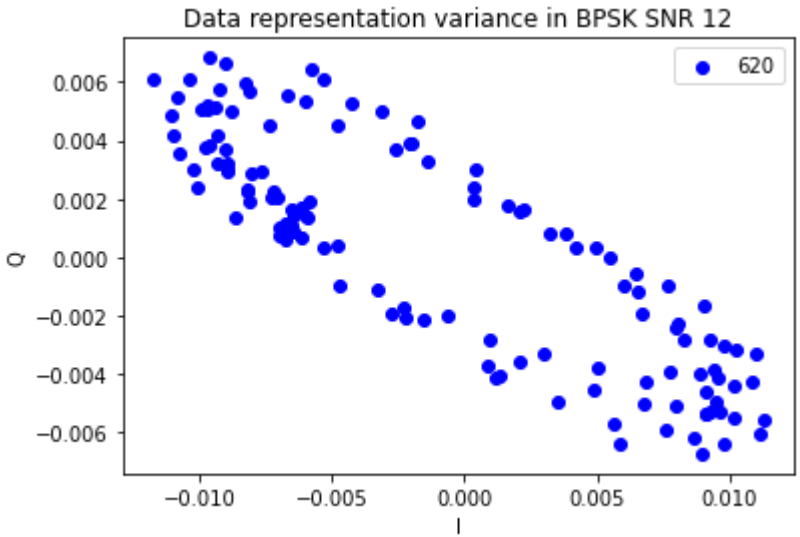
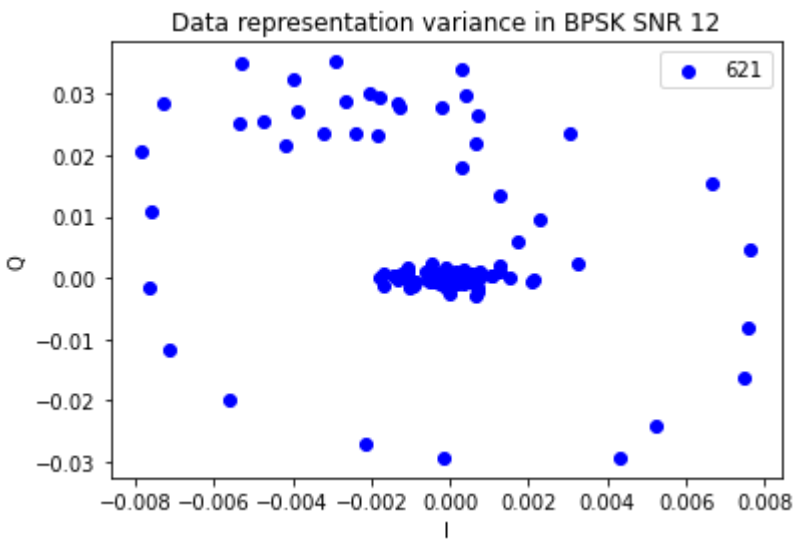
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
620
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
621
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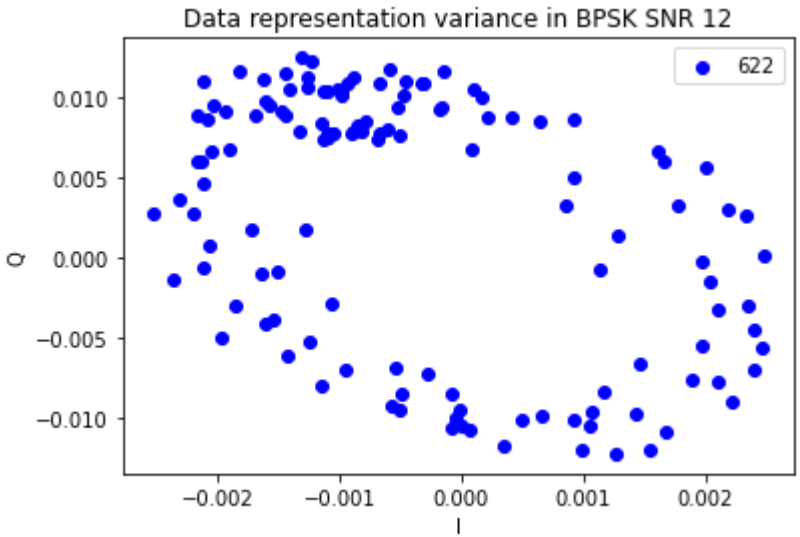
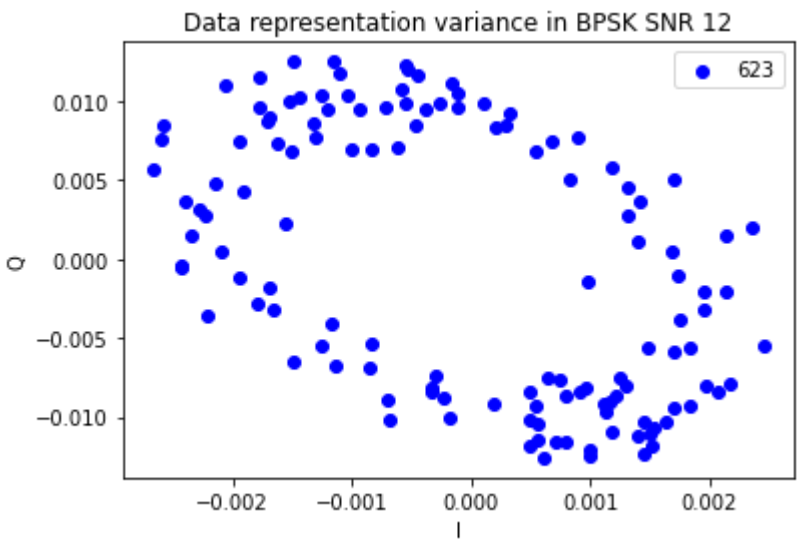
0.02
0.01
0.00
−0.01
−0.02
−0.03
Q
−0.008
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I


Data representation variance in BPSK SNR 12
622
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
623
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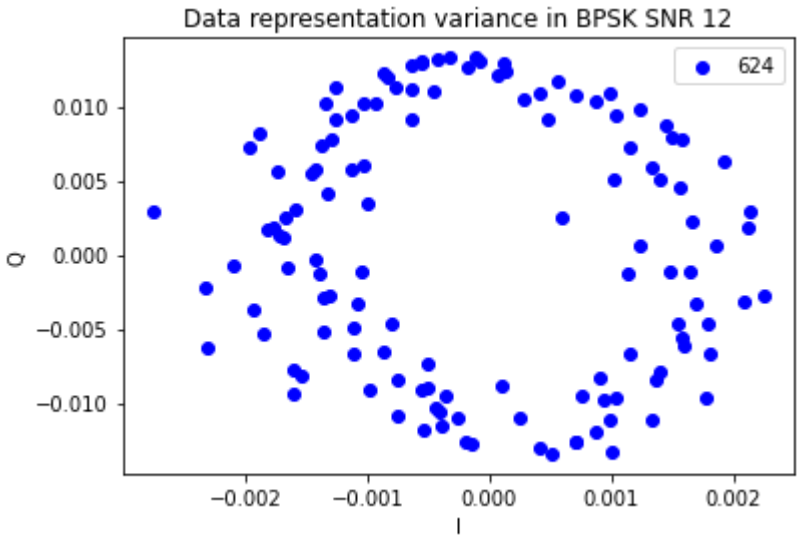
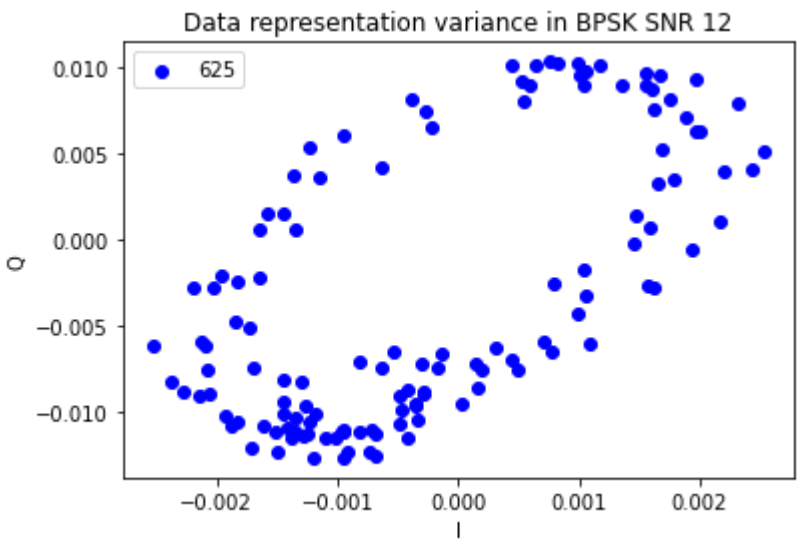
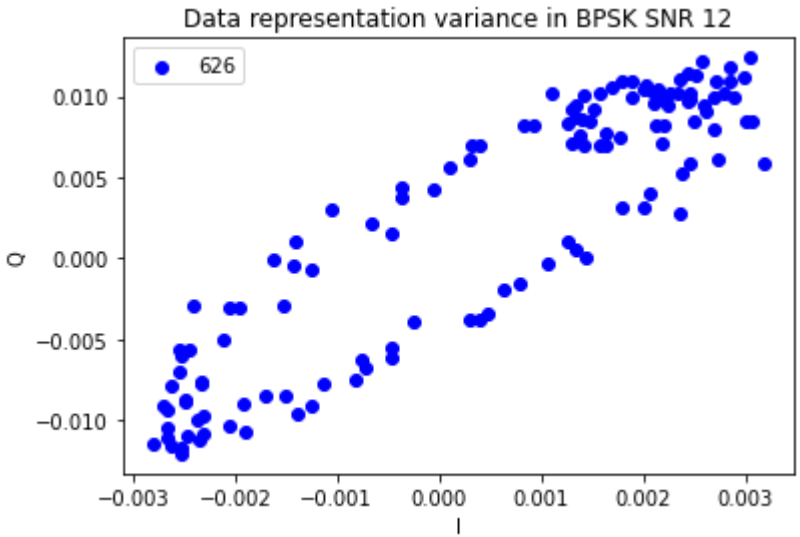
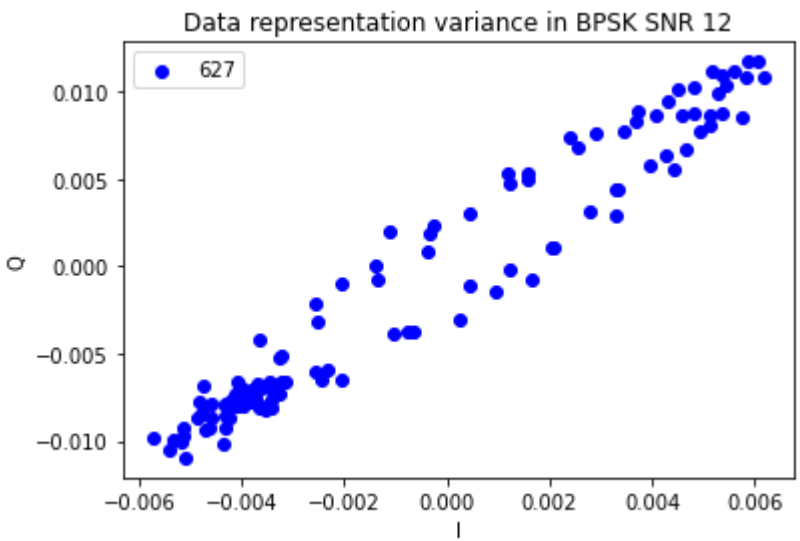
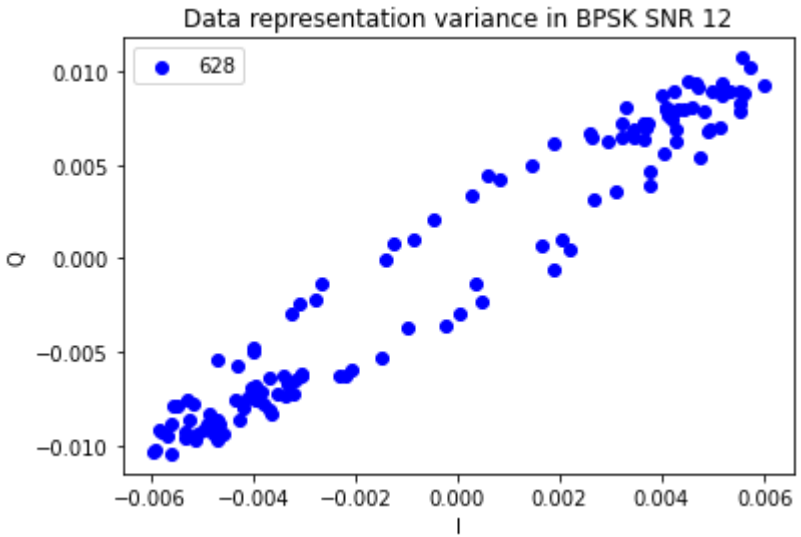
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

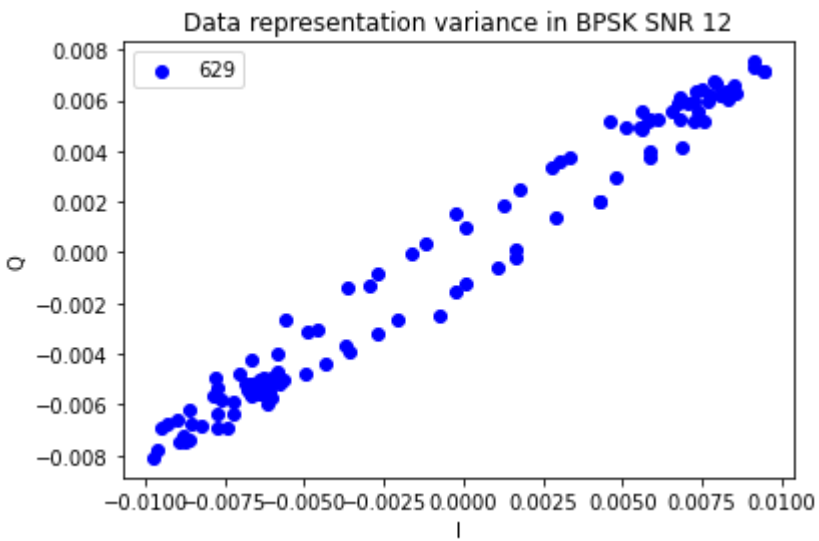

Data representation variance in BPSK SNR 12
624
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
625
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
626
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
627
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
628
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
629
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0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
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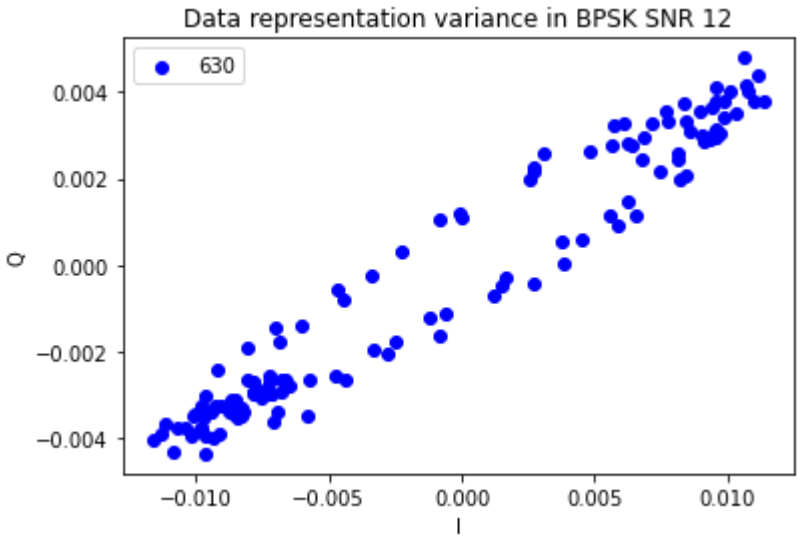
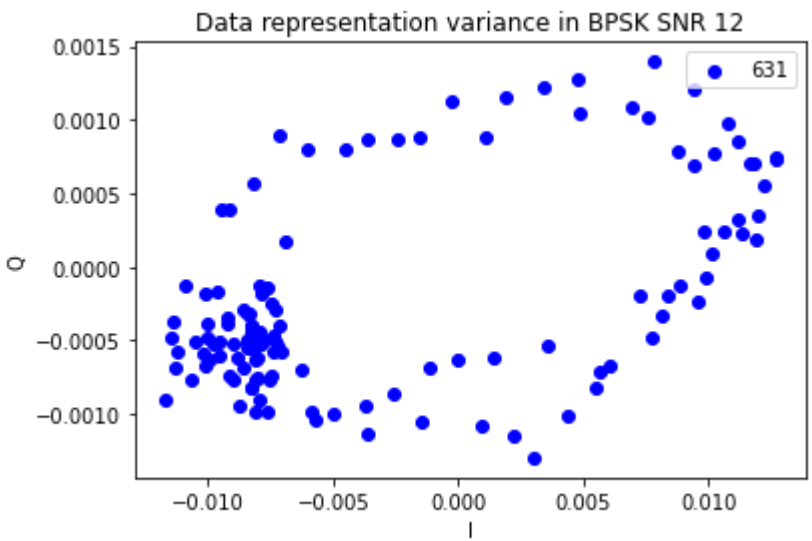
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I


Data representation variance in BPSK SNR 12
630
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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0.0005
0.0000
−0.0005
−0.0010
Q
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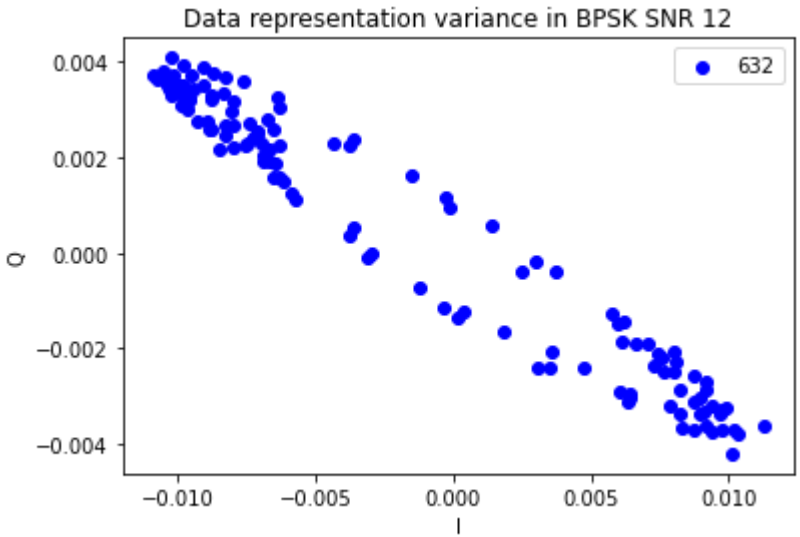
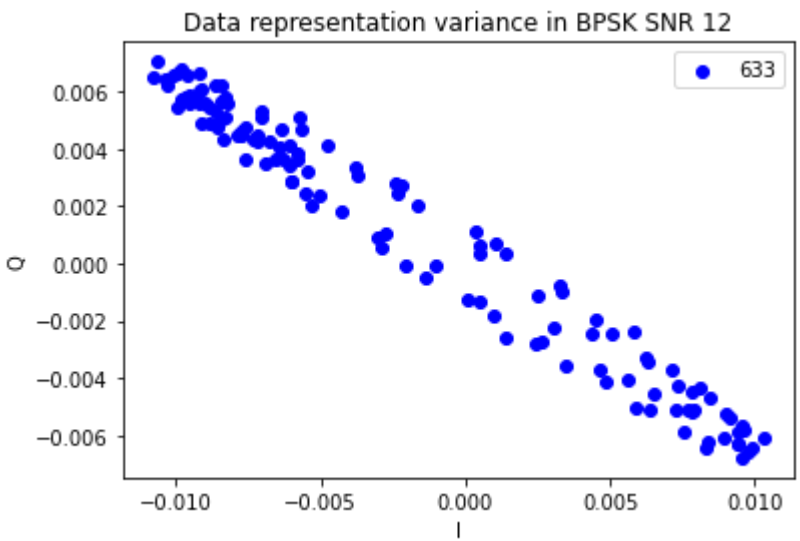
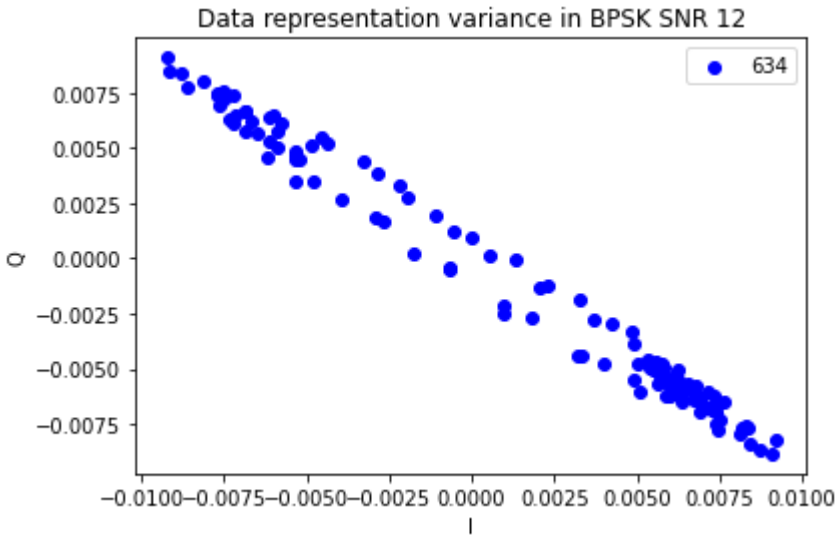
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
632
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
633
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
634
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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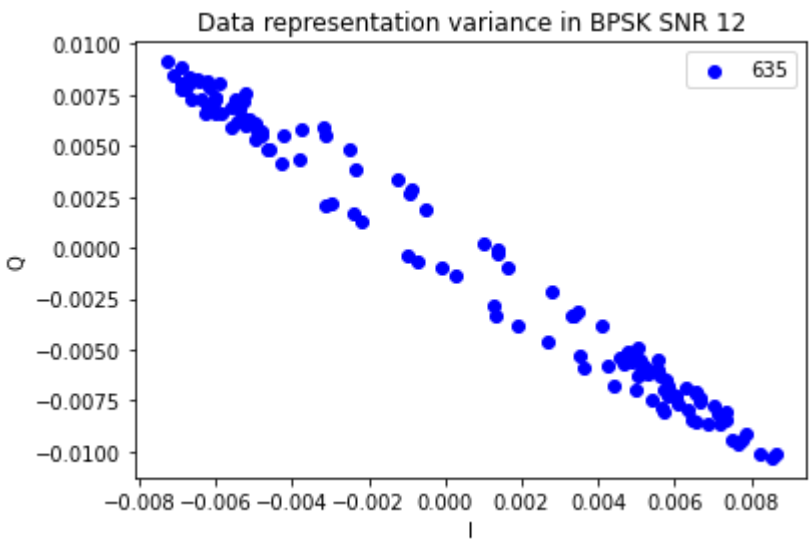
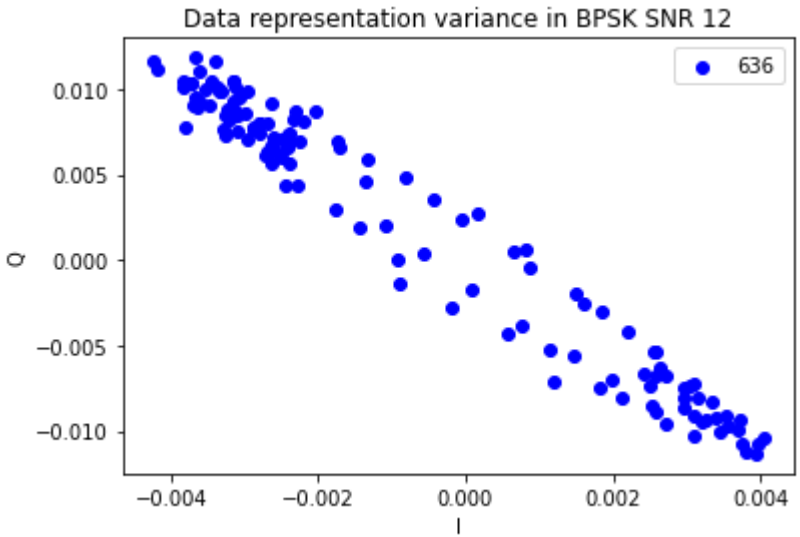
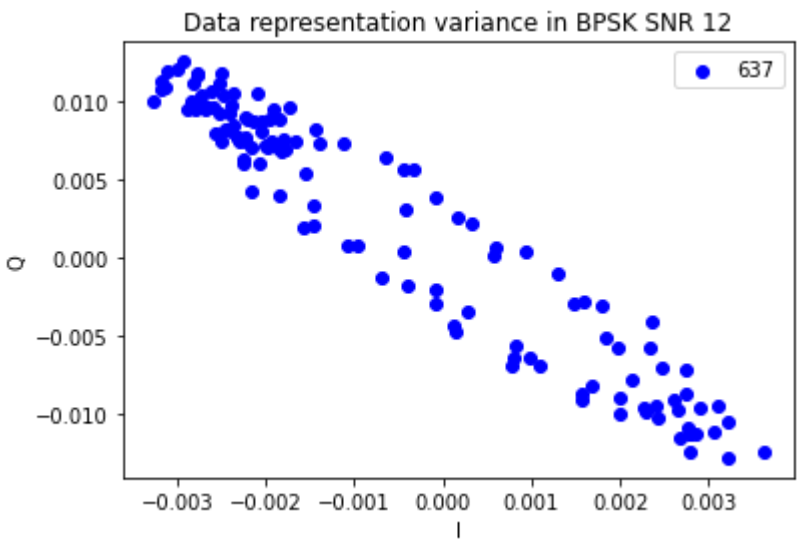
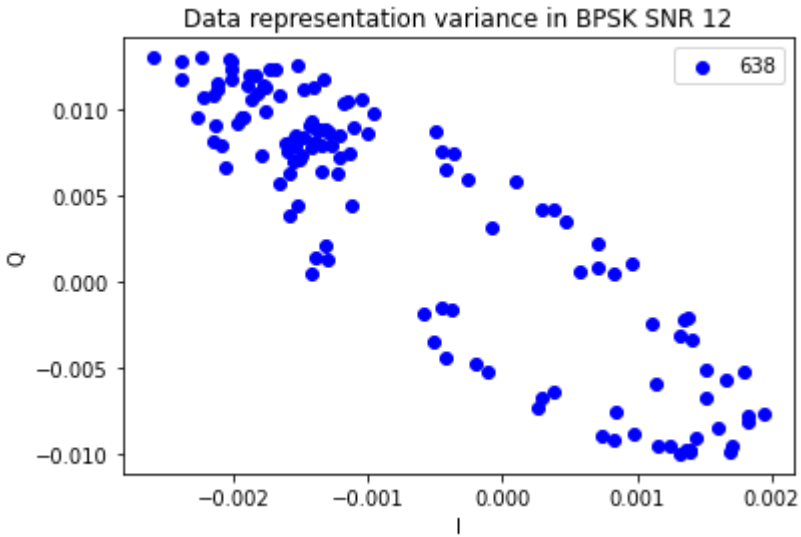
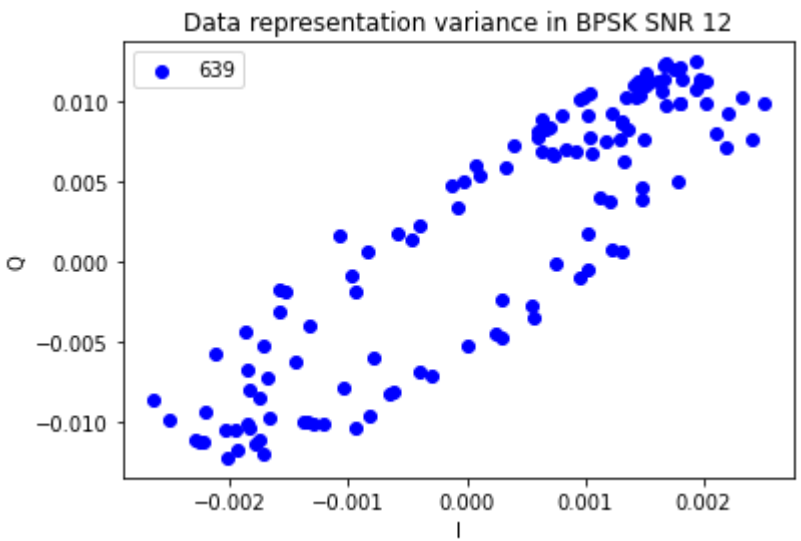
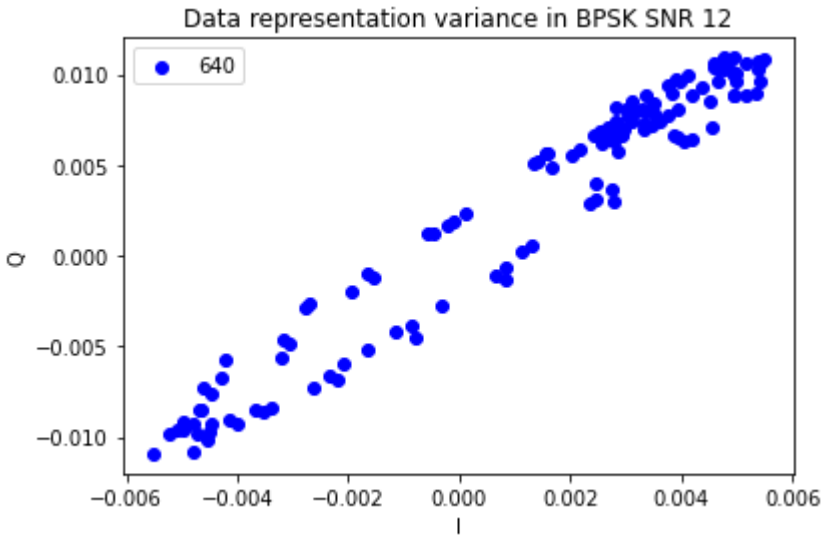

Data representation variance in BPSK SNR 12
635
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

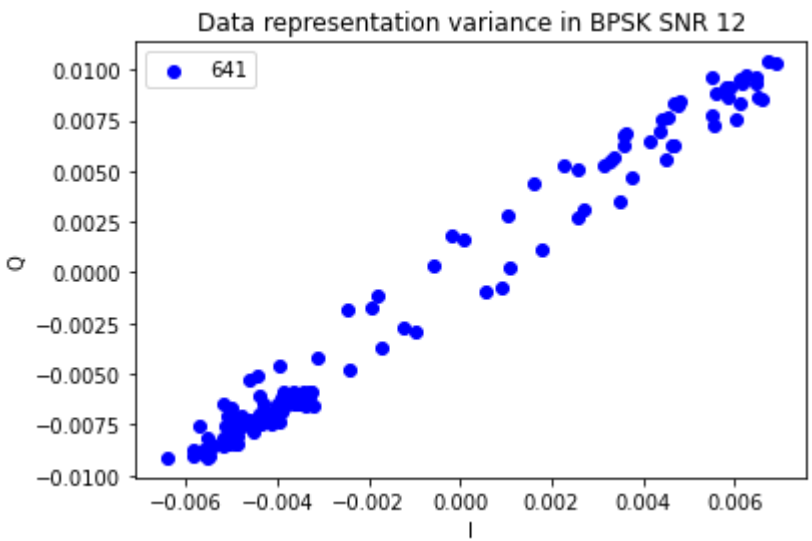

Data representation variance in BPSK SNR 12
636
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

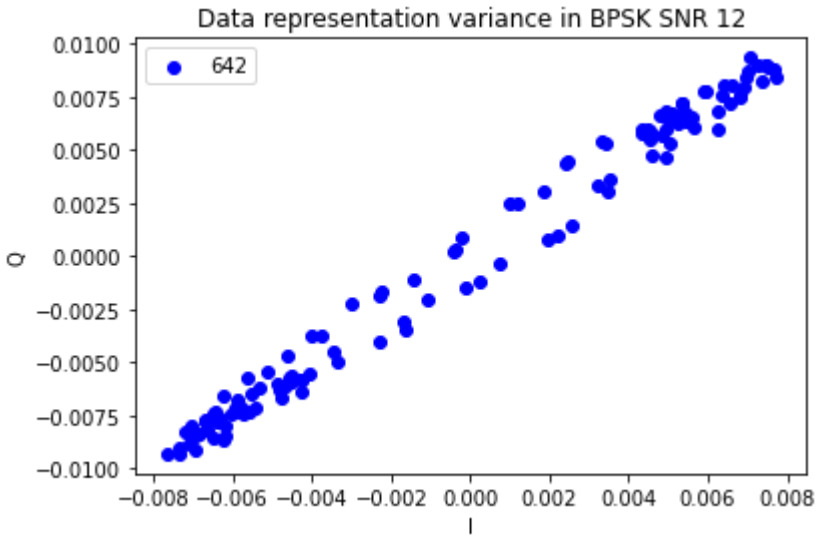

Data representation variance in BPSK SNR 12
637
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

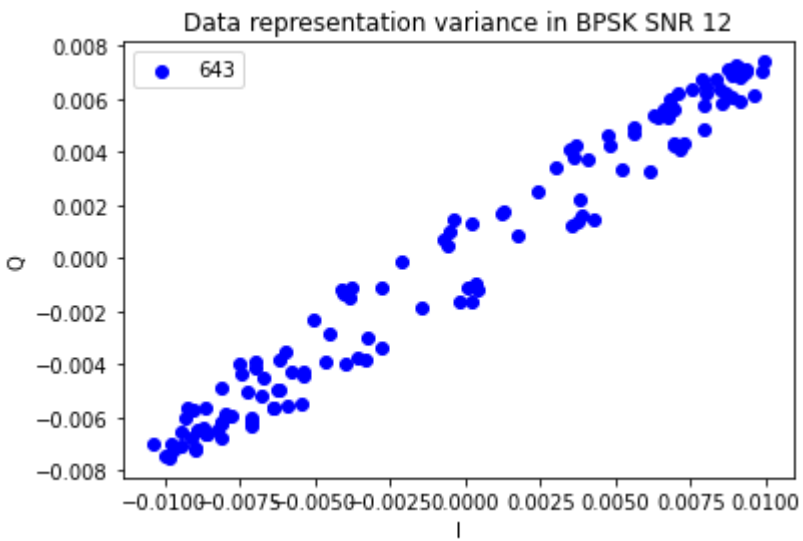

Data representation variance in BPSK SNR 12
638
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
639
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
640
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
641
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
642
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I


Data representation variance in BPSK SNR 12
643
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
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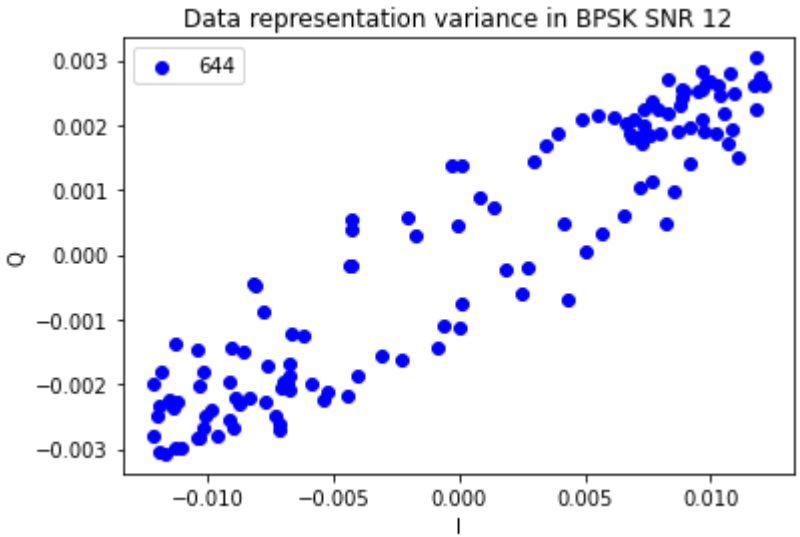
I


Data representation variance in BPSK SNR 12
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0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
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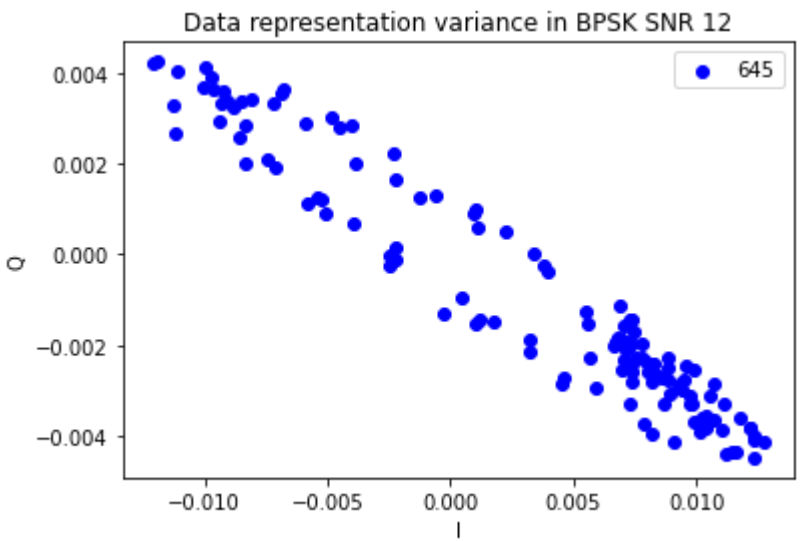
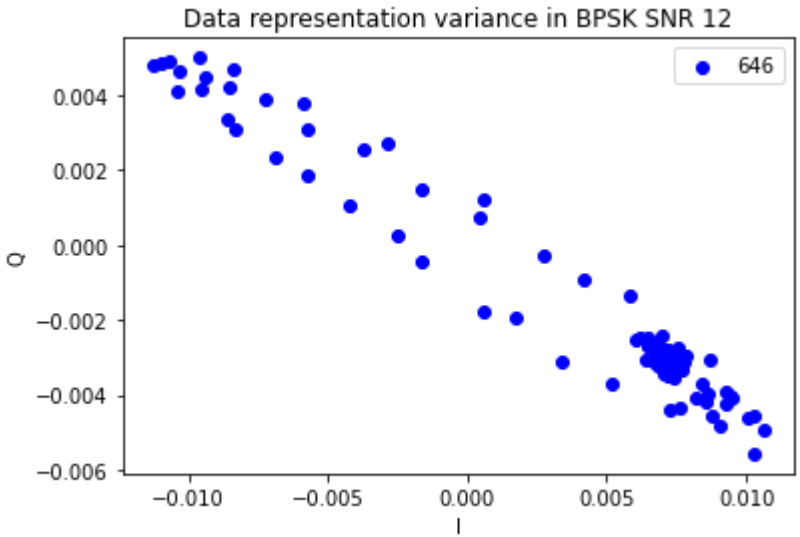
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
645
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
646
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
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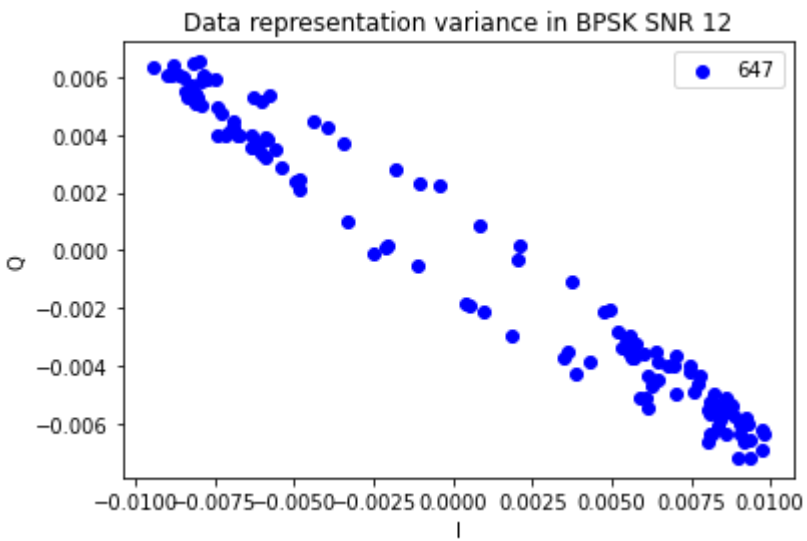
Data representation variance in BPSK SNR 12
647
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
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−0.0075
−0.0050
−0.0025
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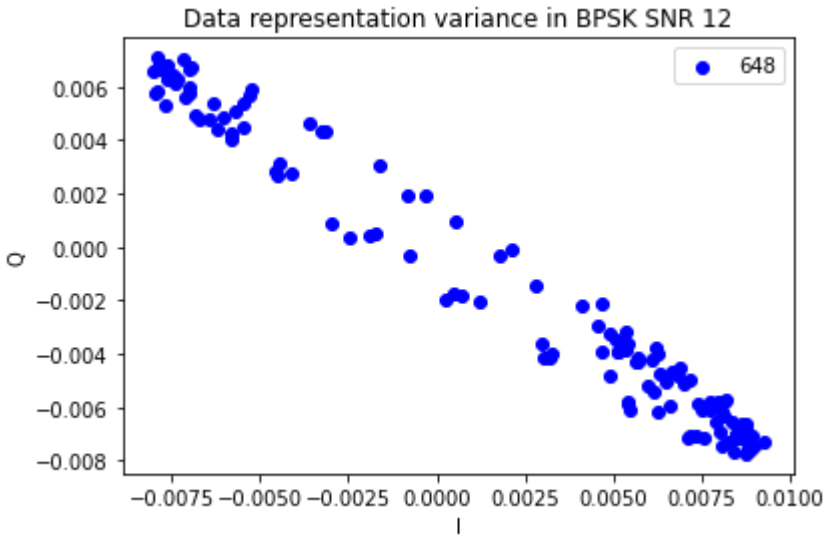
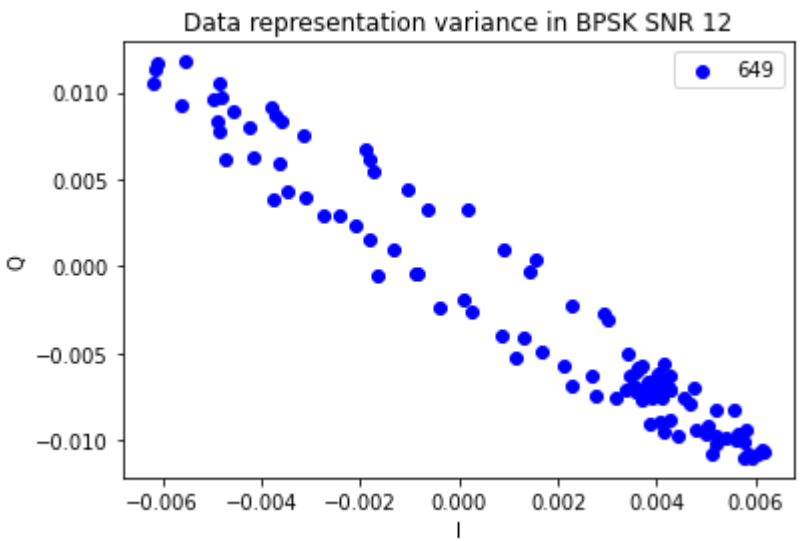
0.0075
0.0100
I


Data representation variance in BPSK SNR 12
648
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
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0.000
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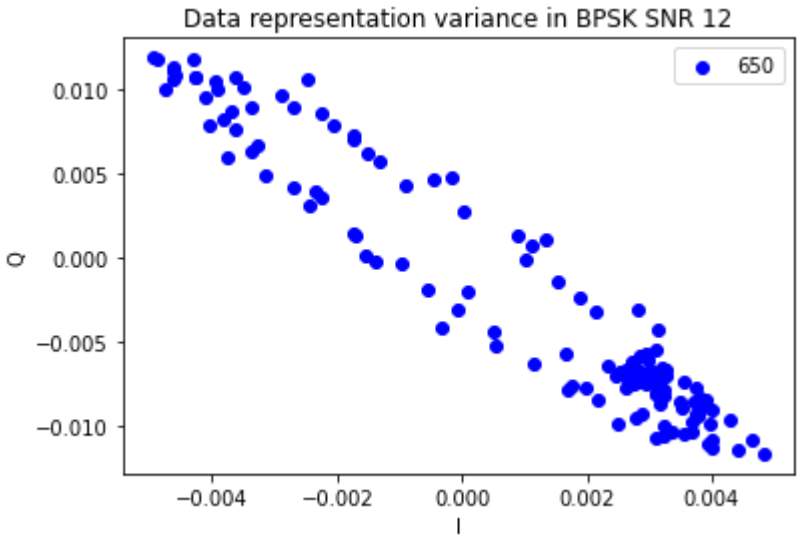
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I


Data representation variance in BPSK SNR 12
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0.010
0.005
0.000
−0.005
−0.010
Q
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−0.002
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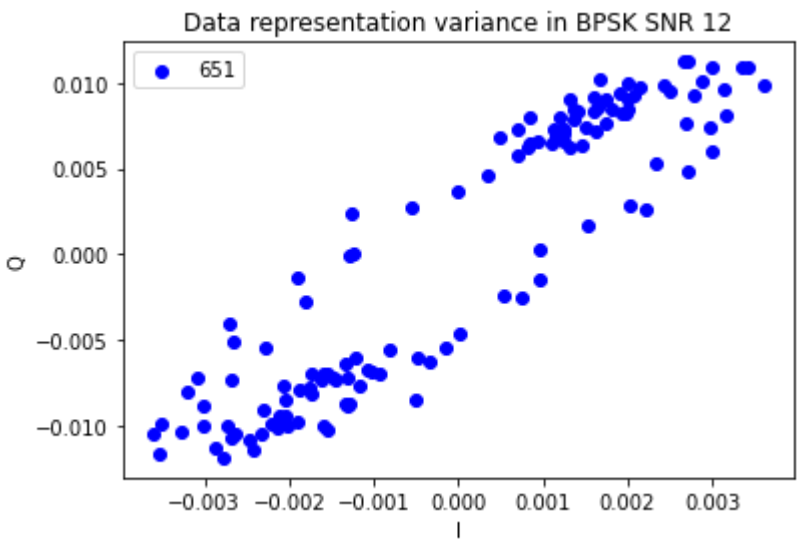
0.002
0.004
I


Data representation variance in BPSK SNR 12
651
0.010
0.005
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−0.005
−0.010
Q
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−0.002
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0.000
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0.002
0.003
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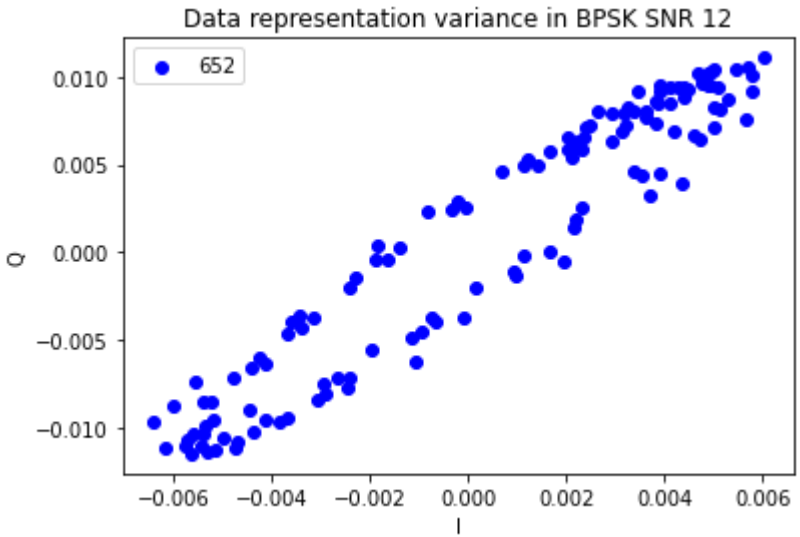
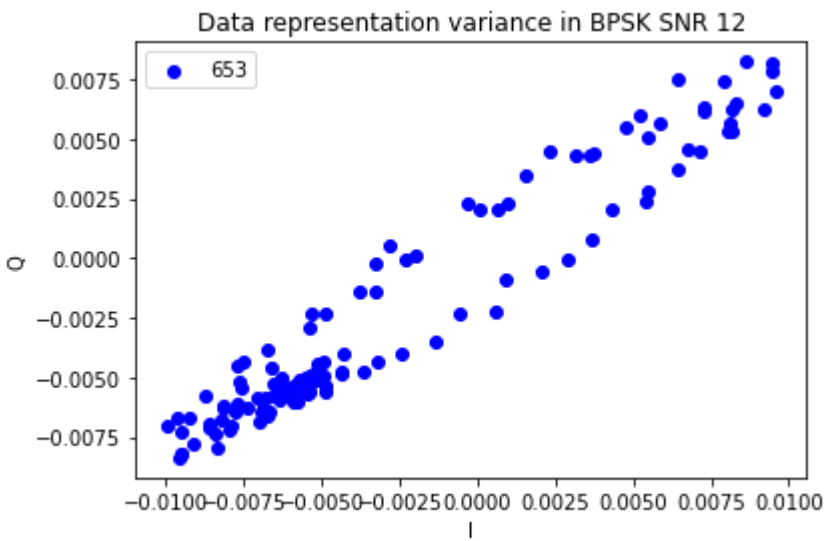

Data representation variance in BPSK SNR 12
652
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
653
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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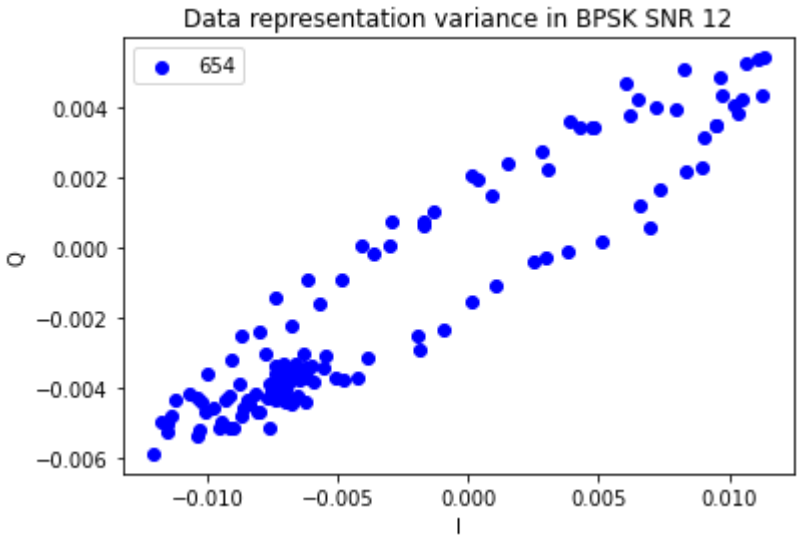
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I


Data representation variance in BPSK SNR 12
654
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
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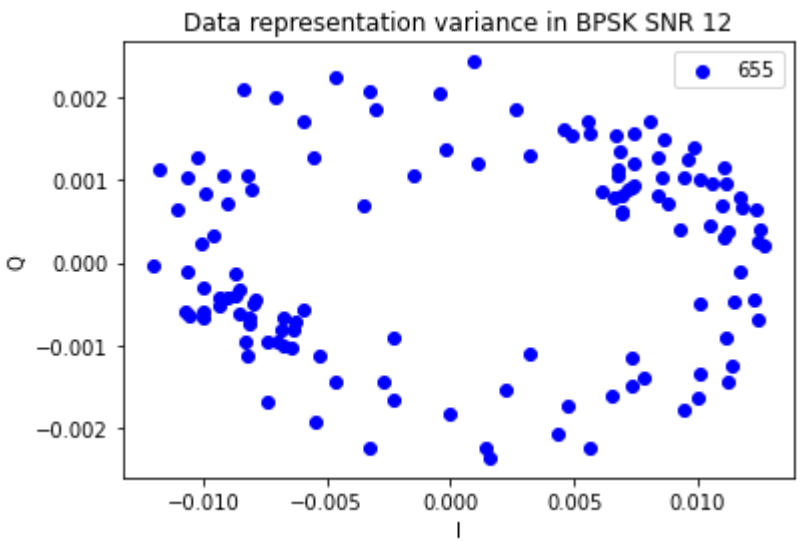
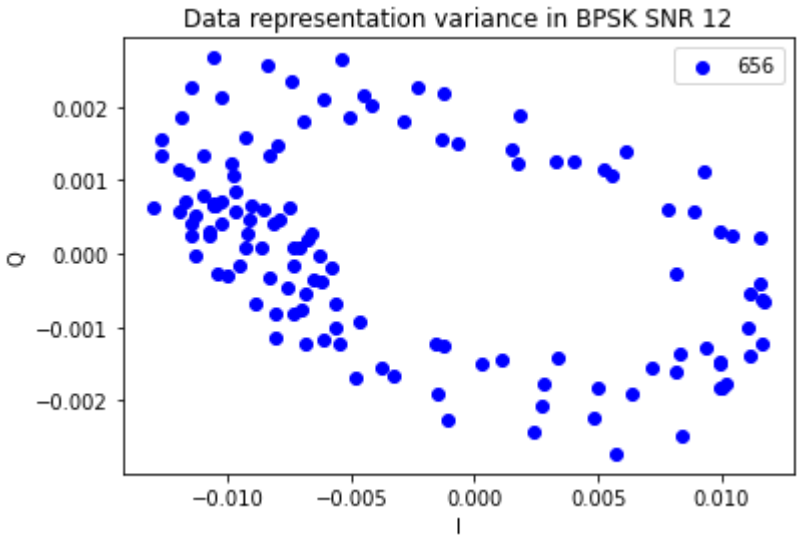

Data representation variance in BPSK SNR 12
655
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
656
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
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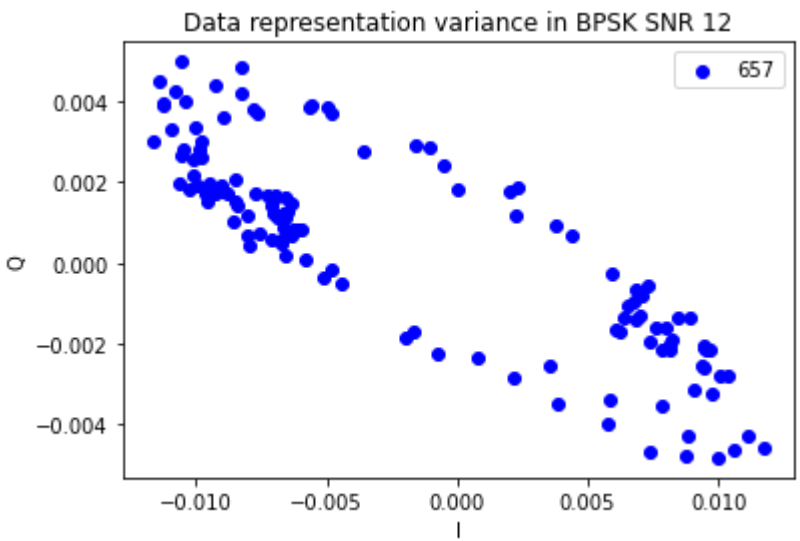
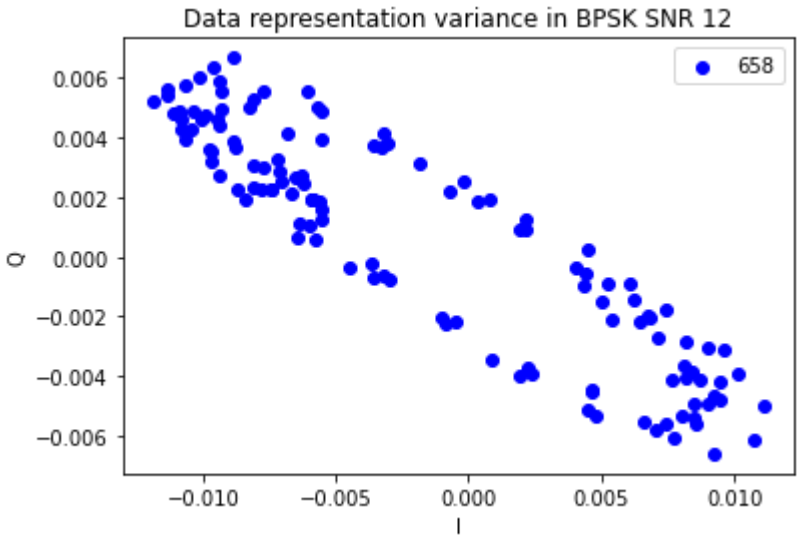
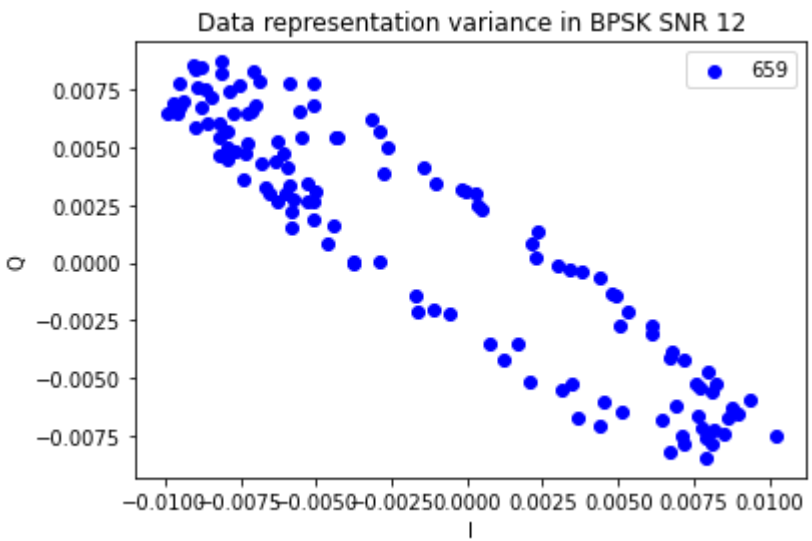

Data representation variance in BPSK SNR 12
657
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
658
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
659
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100
−0.0075
−0.0050
−0.0025
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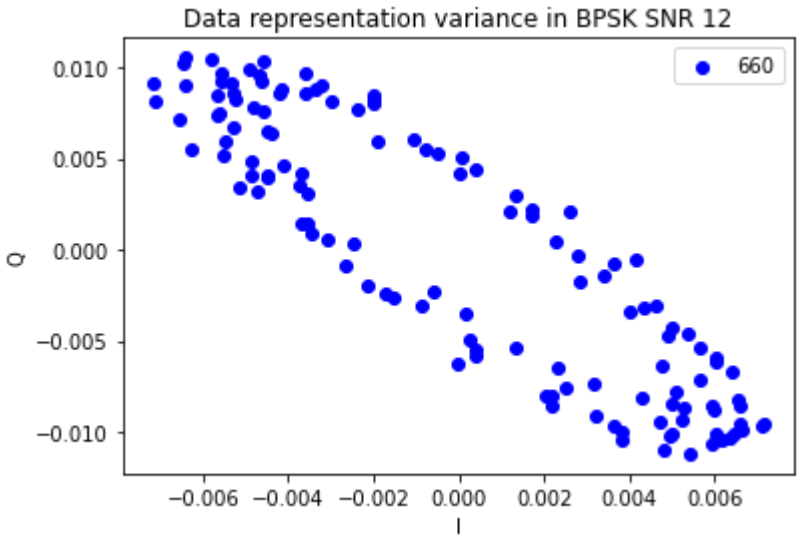
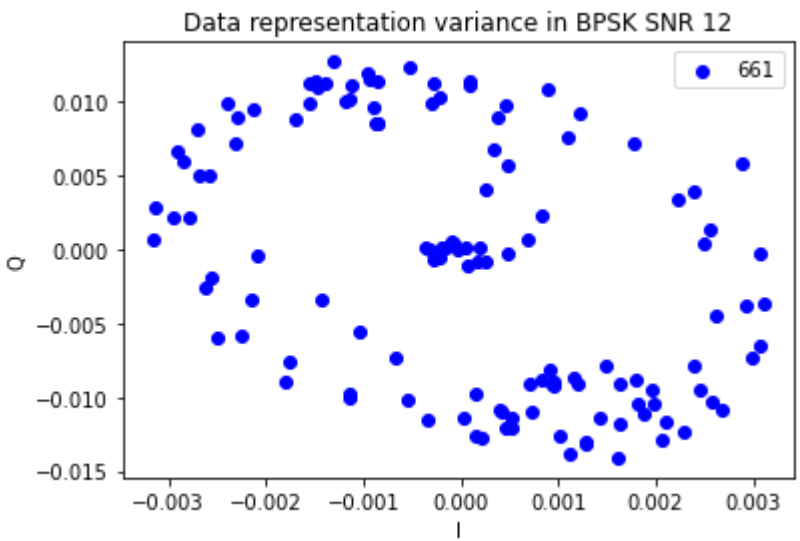
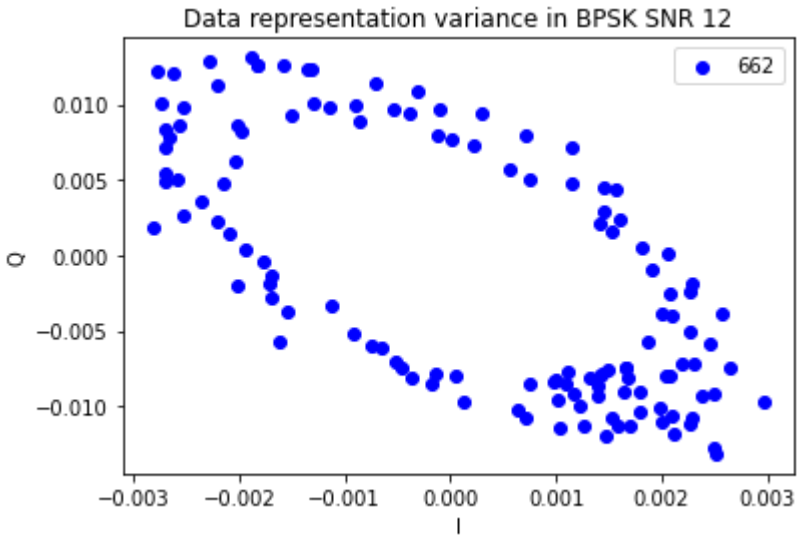
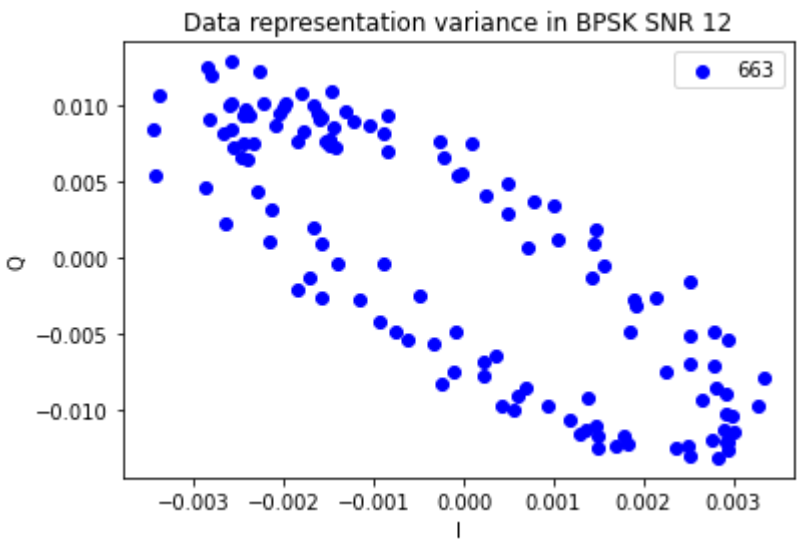
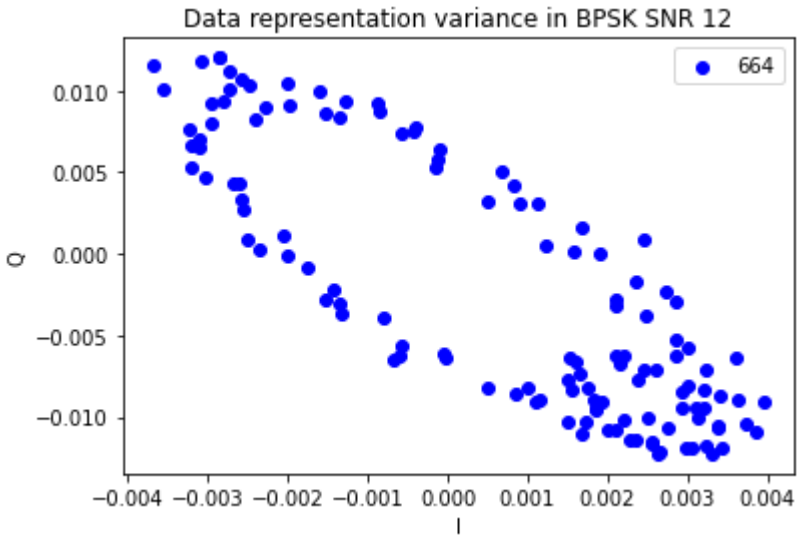
0.0025
0.0050
0.0075
0.0100
I

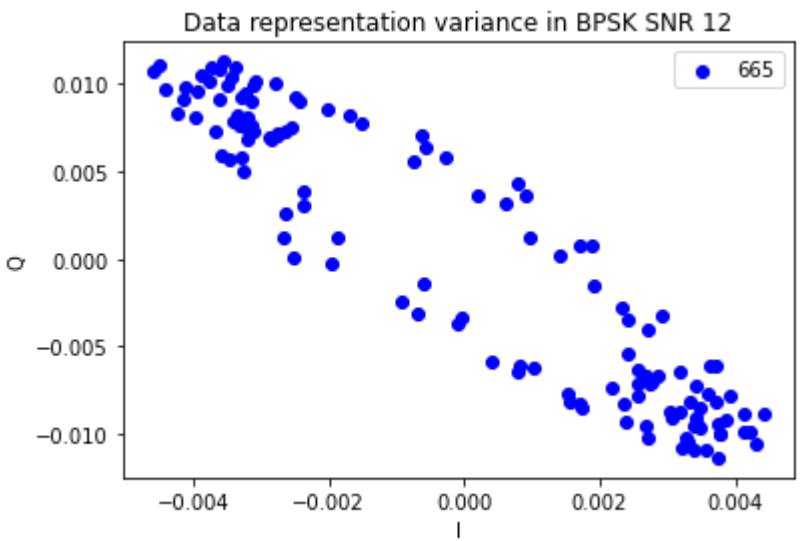

Data representation variance in BPSK SNR 12
660
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

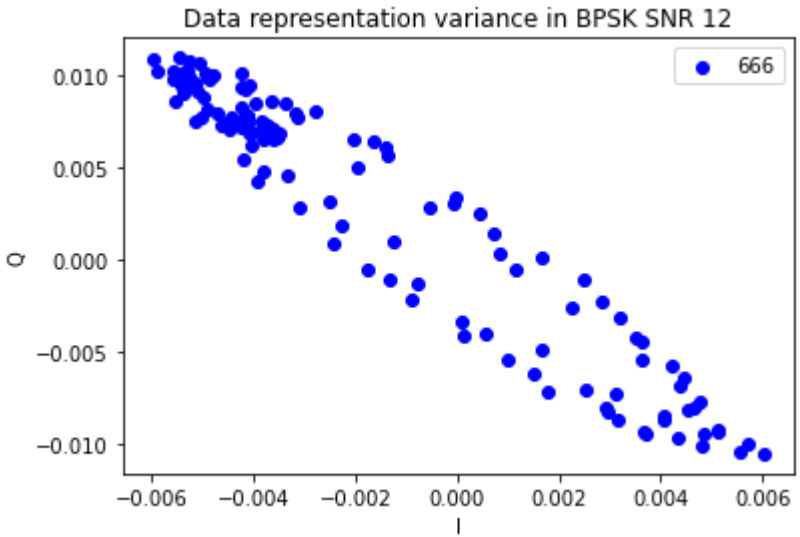

Data representation variance in BPSK SNR 12
661
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

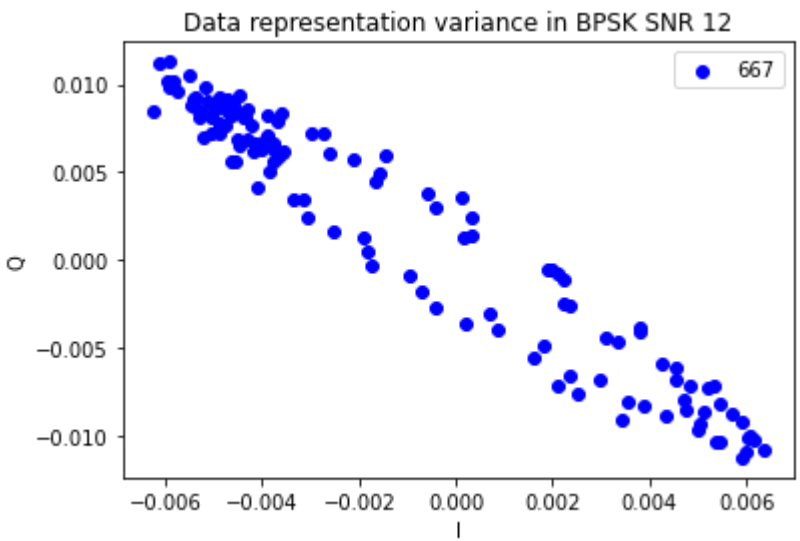

Data representation variance in BPSK SNR 12
662
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

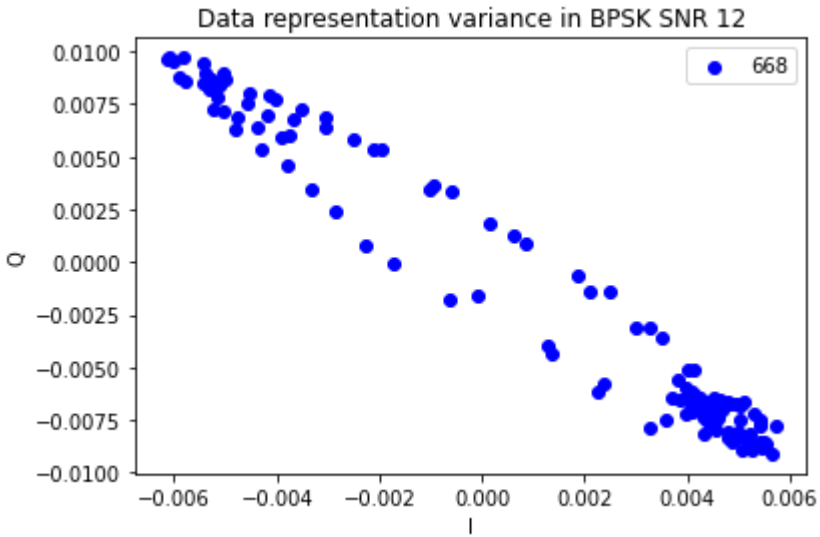

Data representation variance in BPSK SNR 12
663
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

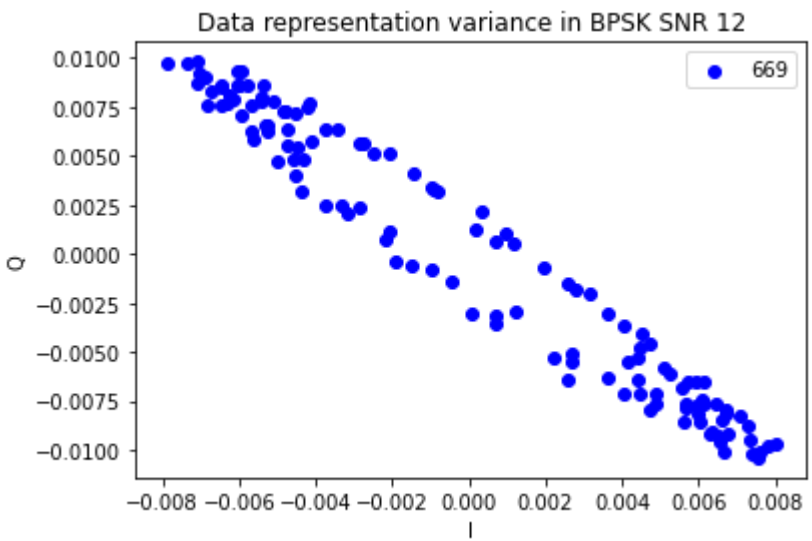

Data representation variance in BPSK SNR 12
664
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I


Data representation variance in BPSK SNR 12
665
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I


Data representation variance in BPSK SNR 12
666
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
667
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
668
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
669
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
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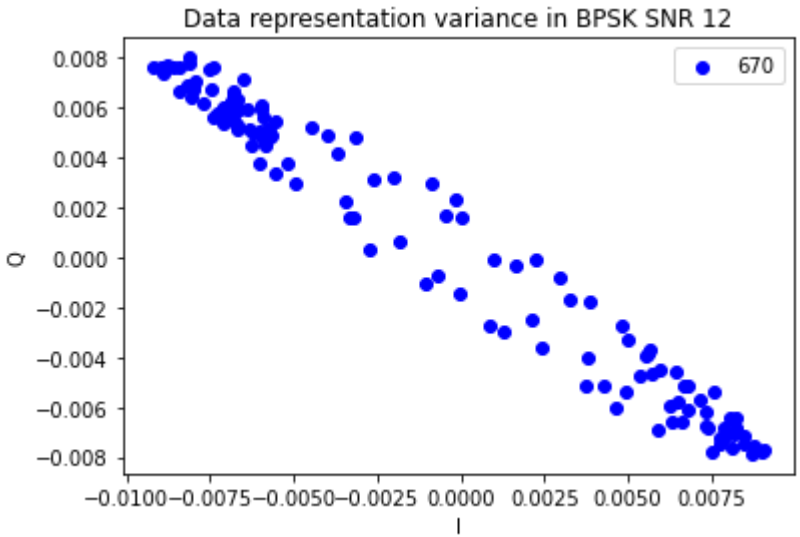
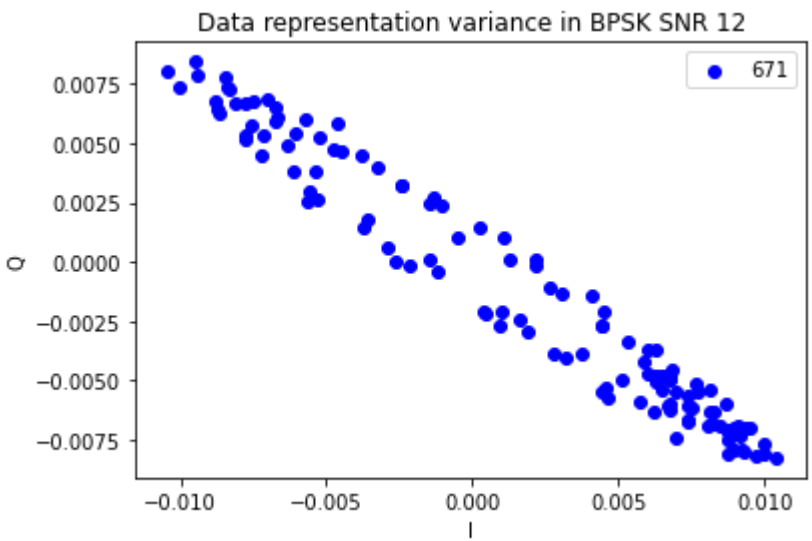
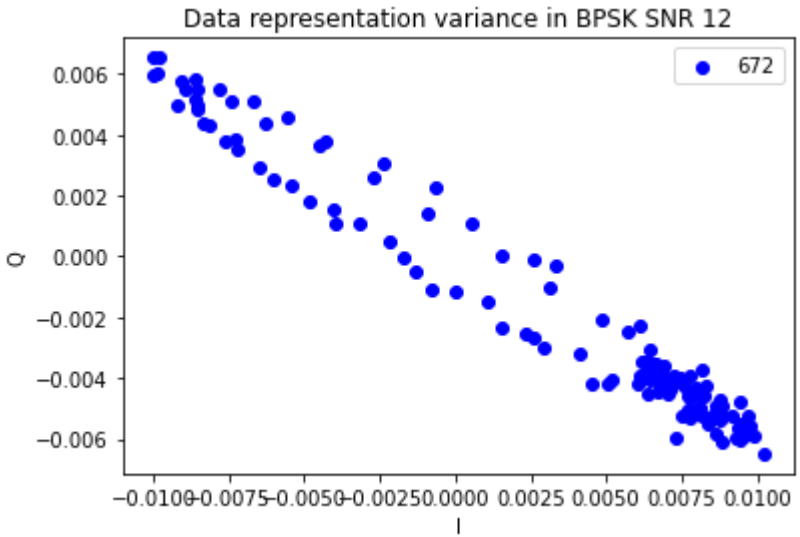
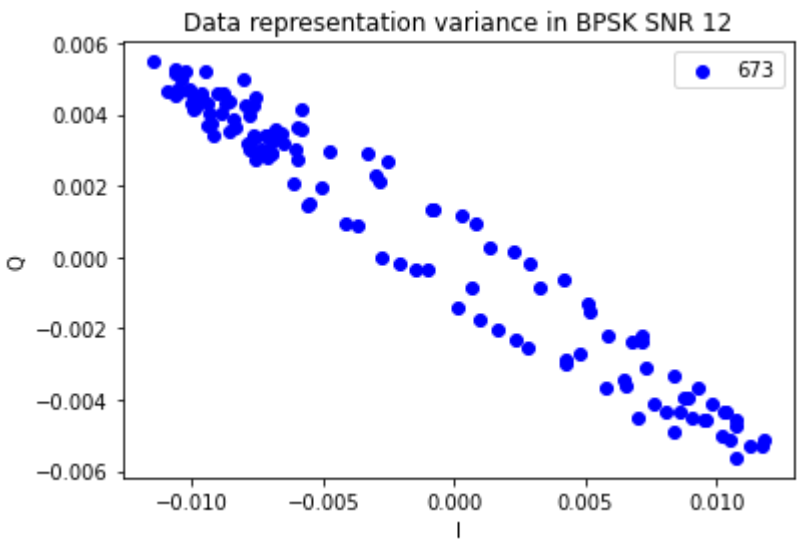
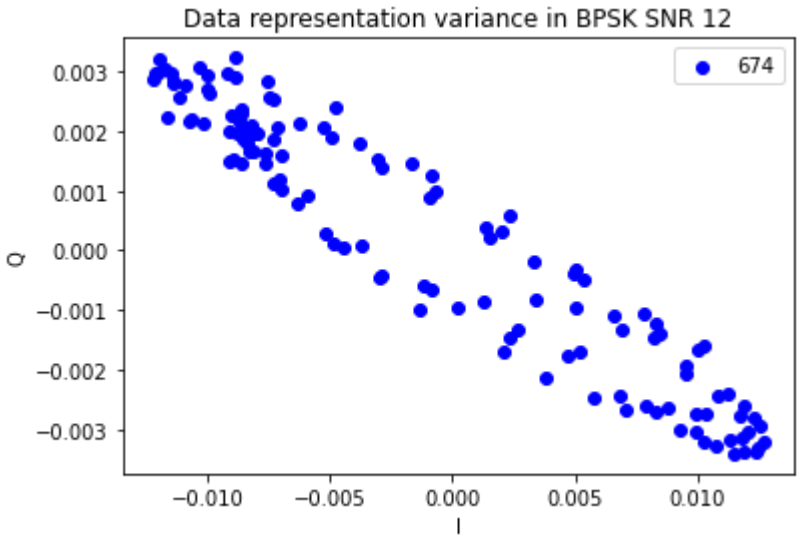
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I

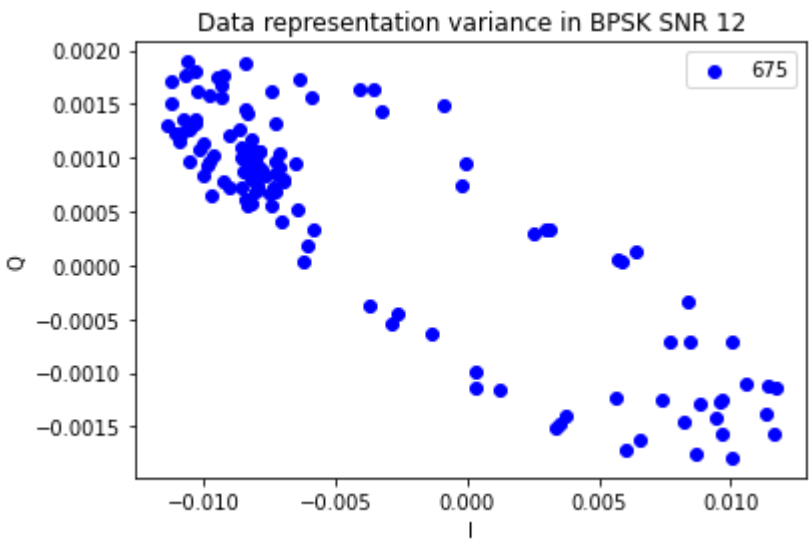

Data representation variance in BPSK SNR 12
670
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

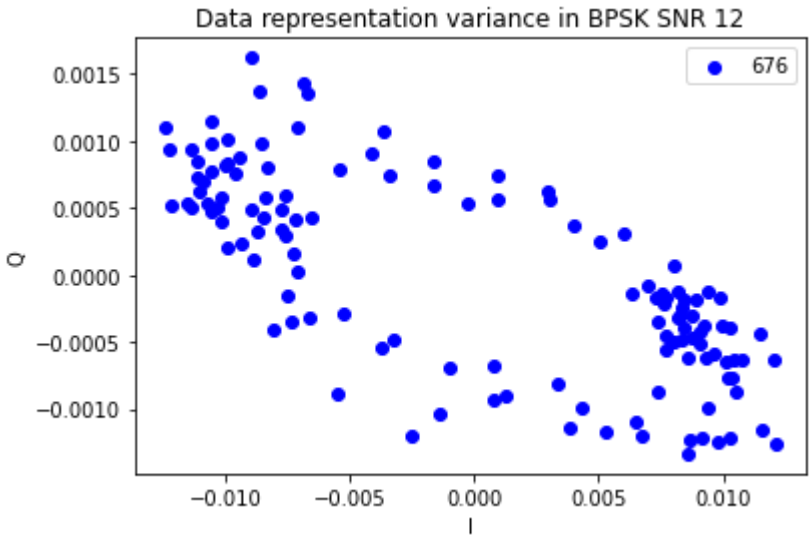

Data representation variance in BPSK SNR 12
671
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.010 −0.005 0.000 0.005 0.010
I

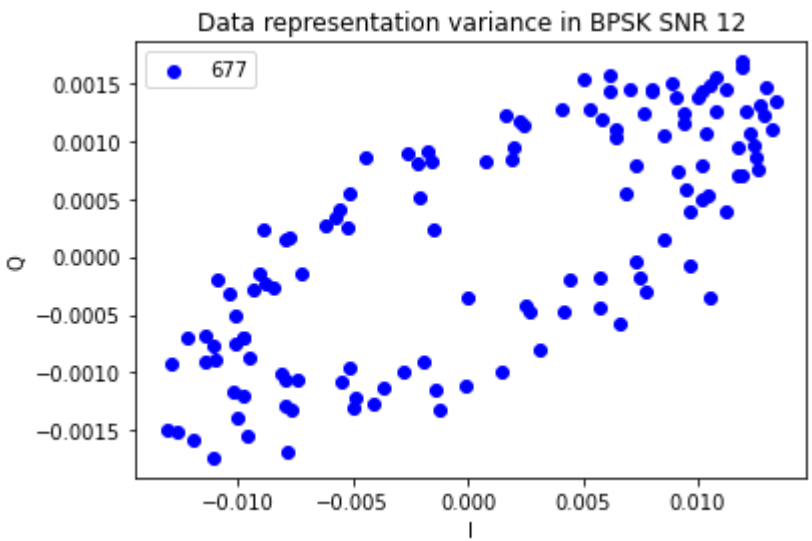

Data representation variance in BPSK SNR 12
672
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I

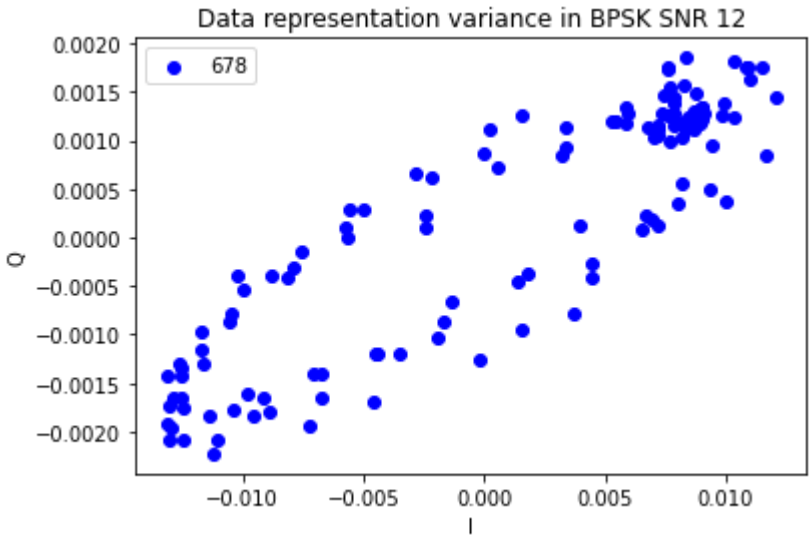

Data representation variance in BPSK SNR 12
673
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

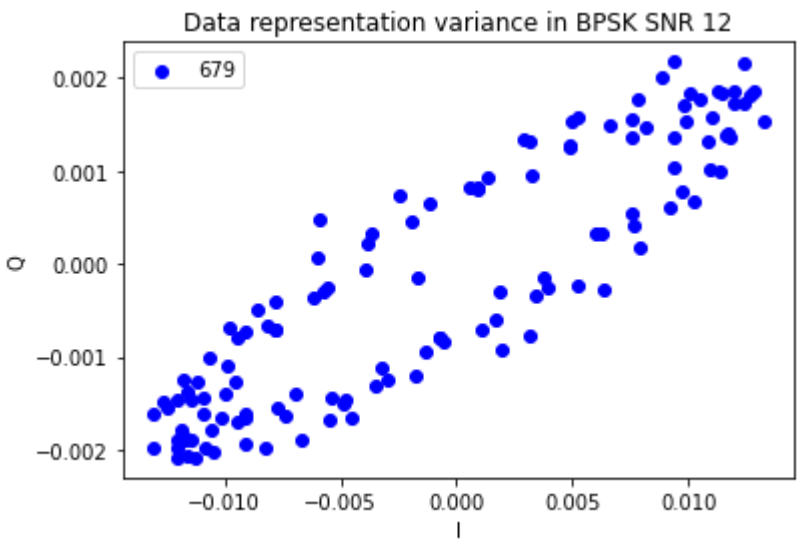

Data representation variance in BPSK SNR 12
674
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
675
0.0020
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
676
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
677
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
678
0.0020
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
−0.0020
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
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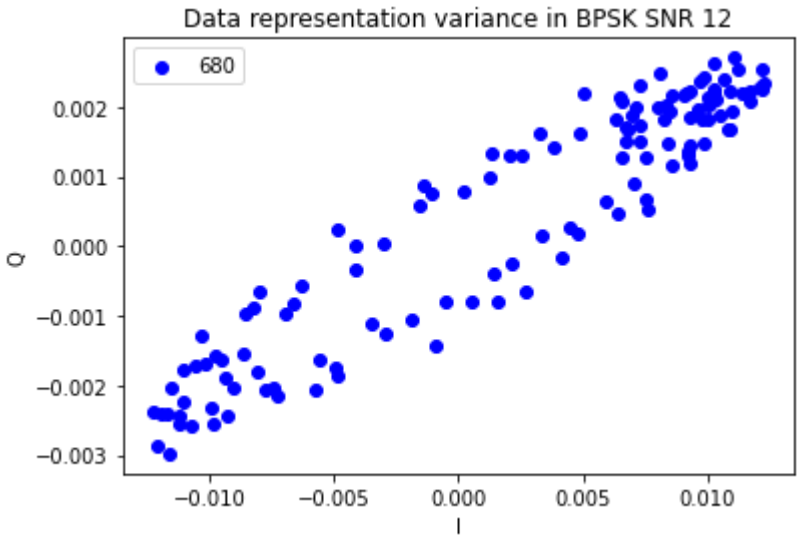
0.005
0.010
I


Data representation variance in BPSK SNR 12
680
0.002
0.001
0.000
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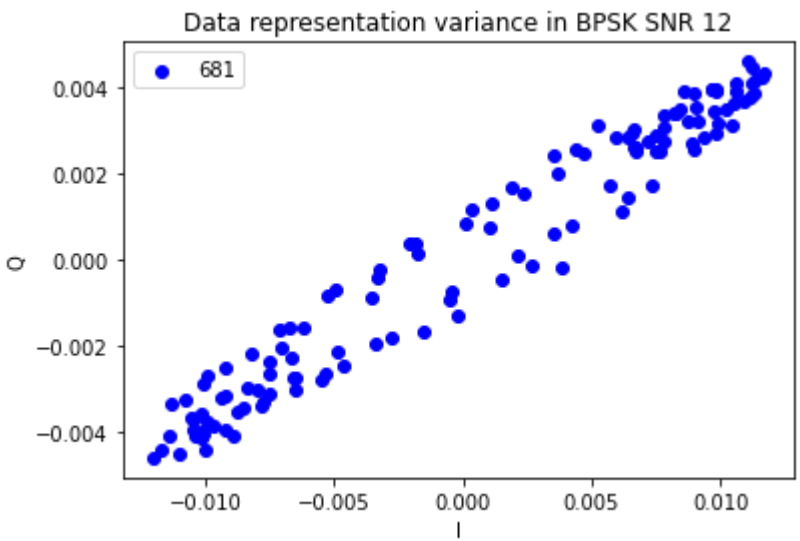
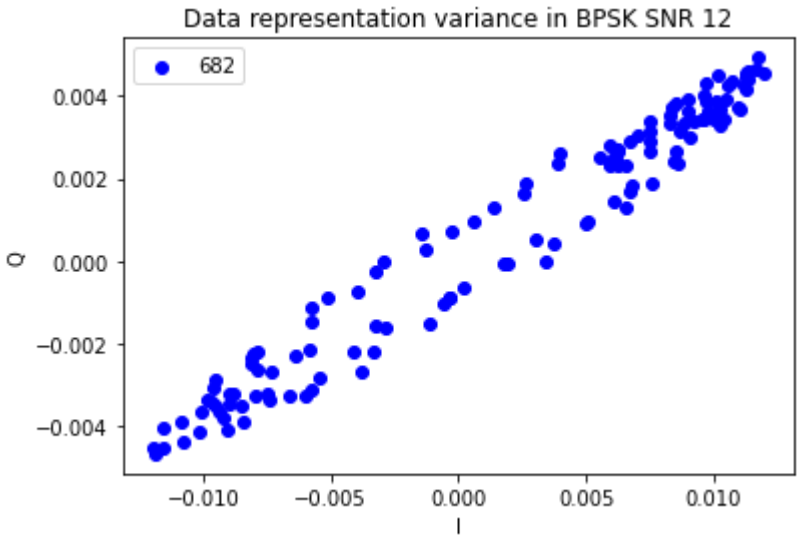
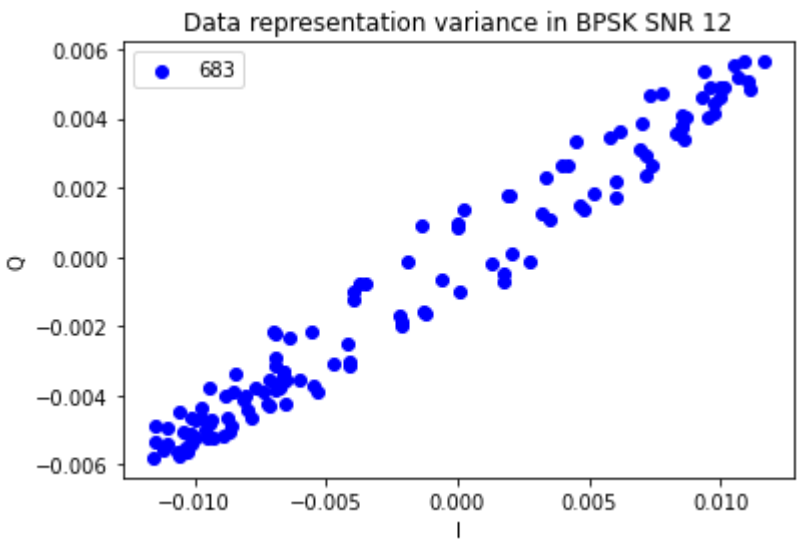
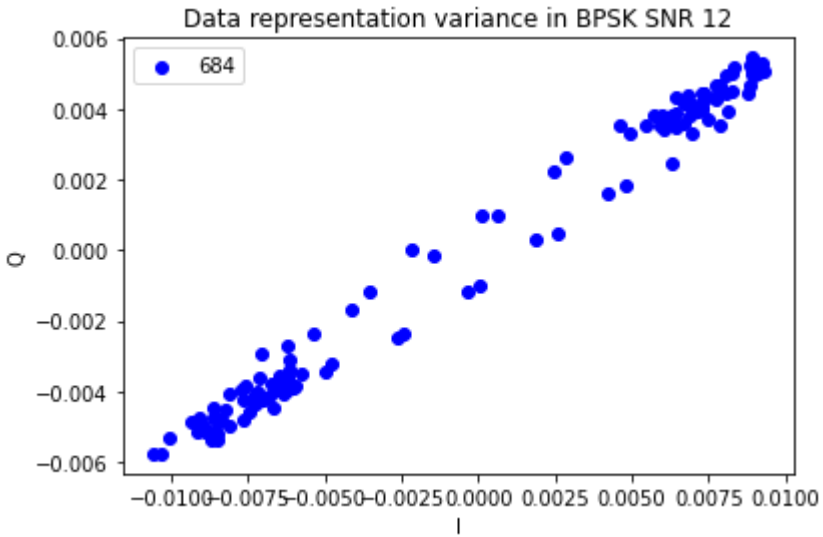
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
681
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
682
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
683
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
684
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
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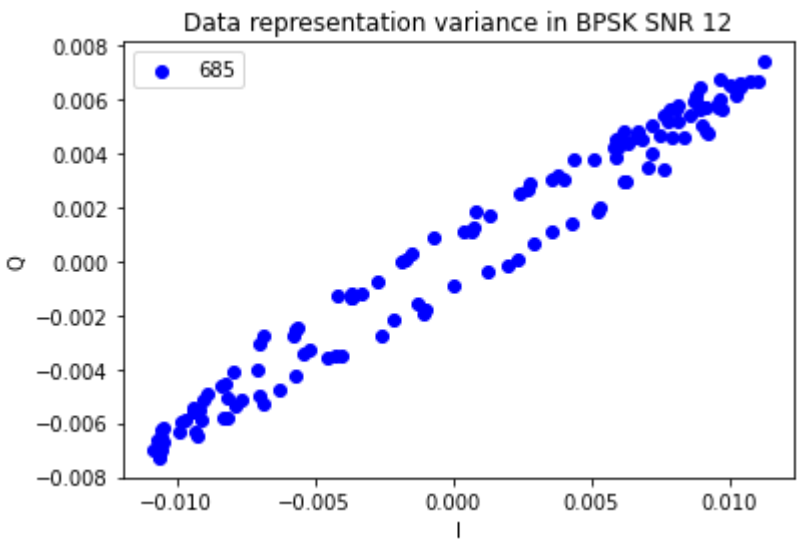
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I


Data representation variance in BPSK SNR 12
685
0.008
0.006
0.004
0.002
0.000
−0.002
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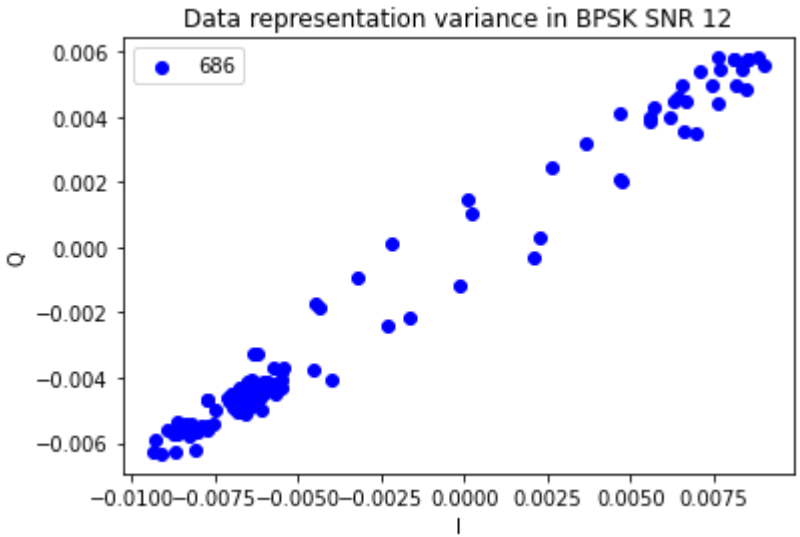
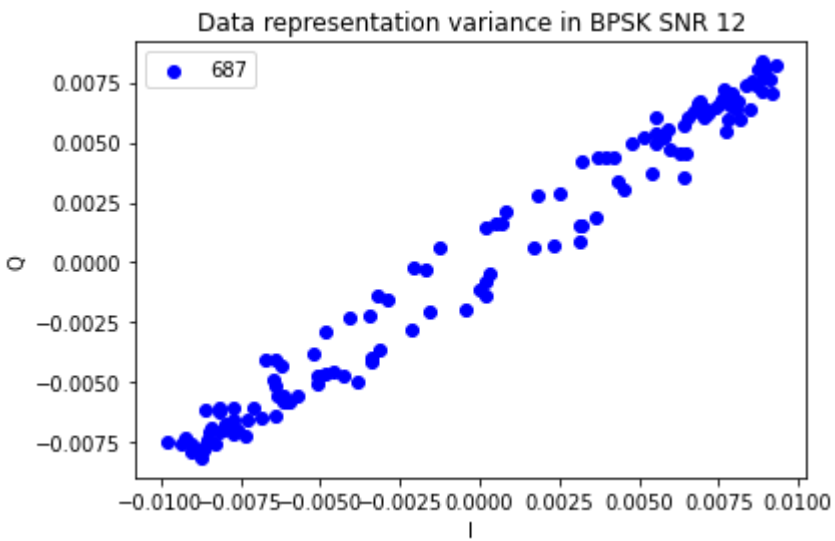
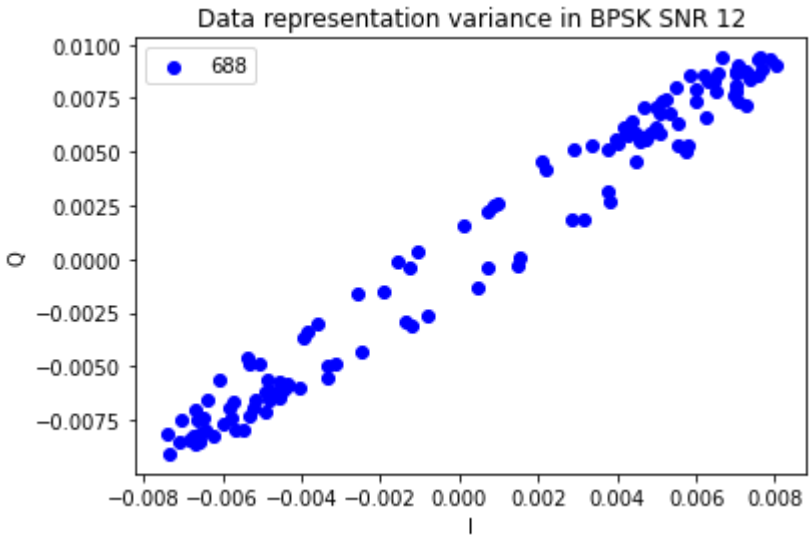
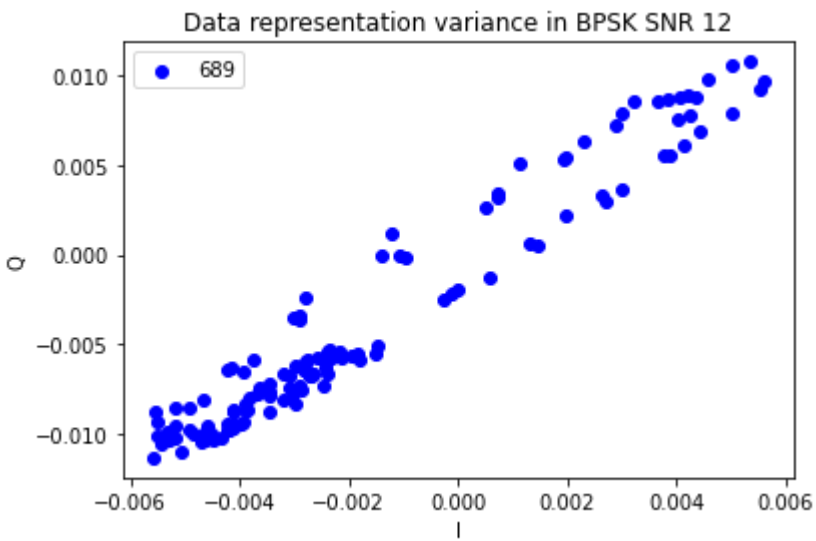
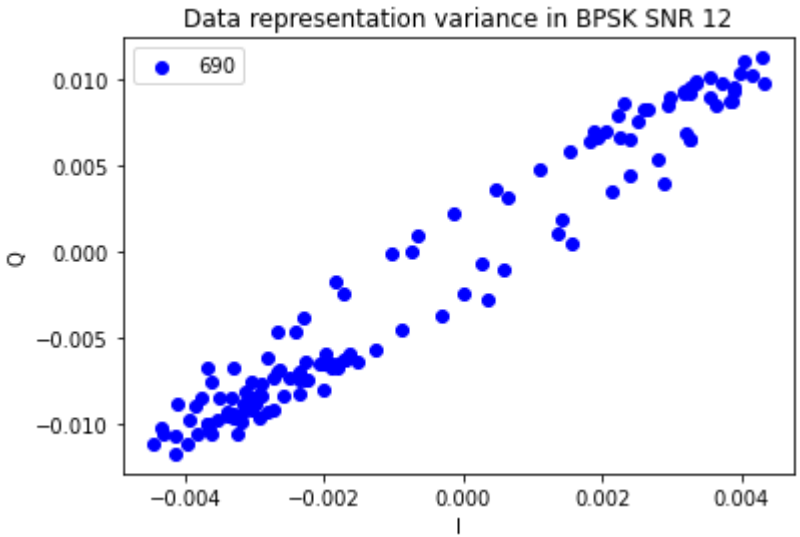
−0.006
−0.008
Q
−0.010
−0.005
0.000
0.005
0.010
I

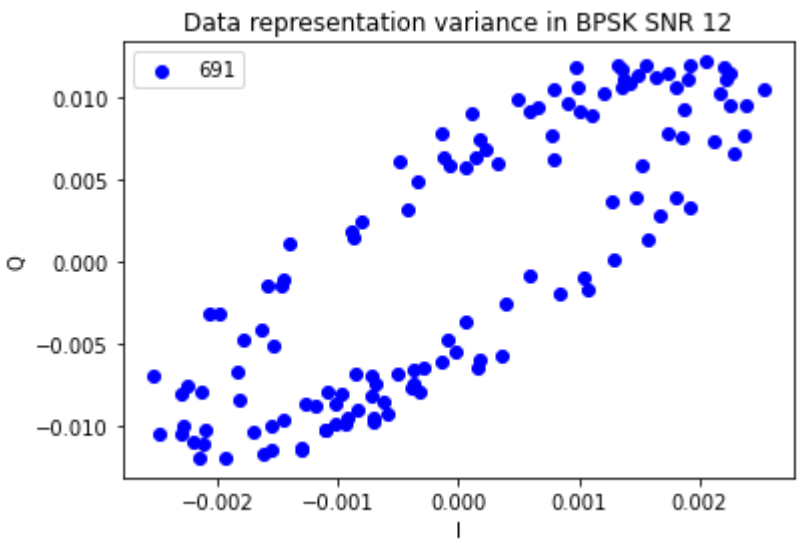

Data representation variance in BPSK SNR 12
686
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

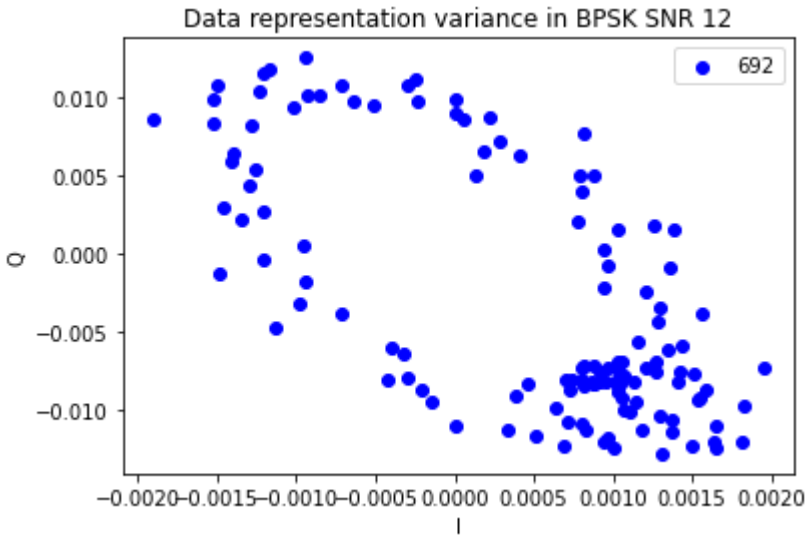

Data representation variance in BPSK SNR 12
687
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

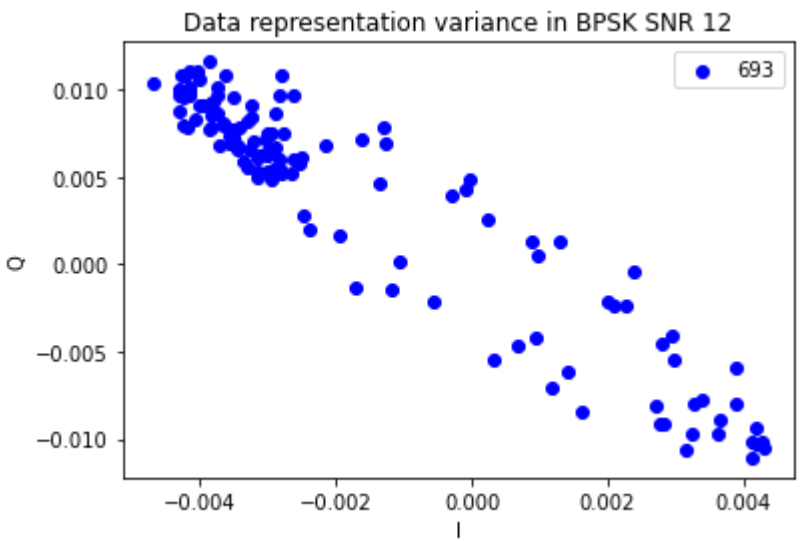

Data representation variance in BPSK SNR 12
688
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

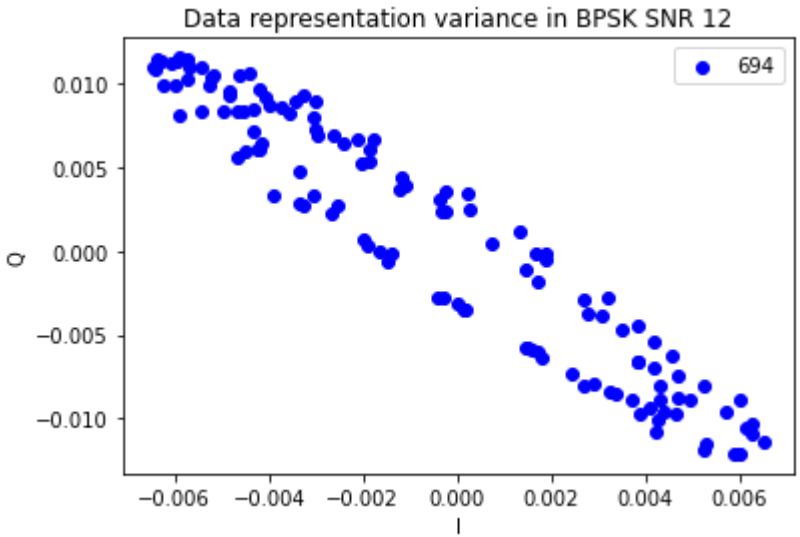

Data representation variance in BPSK SNR 12
689
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I

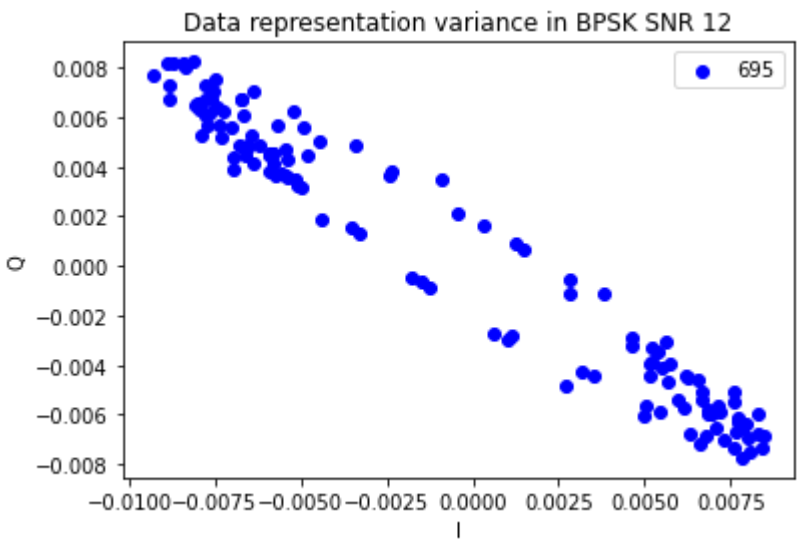

Data representation variance in BPSK SNR 12
690
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

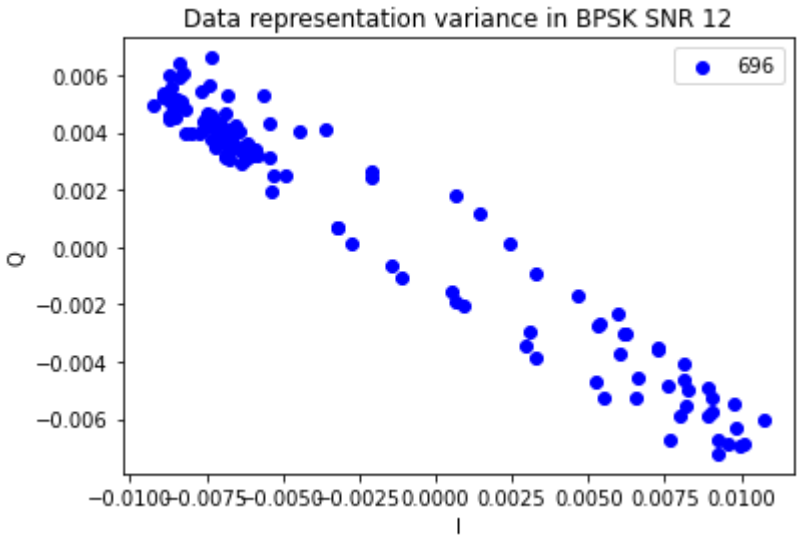

Data representation variance in BPSK SNR 12
691
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

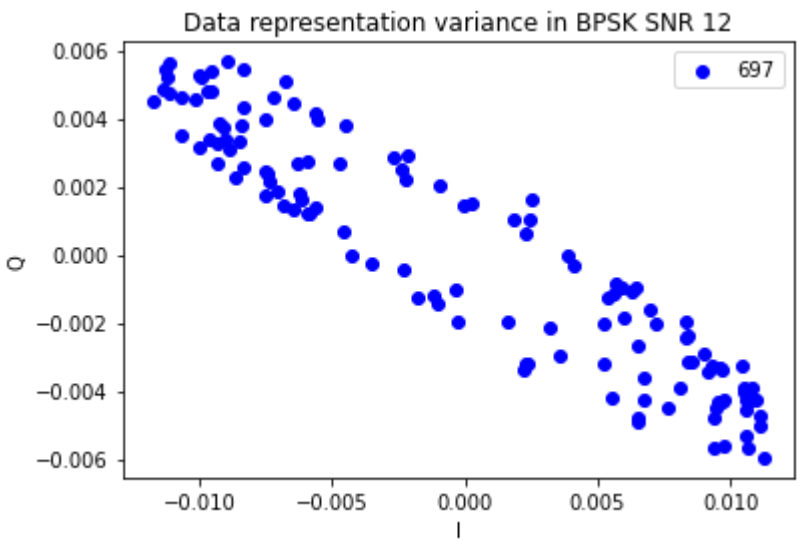

Data representation variance in BPSK SNR 12
692
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020 −0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
I

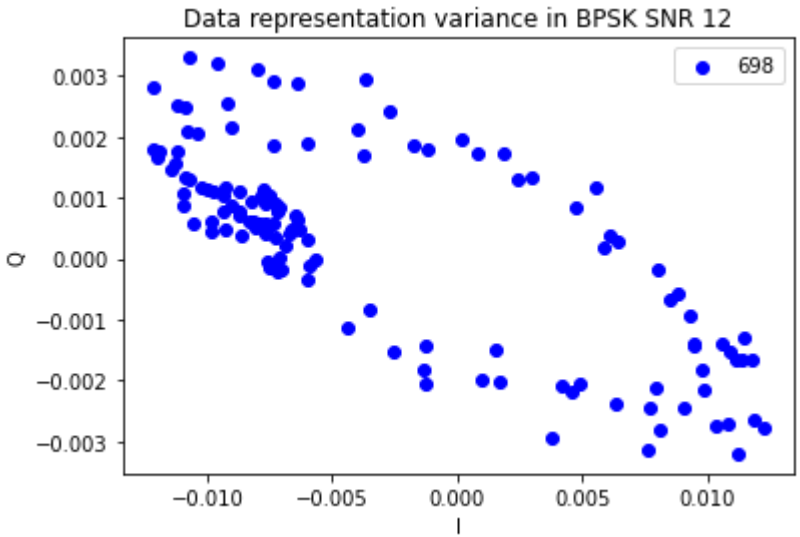

Data representation variance in BPSK SNR 12
693
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I

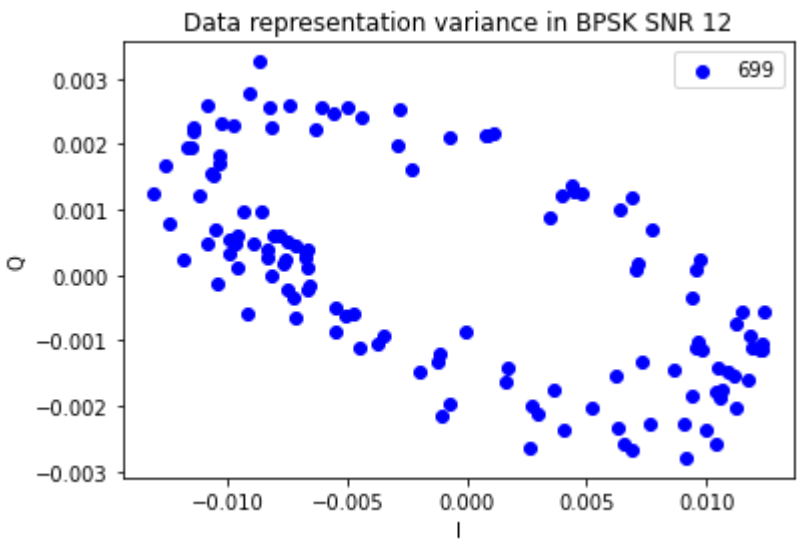

Data representation variance in BPSK SNR 12
694
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

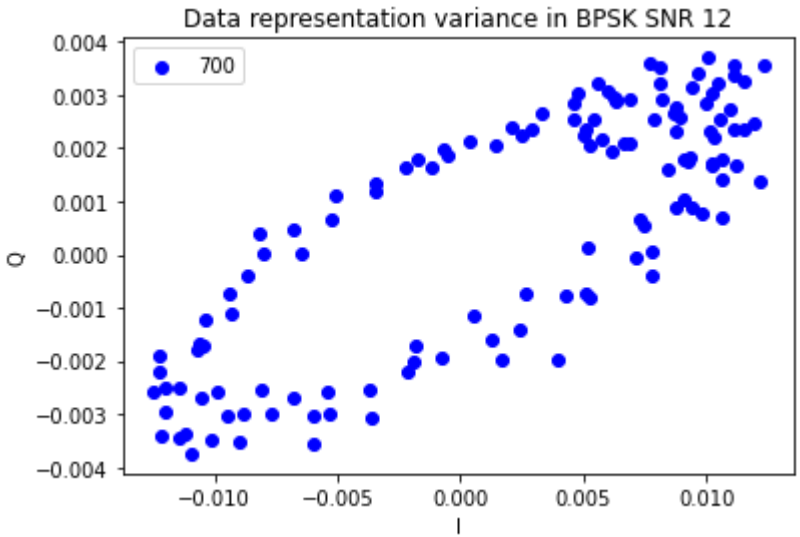

Data representation variance in BPSK SNR 12
695
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
I

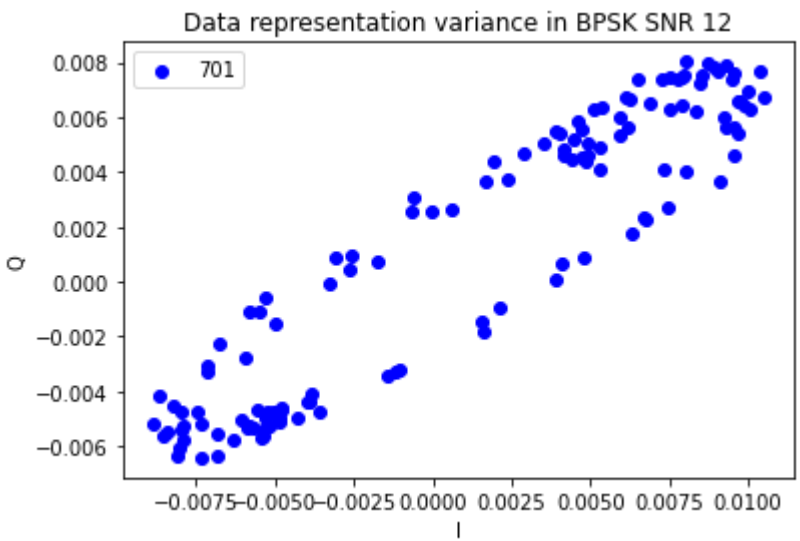

Data representation variance in BPSK SNR 12
696
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

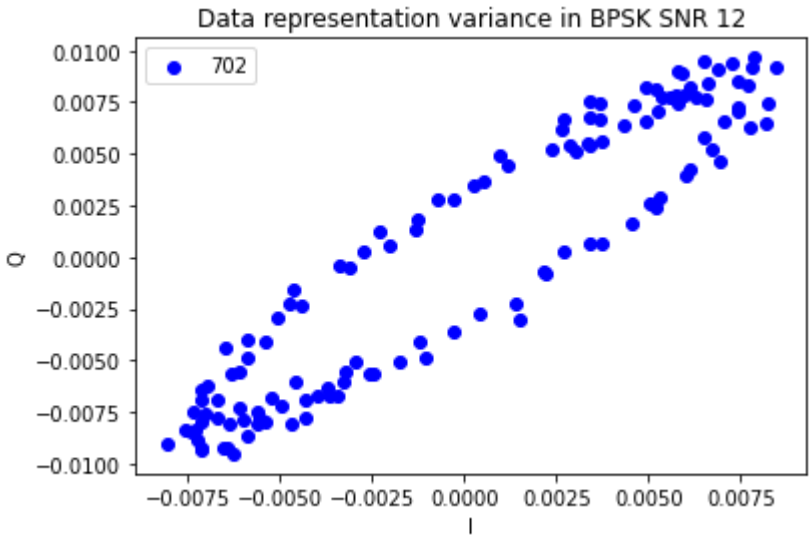

Data representation variance in BPSK SNR 12
697
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010 −0.005 0.000 0.005 0.010
I


Data representation variance in BPSK SNR 12
698
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
699
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
700
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
701
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I


Data representation variance in BPSK SNR 12
702
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
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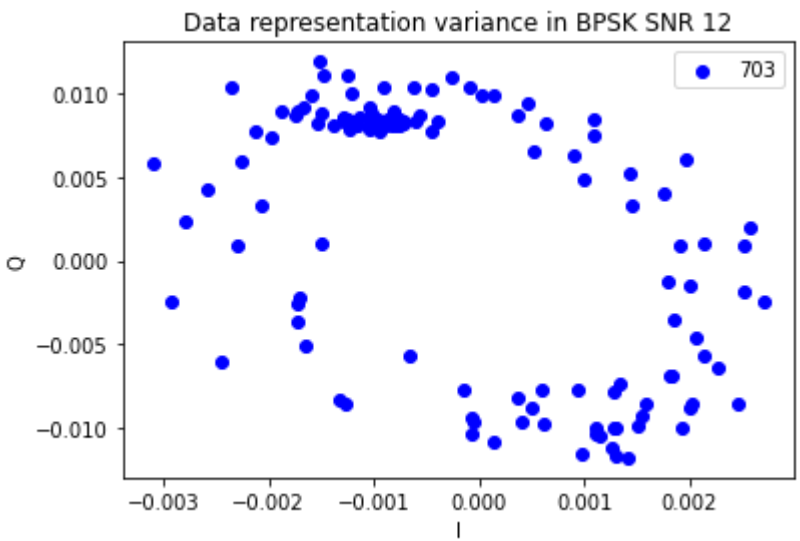
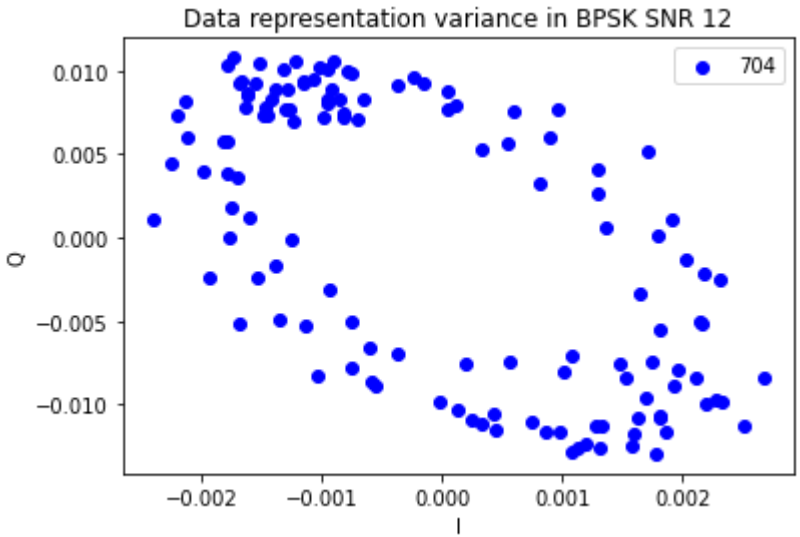
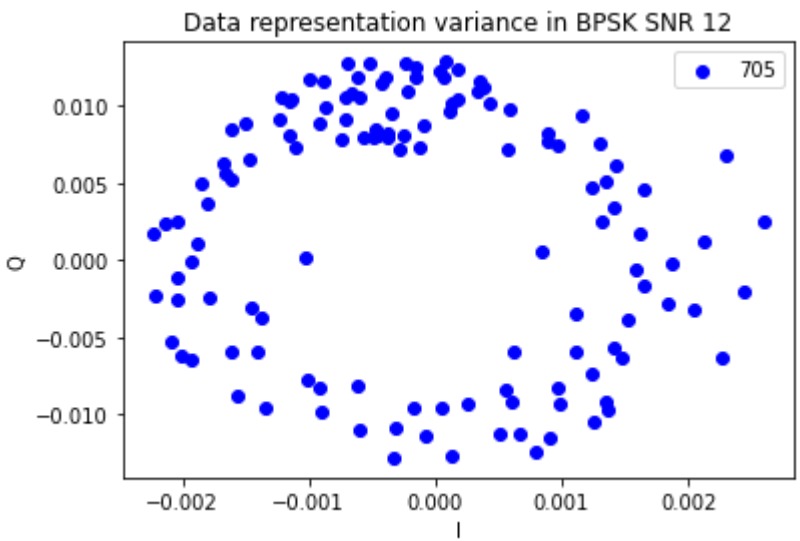
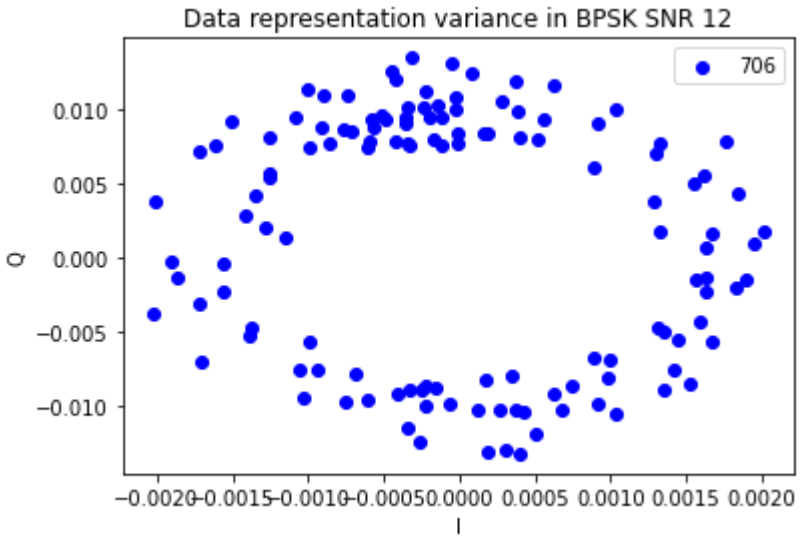

Data representation variance in BPSK SNR 12
703
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002
I


Data representation variance in BPSK SNR 12
704
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
705
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
706
0.010
0.005
0.000
−0.005
−0.010
Q
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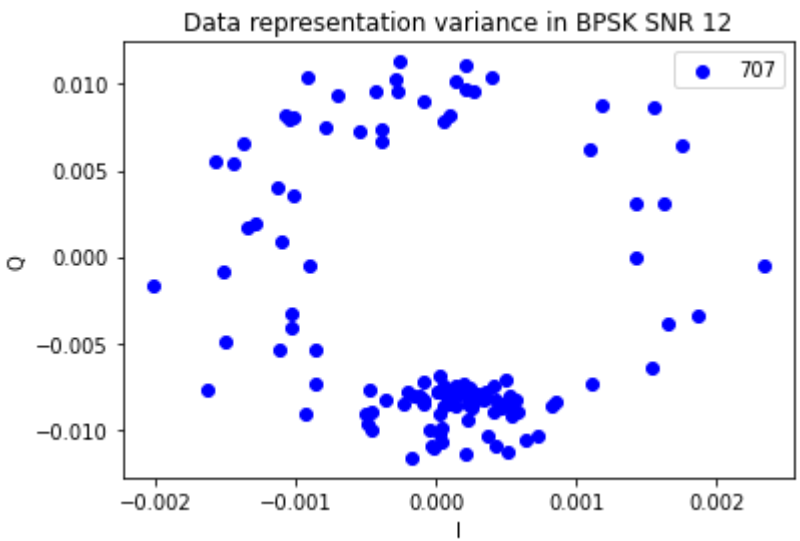
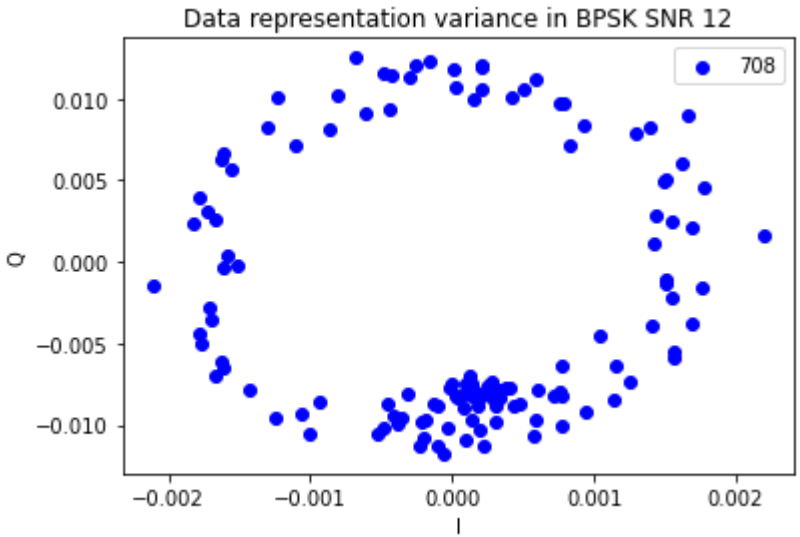
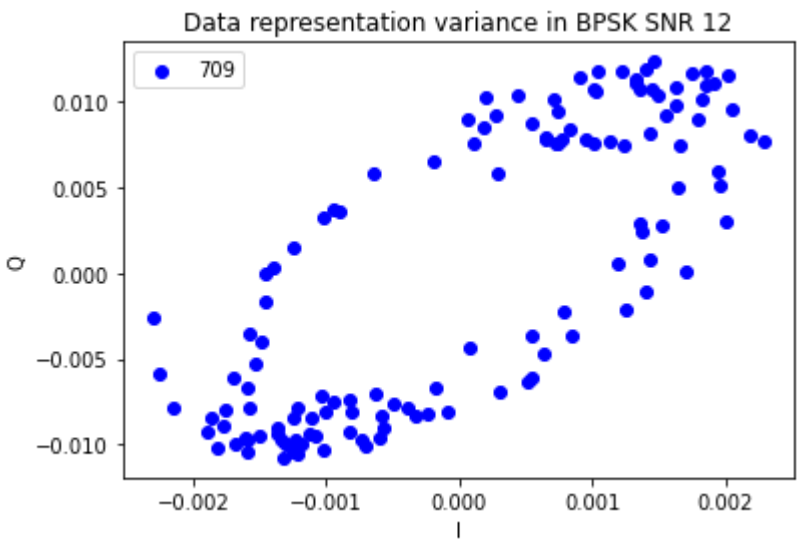
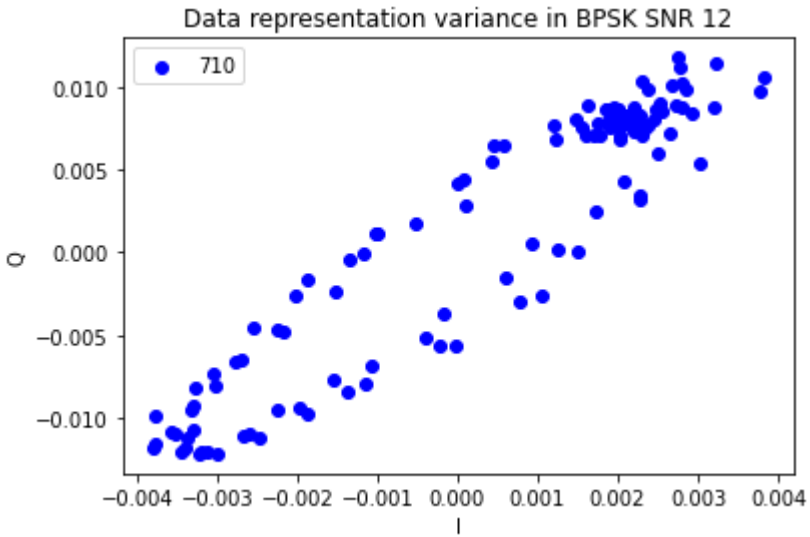
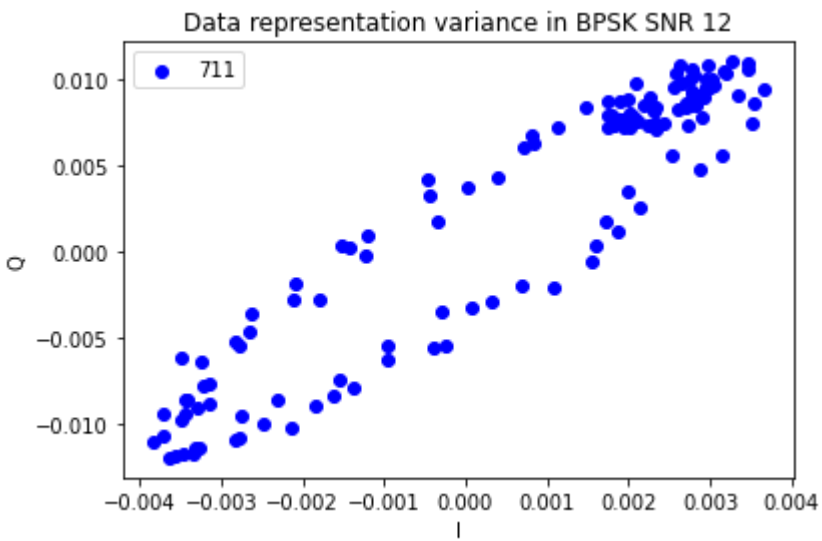
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
0.0020
I

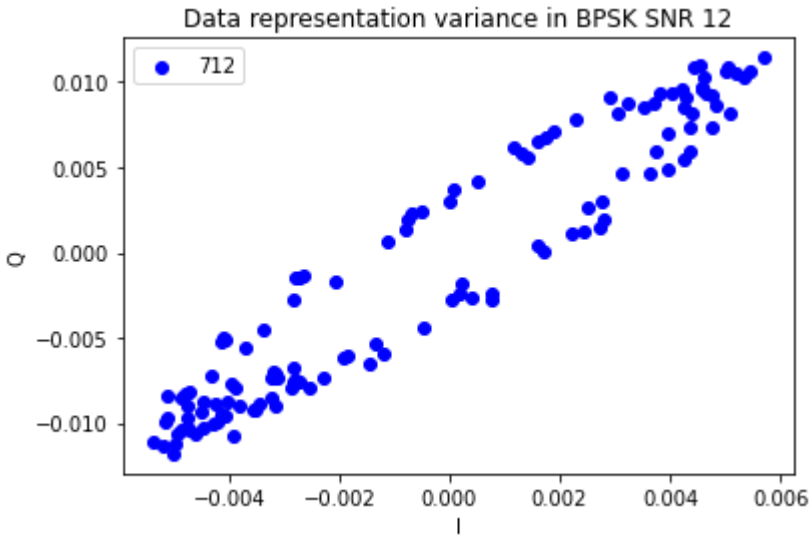

Data representation variance in BPSK SNR 12
707
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

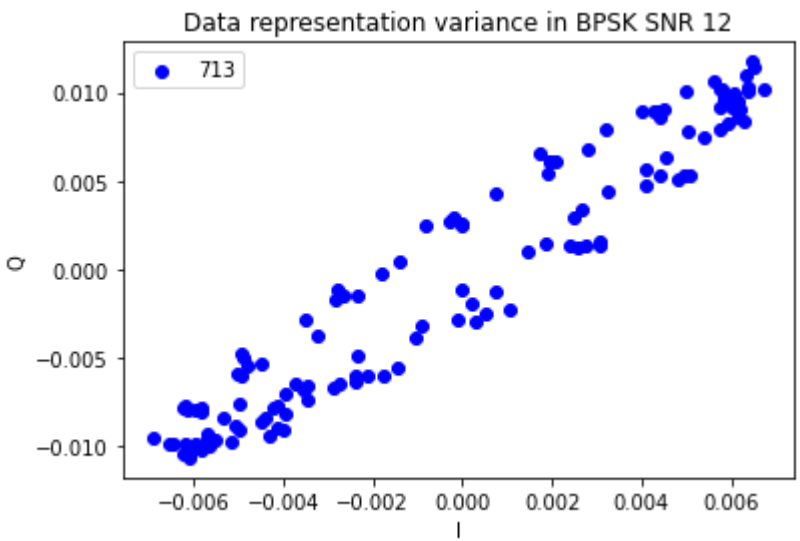

Data representation variance in BPSK SNR 12
708
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

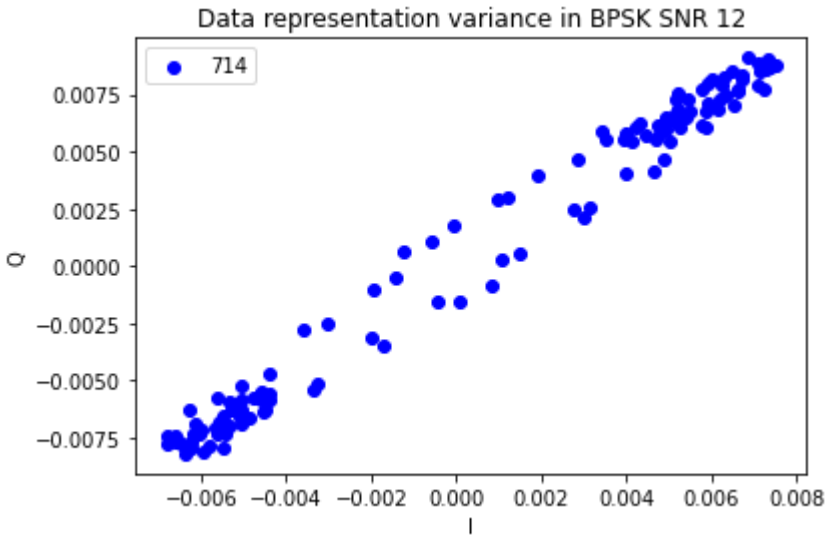

Data representation variance in BPSK SNR 12
709
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
710
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I


Data representation variance in BPSK SNR 12
711
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I


Data representation variance in BPSK SNR 12
712
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
713
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
714
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
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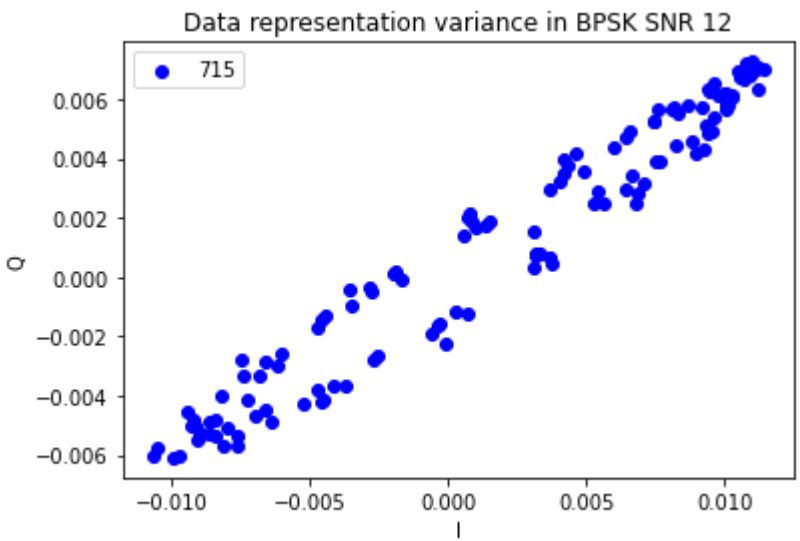
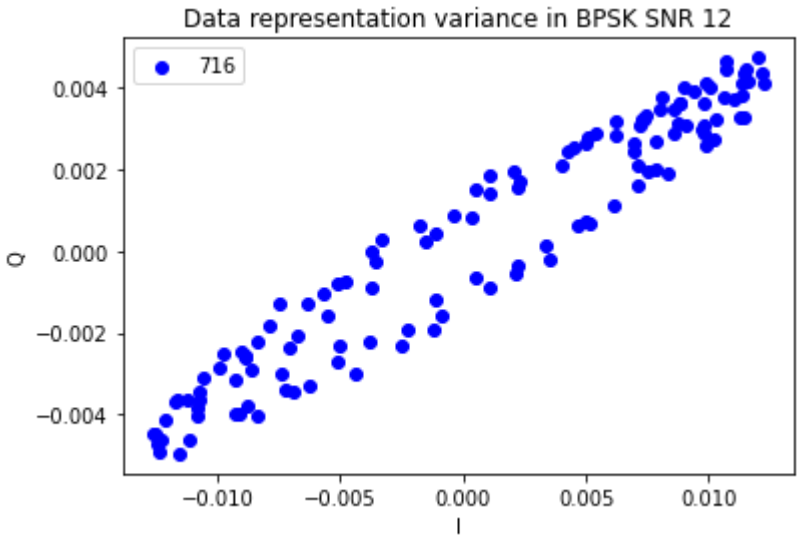

Data representation variance in BPSK SNR 12
715
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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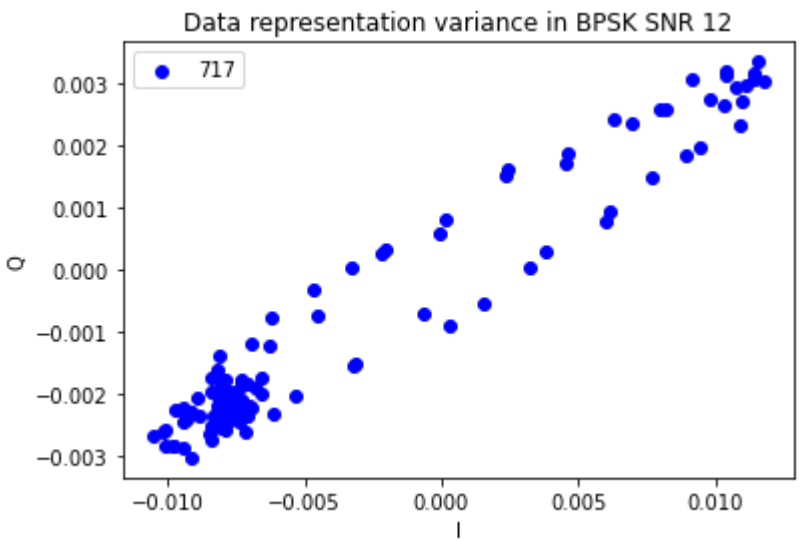
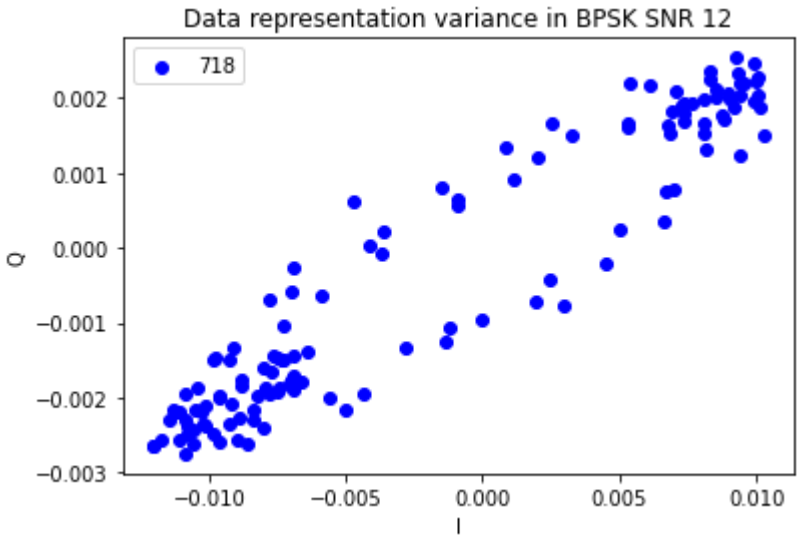
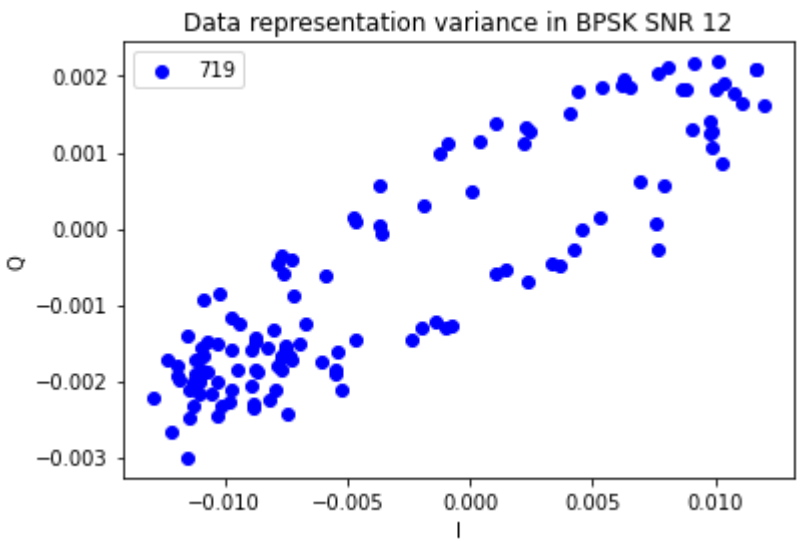
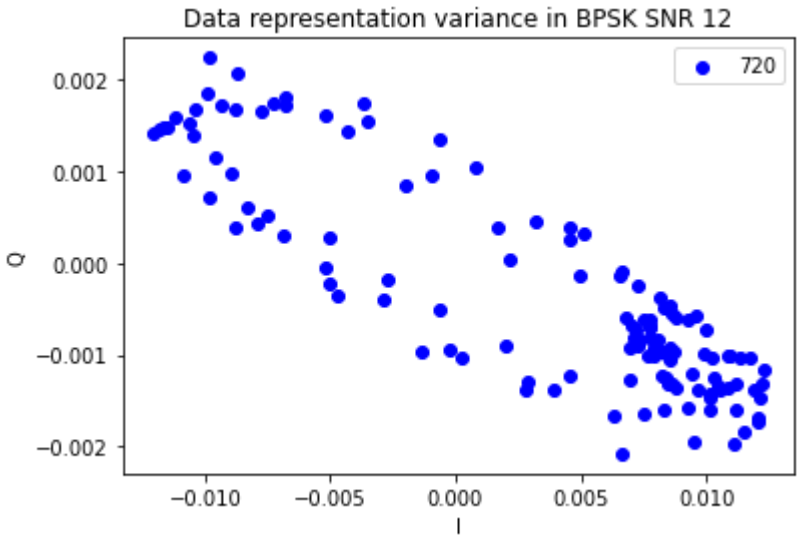
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
717
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
718
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
719
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
720
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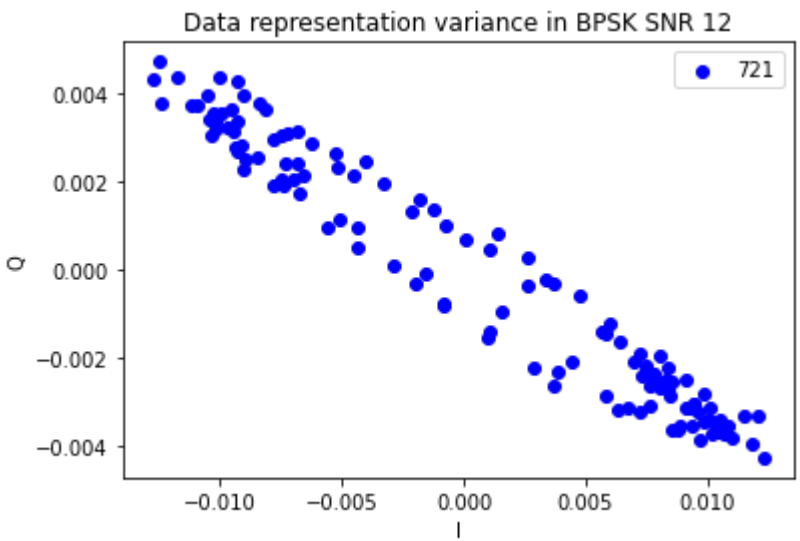
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
721
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0.002
0.000
−0.002
−0.004
Q
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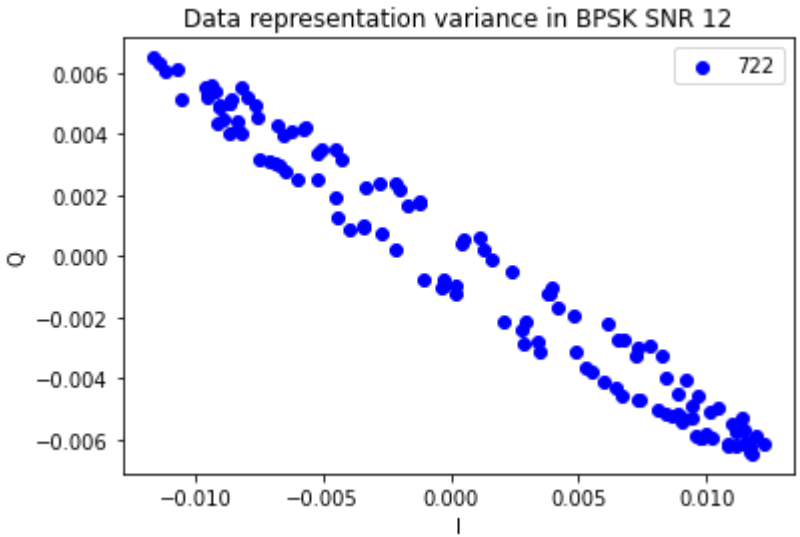
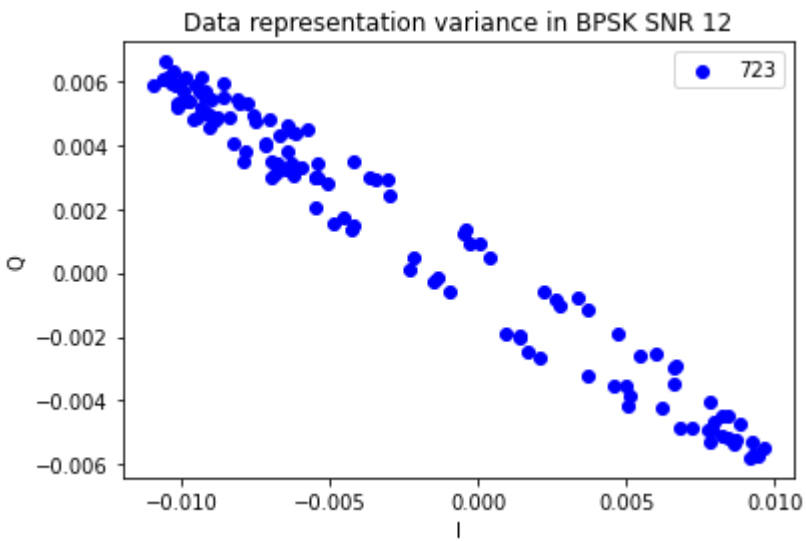
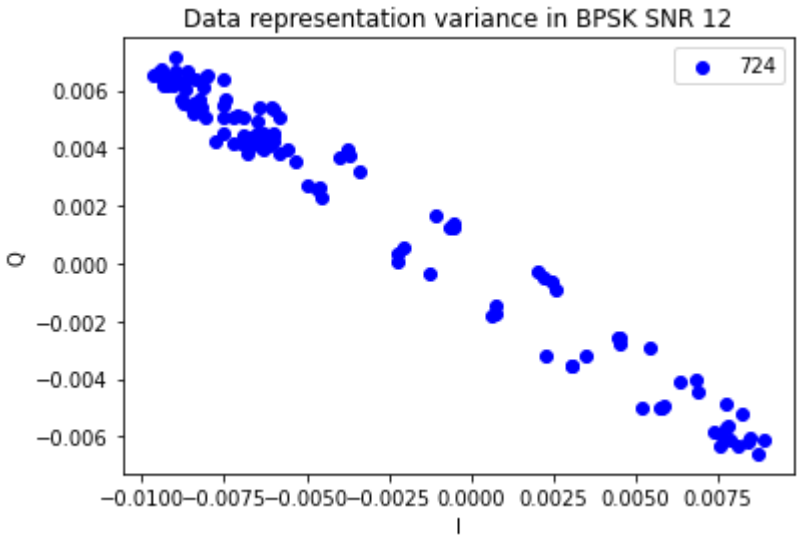
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
722
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
723
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
724
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0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
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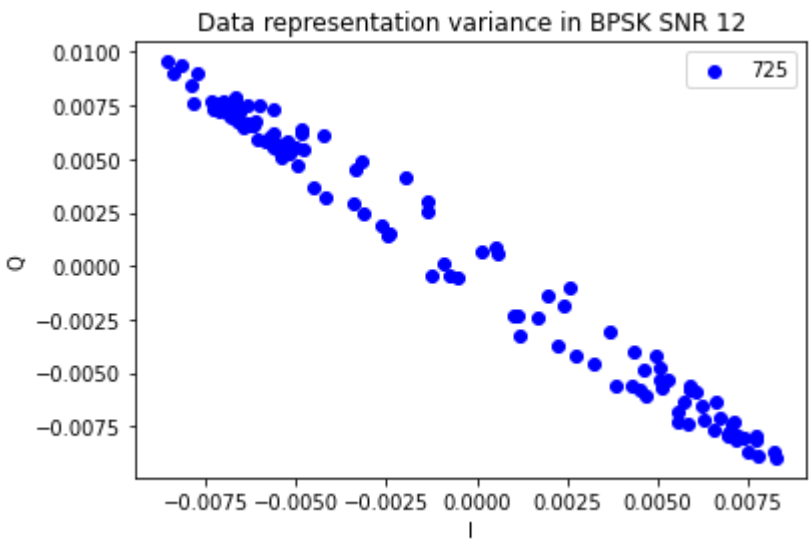
I


Data representation variance in BPSK SNR 12
725
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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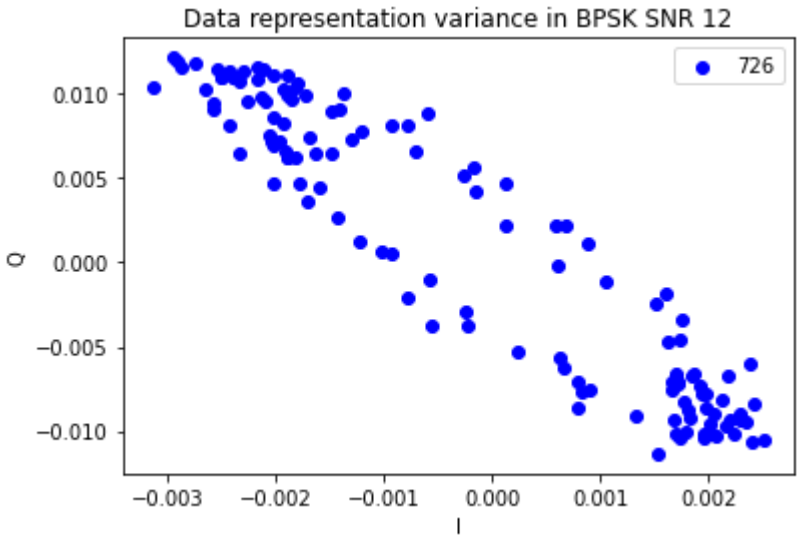
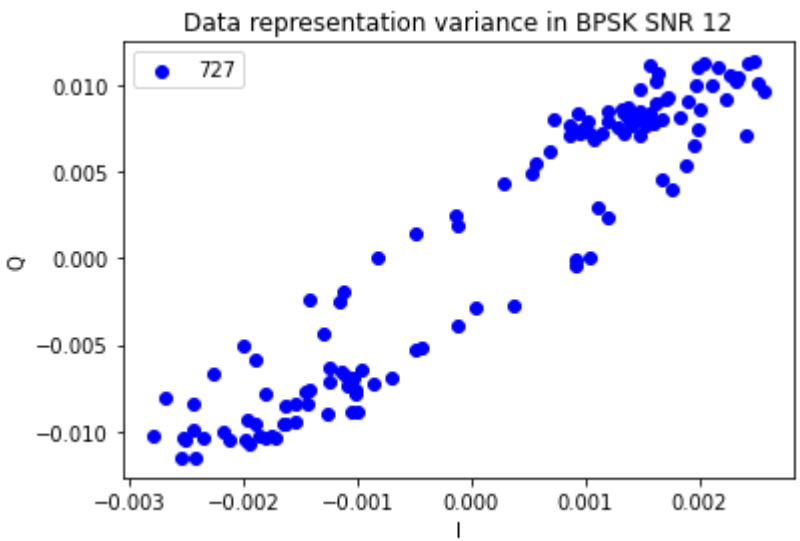
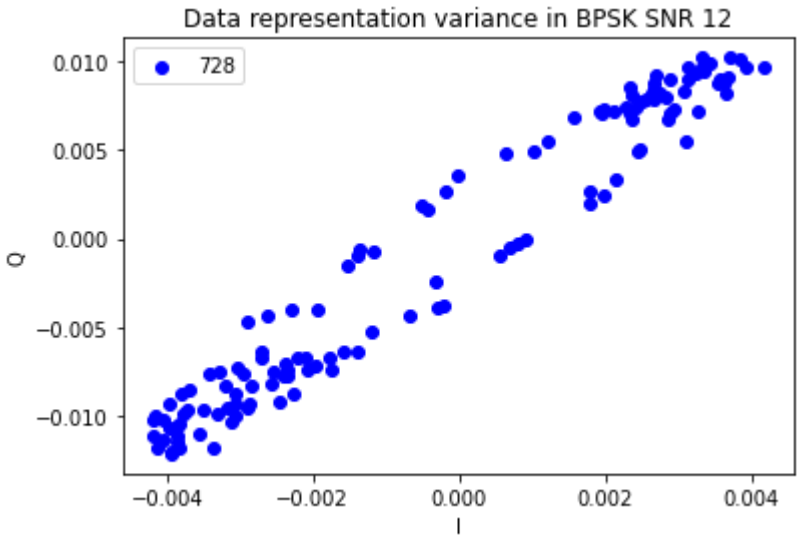
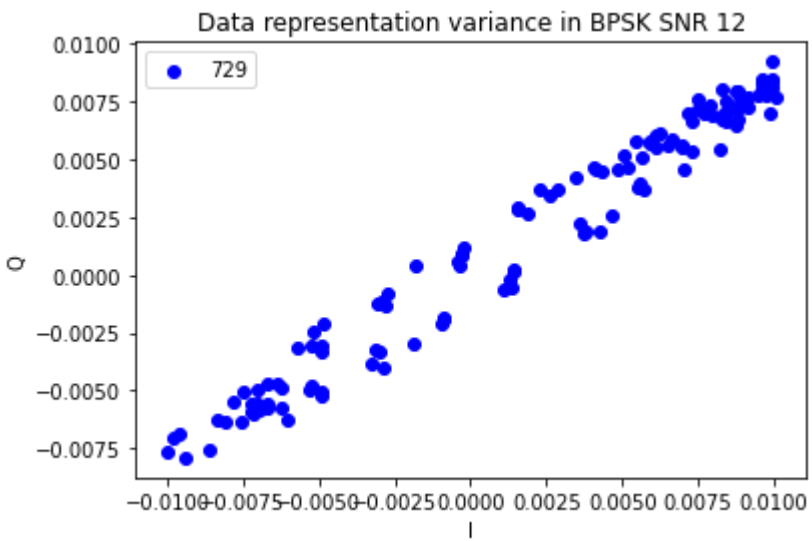
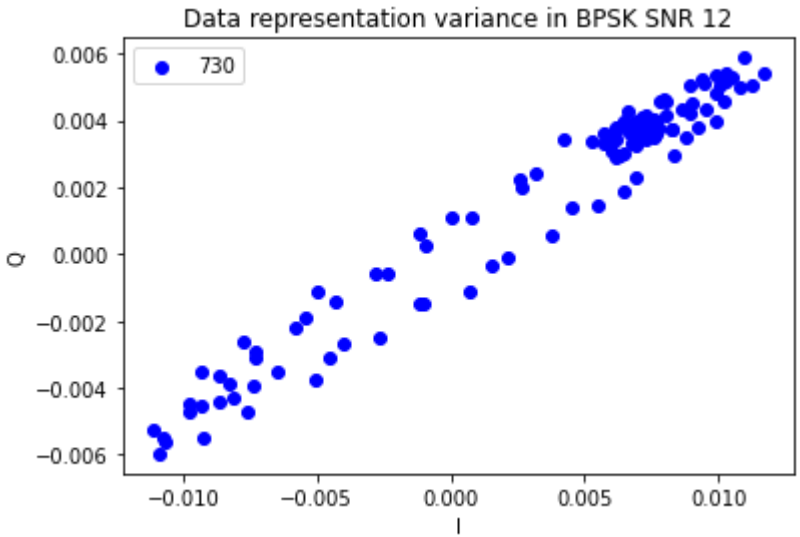
I

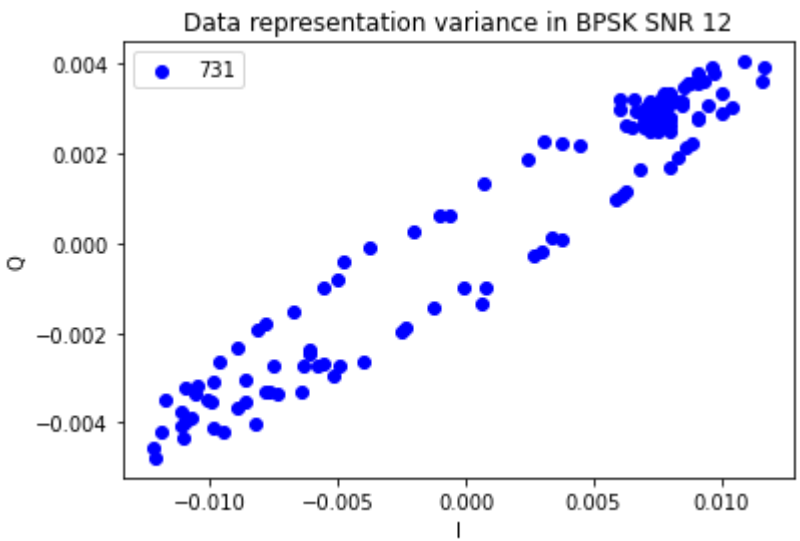

Data representation variance in BPSK SNR 12
726
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I

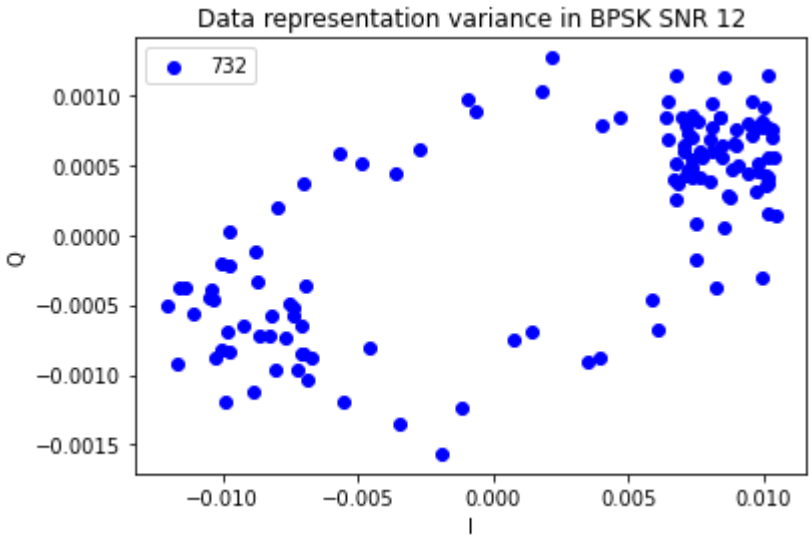

Data representation variance in BPSK SNR 12
727
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
I

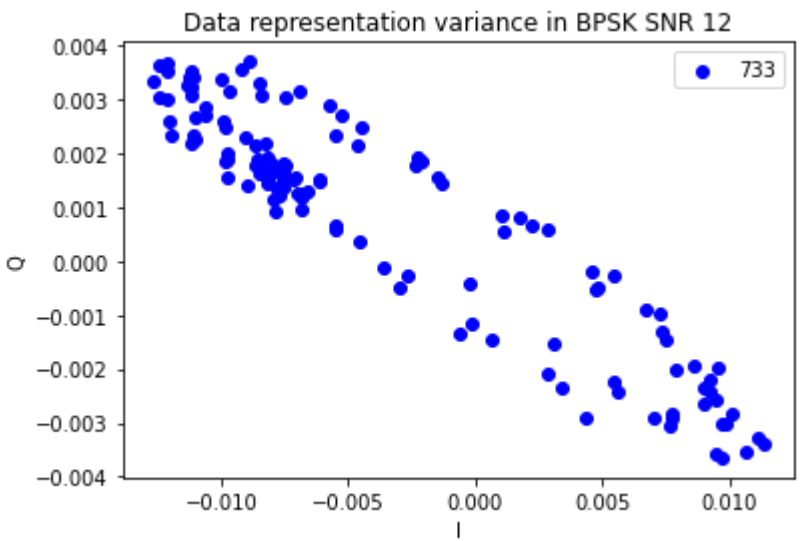

Data representation variance in BPSK SNR 12
728
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

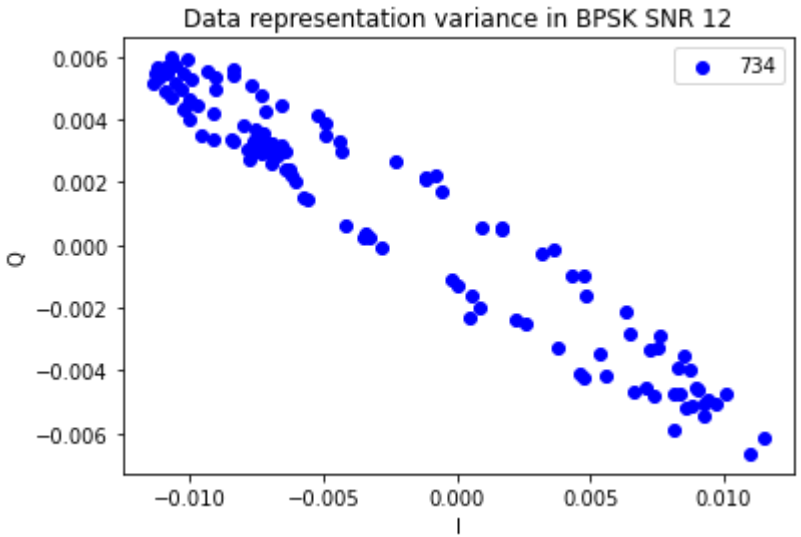

Data representation variance in BPSK SNR 12
729
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I

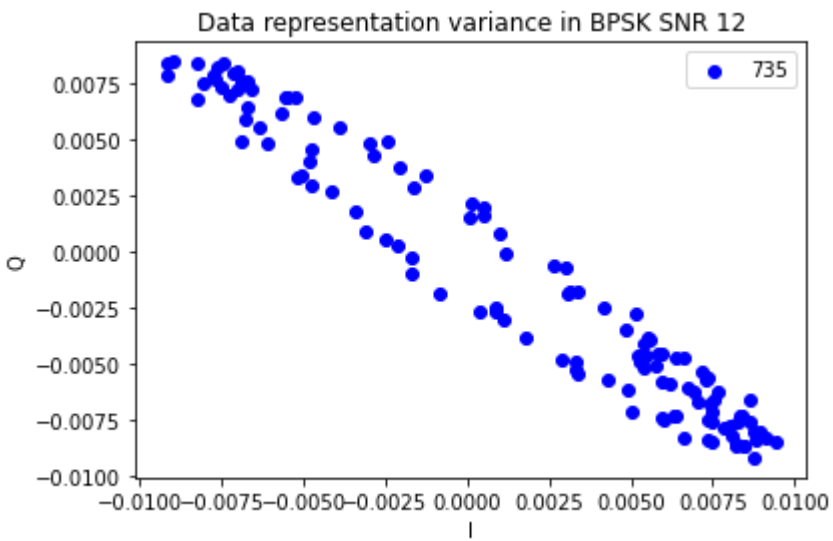

Data representation variance in BPSK SNR 12
730
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

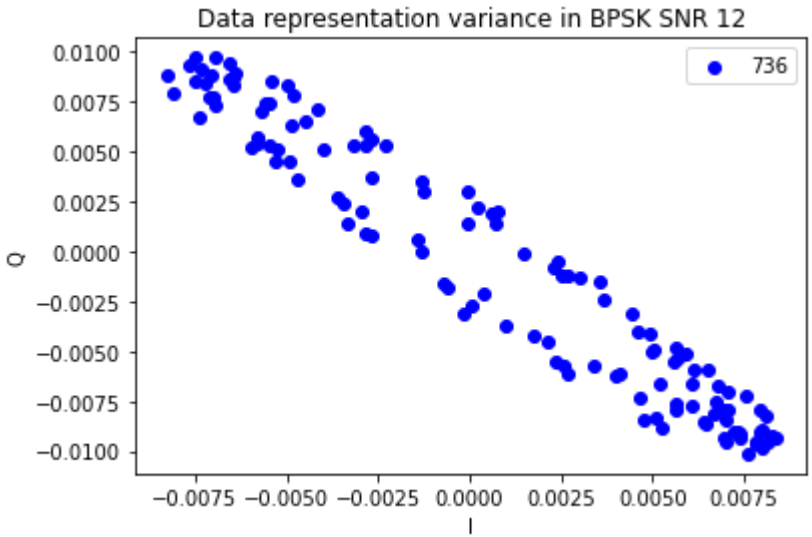

Data representation variance in BPSK SNR 12
731
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

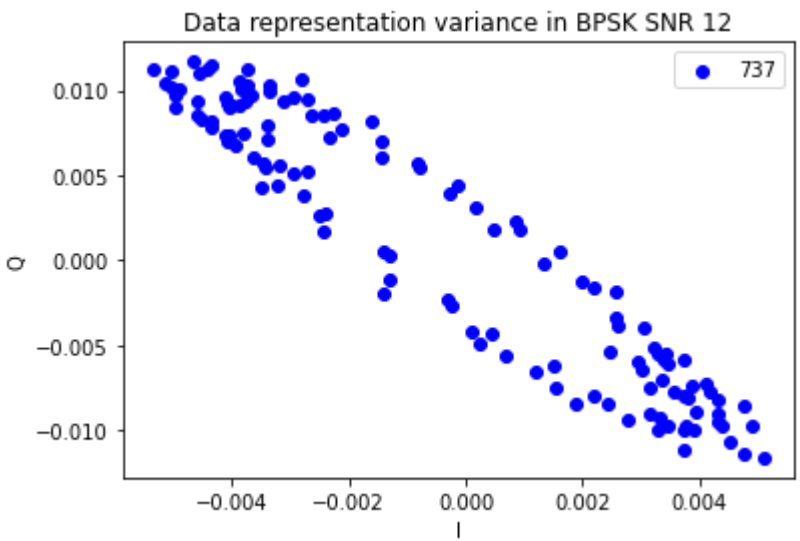

Data representation variance in BPSK SNR 12
732
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I

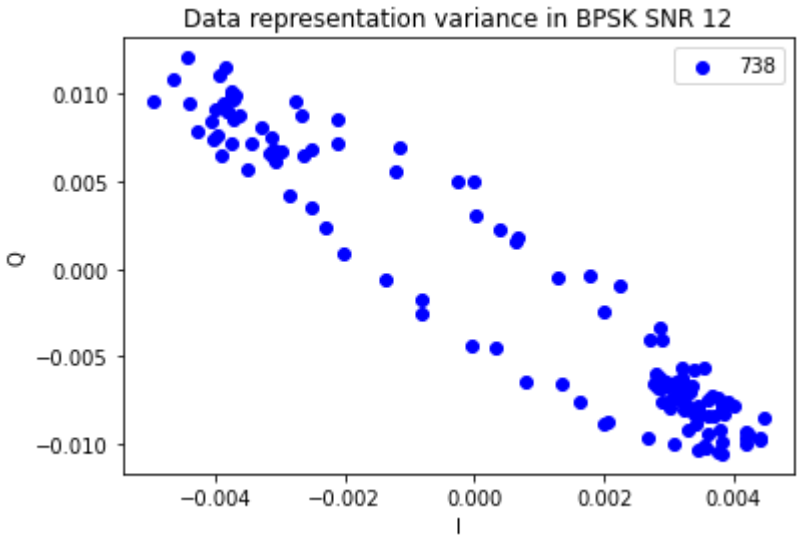

Data representation variance in BPSK SNR 12
733
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

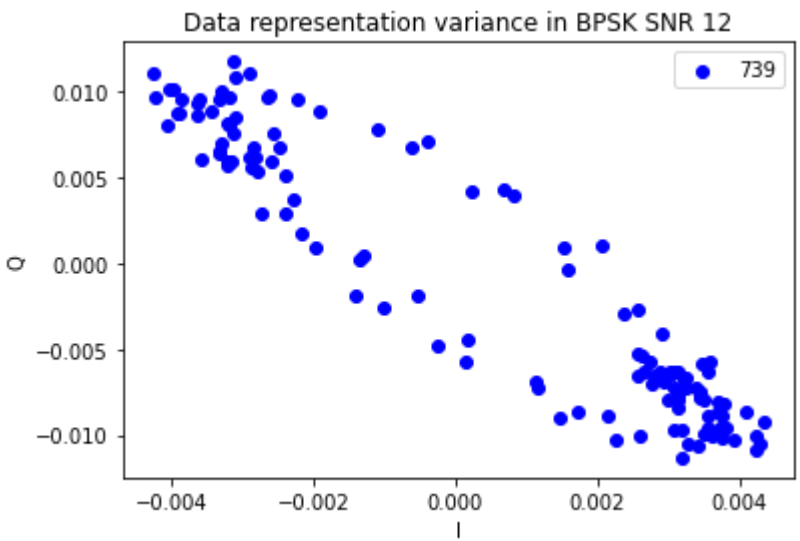

Data representation variance in BPSK SNR 12
734
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

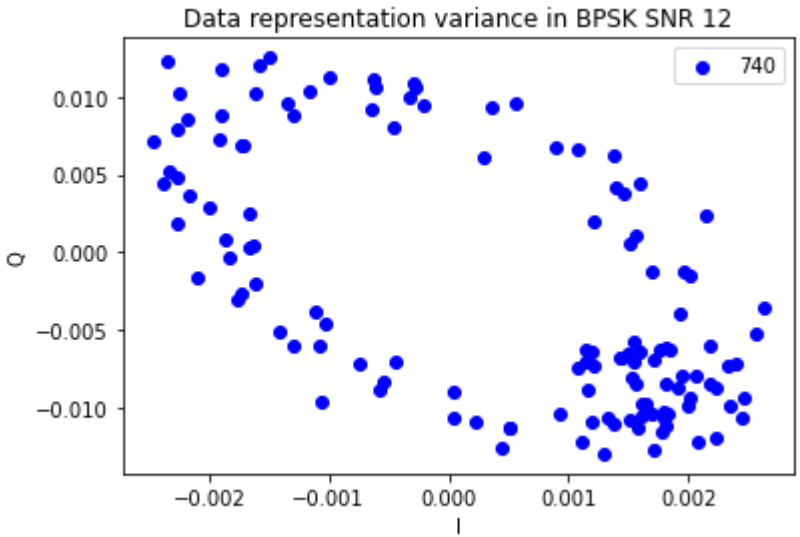

Data representation variance in BPSK SNR 12
735
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0100
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I

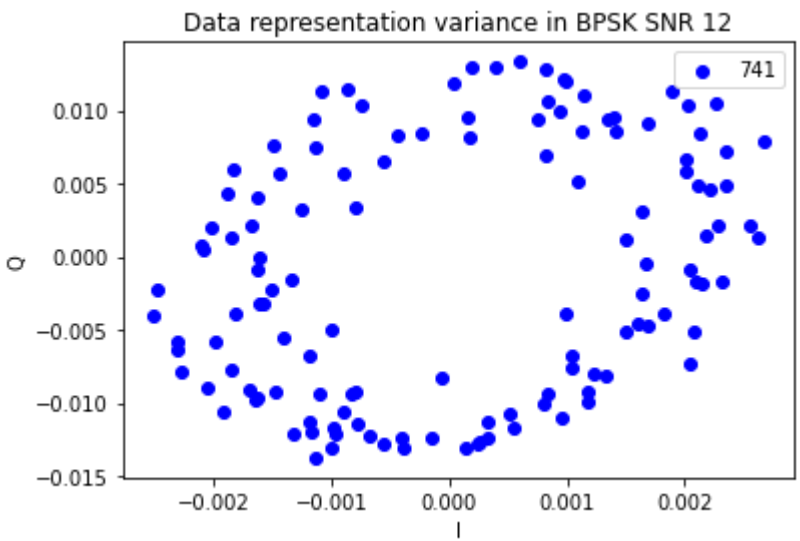

Data representation variance in BPSK SNR 12
736
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

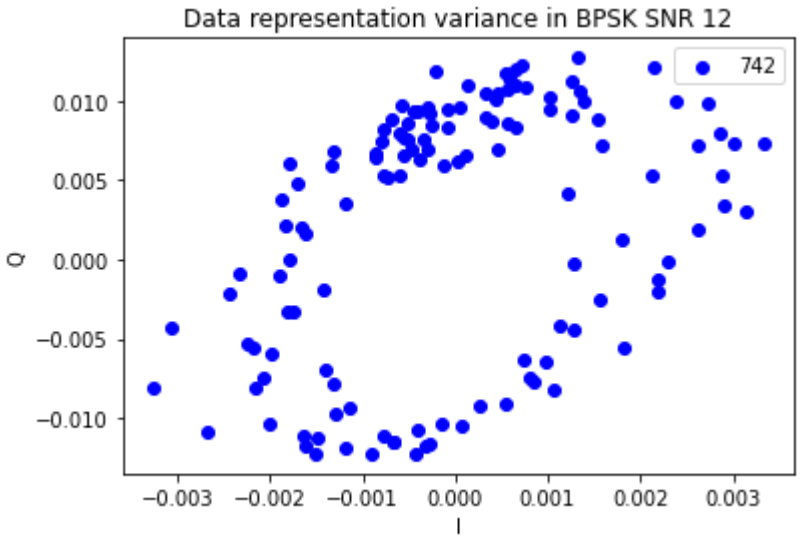

Data representation variance in BPSK SNR 12
737
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I

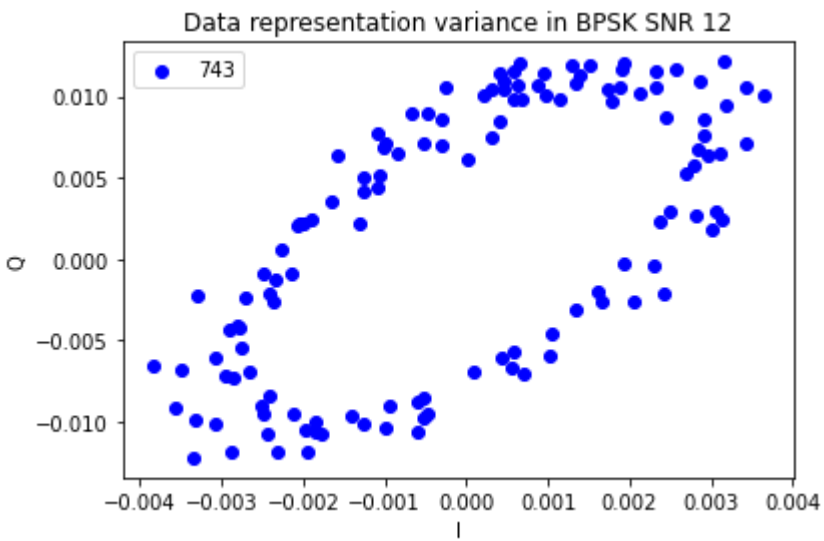

Data representation variance in BPSK SNR 12
738
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

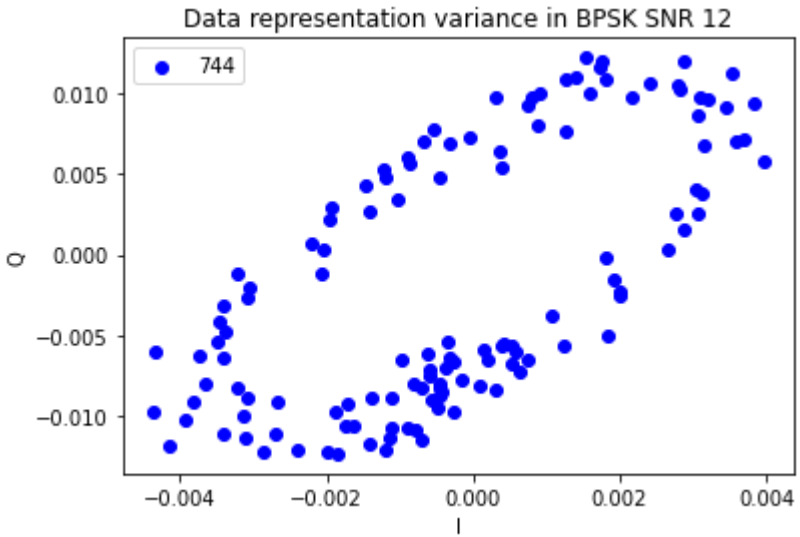

Data representation variance in BPSK SNR 12
739
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

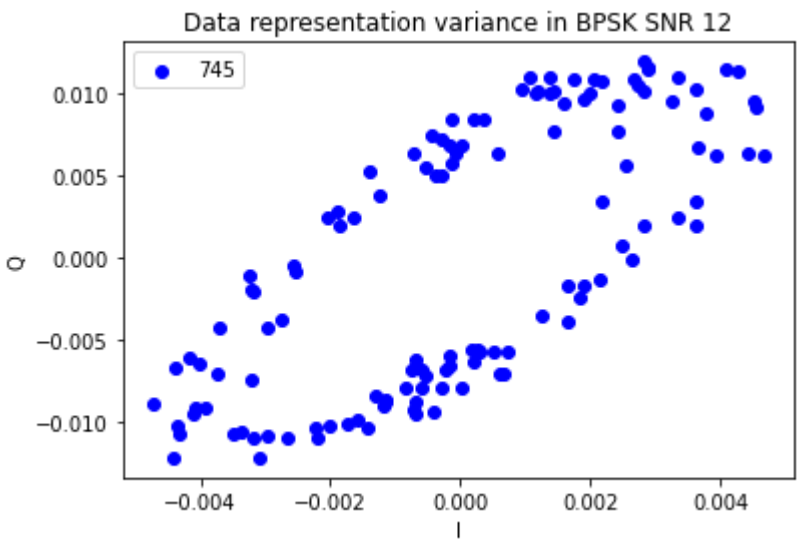

Data representation variance in BPSK SNR 12
740
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

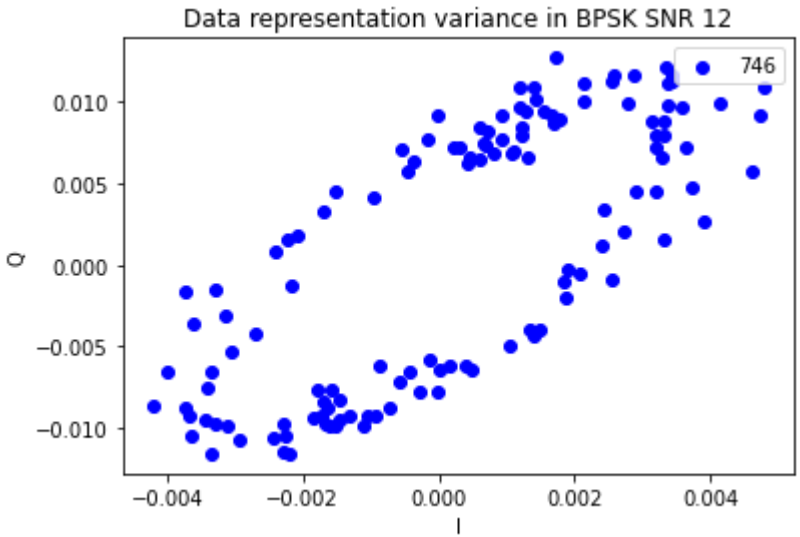

Data representation variance in BPSK SNR 12
741
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.002
−0.001
0.000
0.001
0.002
I

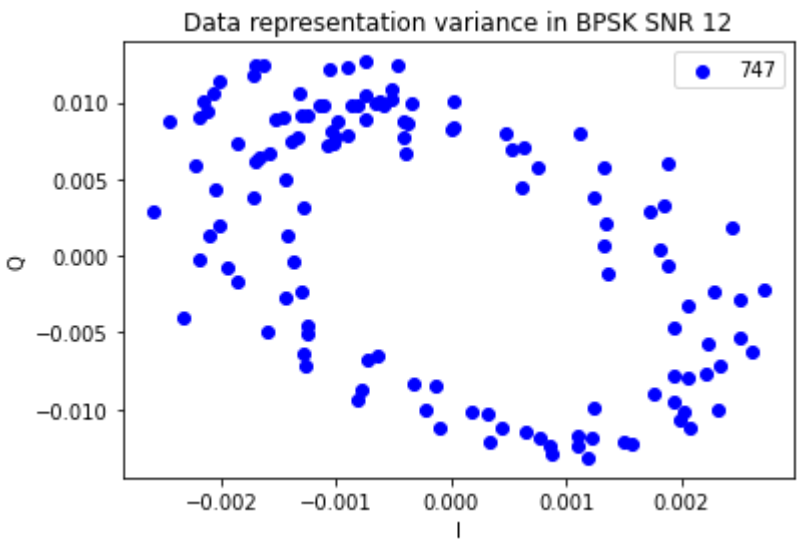

Data representation variance in BPSK SNR 12
742
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

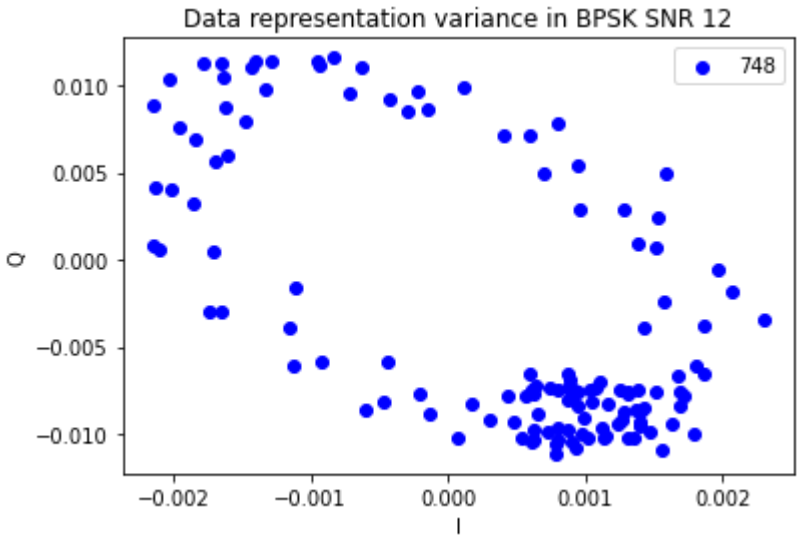

Data representation variance in BPSK SNR 12
743
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I


Data representation variance in BPSK SNR 12
744
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
745
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
746
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
747
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
748
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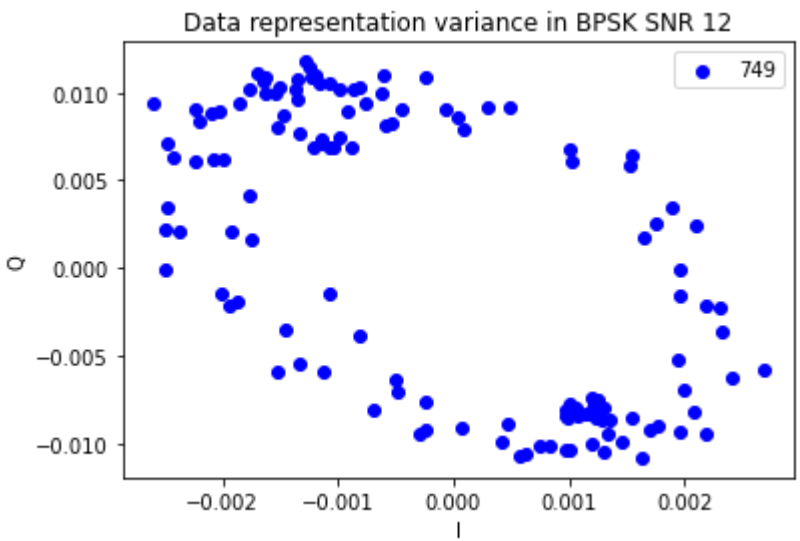
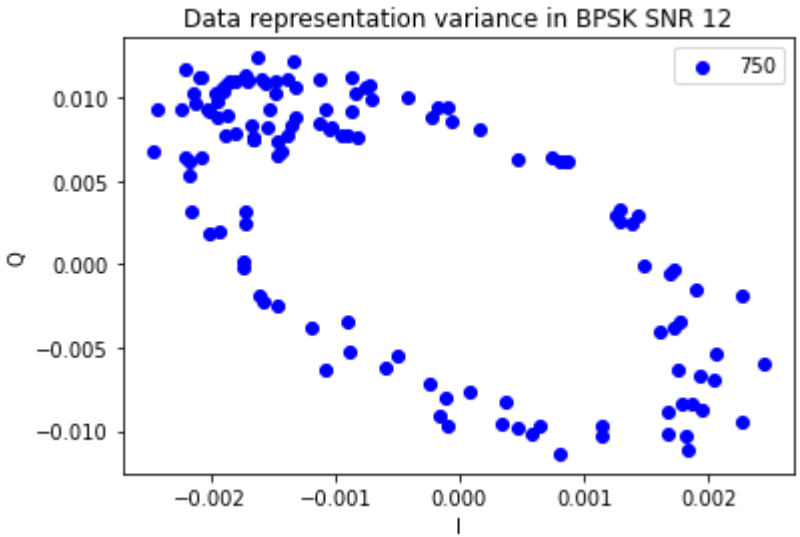
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
749
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
750
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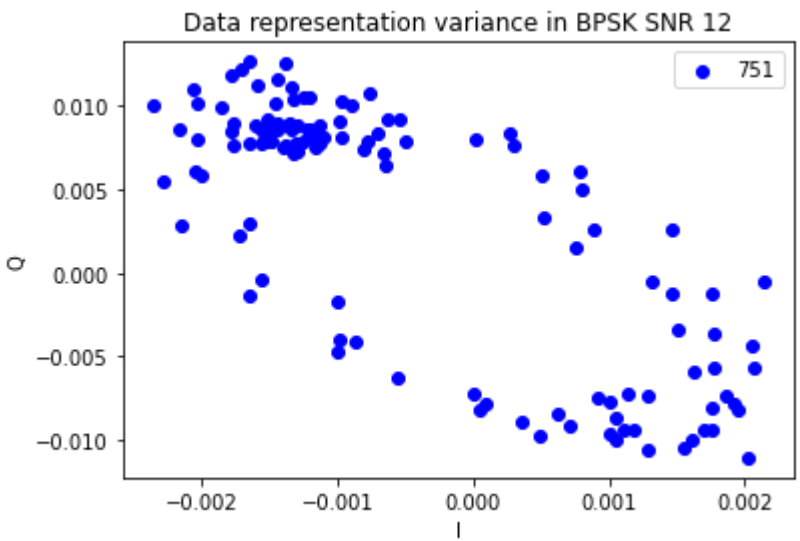
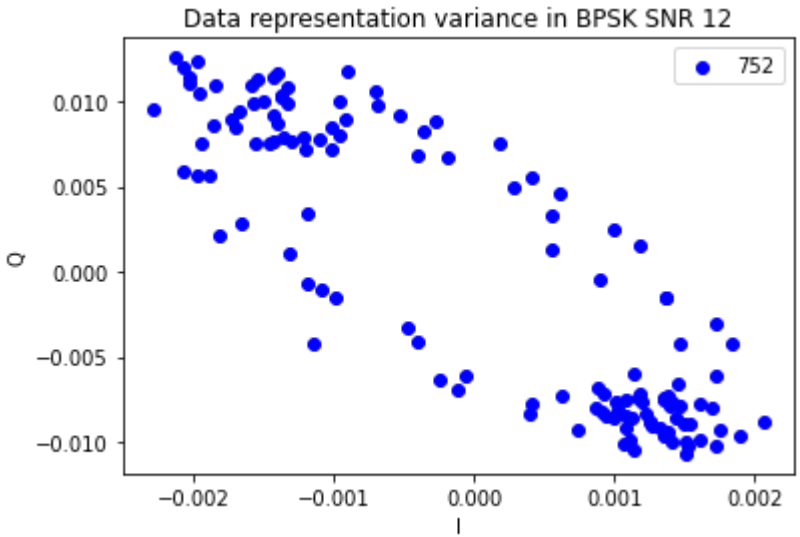
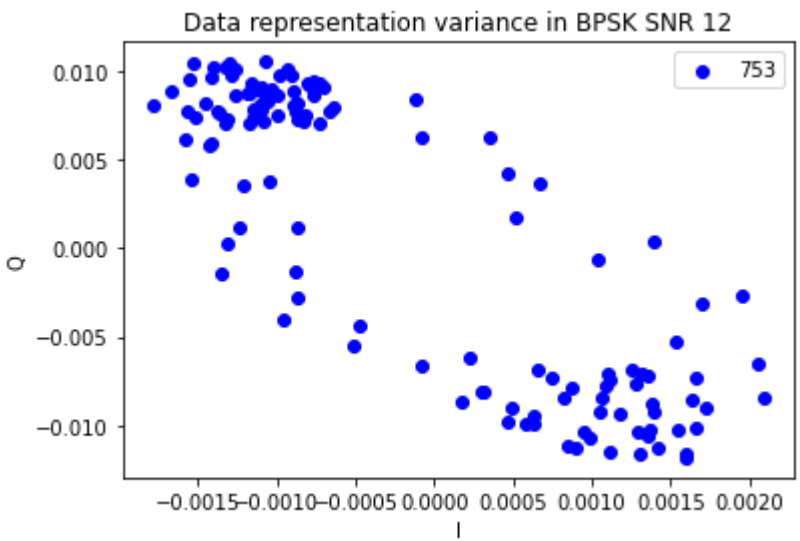
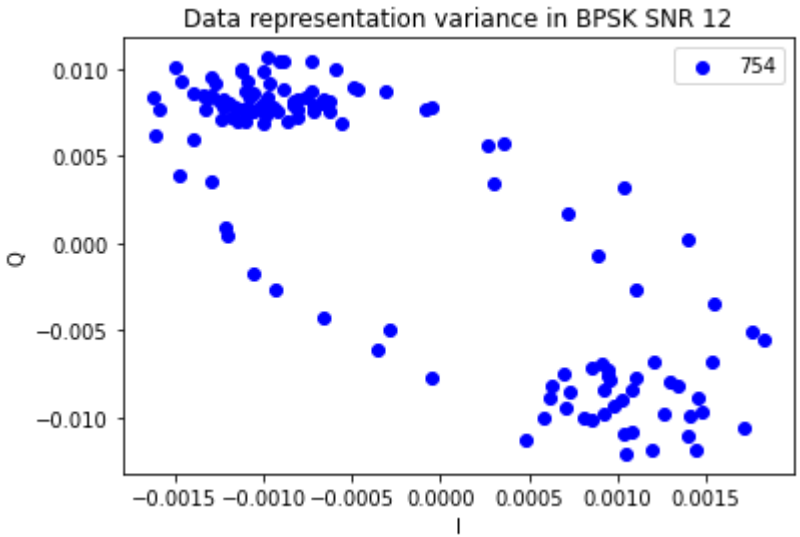
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
751
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
752
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
753
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
0.0020
I


Data representation variance in BPSK SNR 12
754
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0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015
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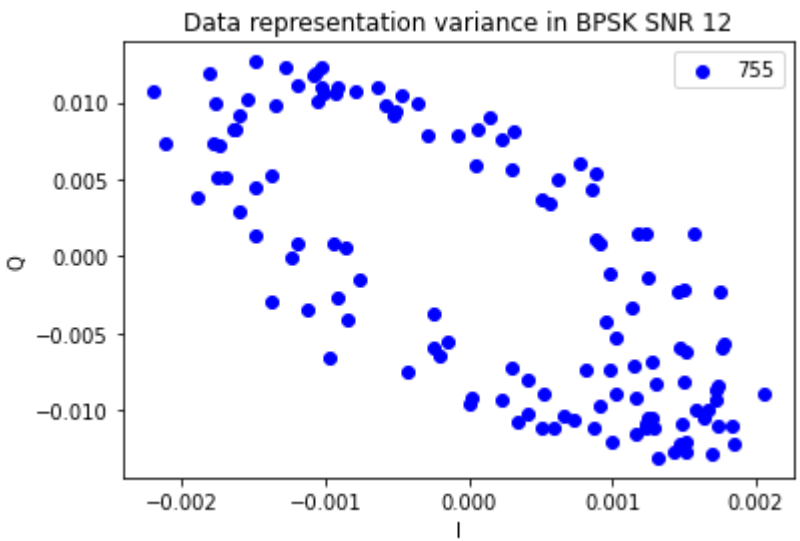
Data representation variance in BPSK SNR 12
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0.000
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−0.010
Q
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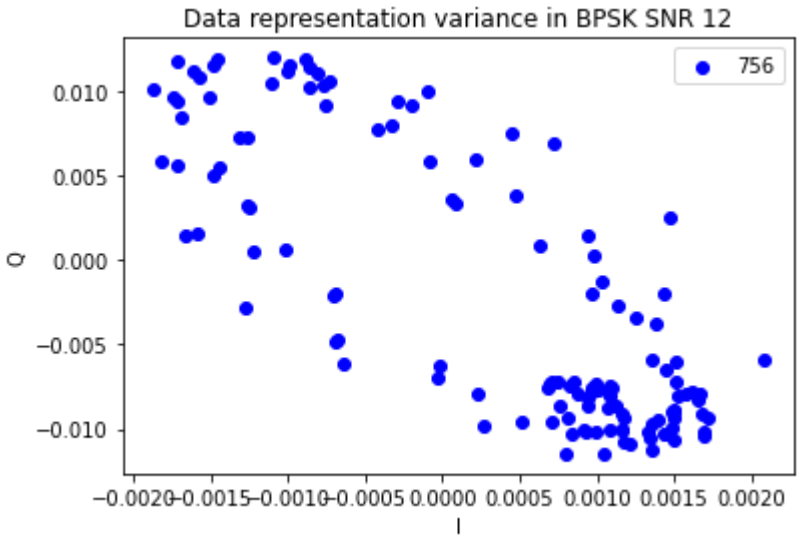
I


Data representation variance in BPSK SNR 12
756
0.010
0.005
0.000
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−0.010
Q
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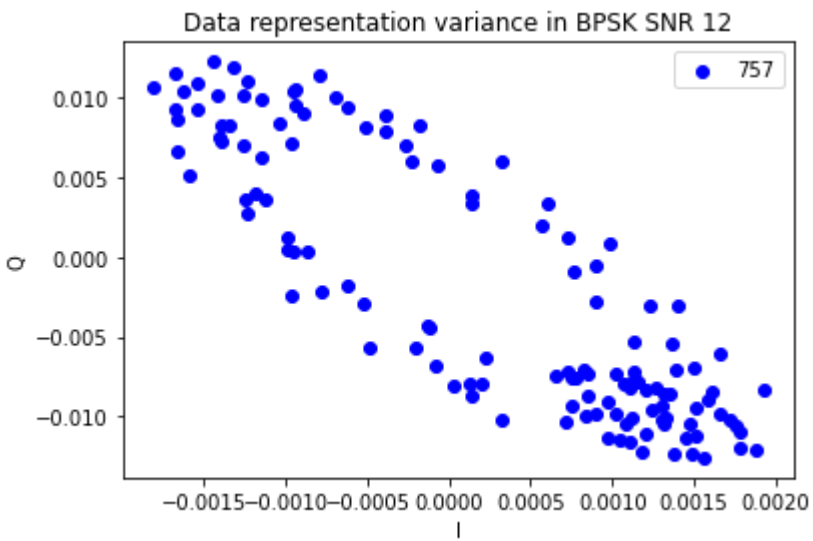
Data representation variance in BPSK SNR 12
757
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0.005
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−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
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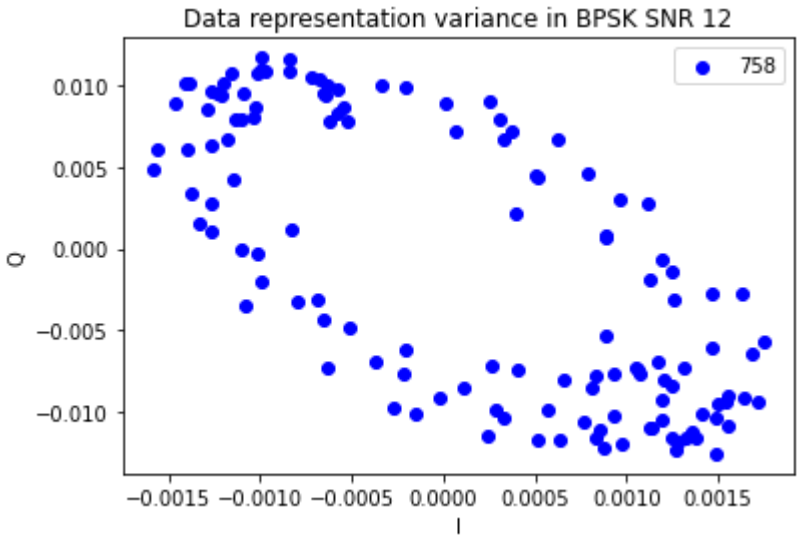
Data representation variance in BPSK SNR 12
758
0.010
0.005
0.000
−0.005
−0.010
Q
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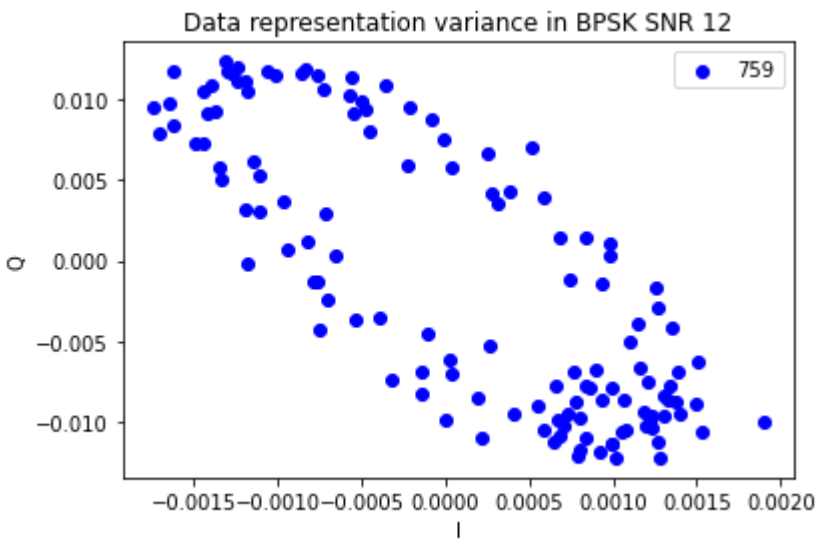
Data representation variance in BPSK SNR 12
759
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015 −0.0010 −0.0005 0.0000 0.0005 0.0010 0.0015 0.0020
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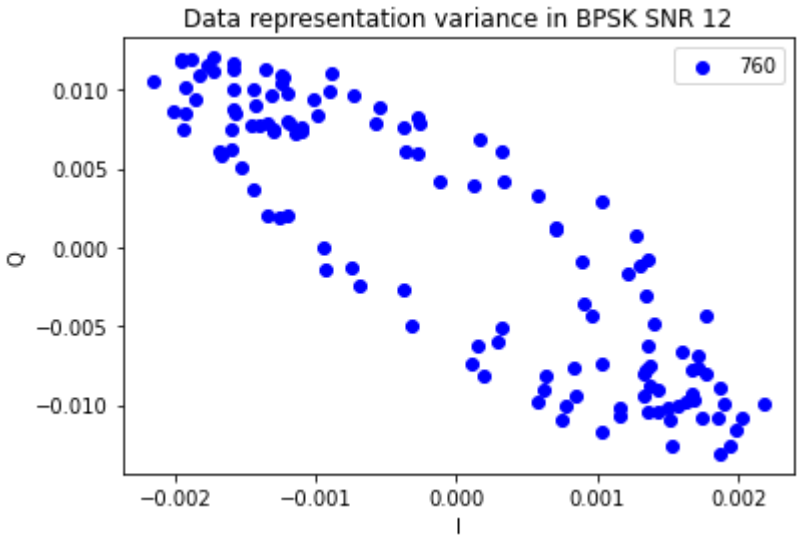
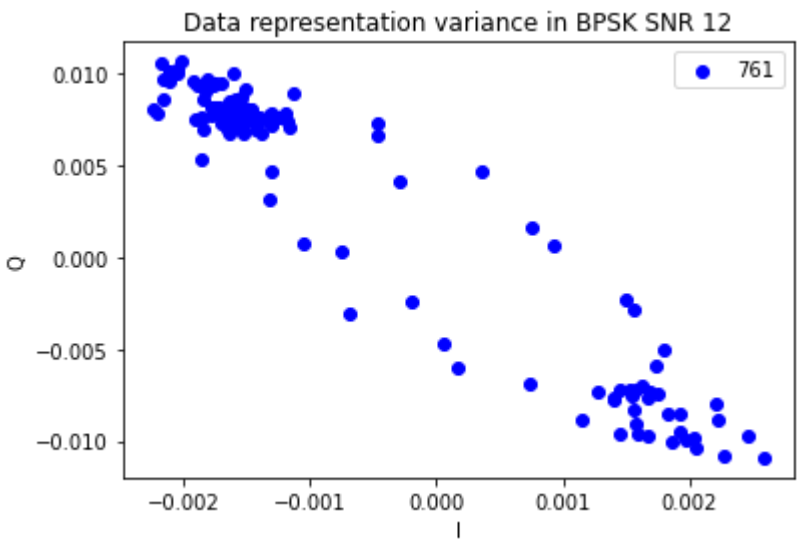
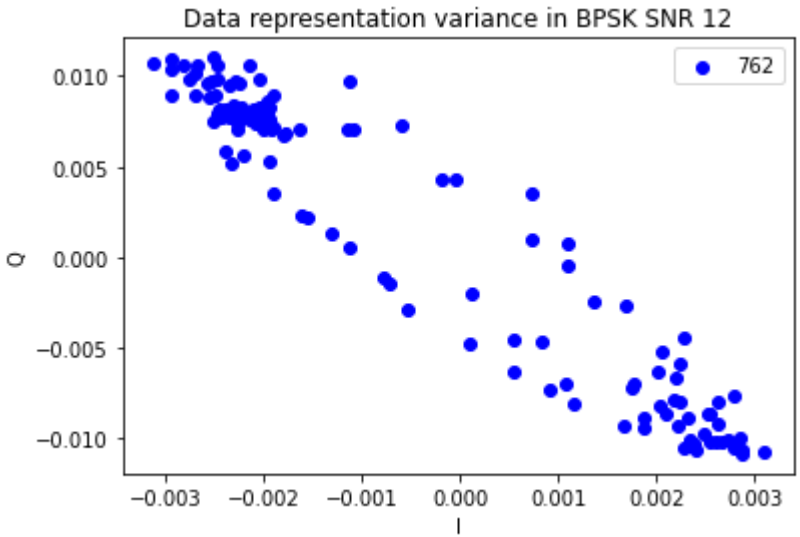

Data representation variance in BPSK SNR 12
760
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
761
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
762
0.010
0.005
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−0.005
−0.010
Q
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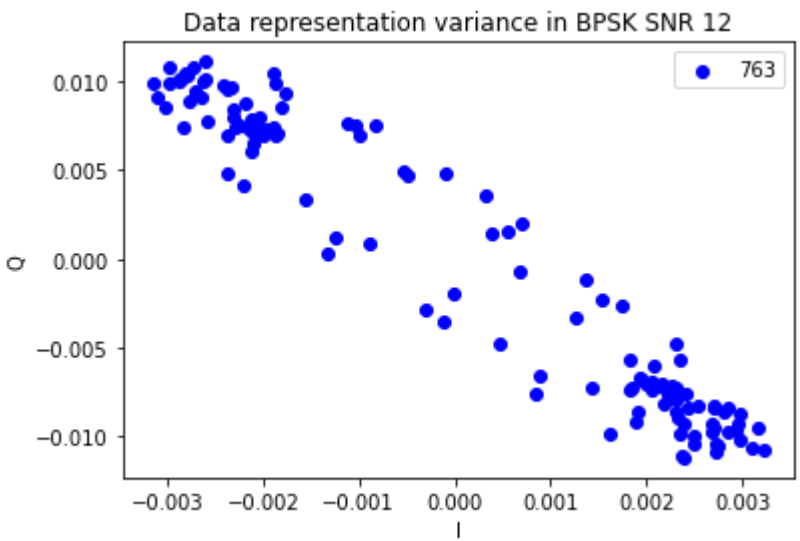
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
763
0.010
0.005
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−0.005
−0.010
Q
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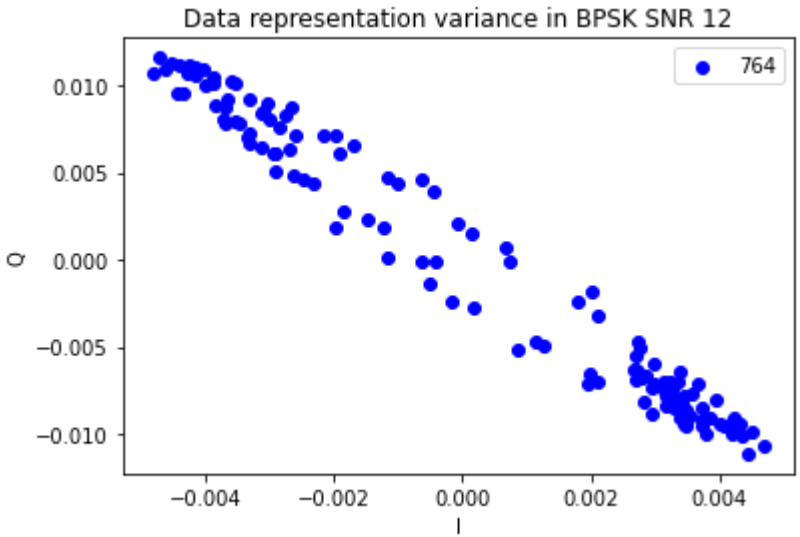
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
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0.000
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−0.010
Q
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−0.002
0.000
0.002
0.004
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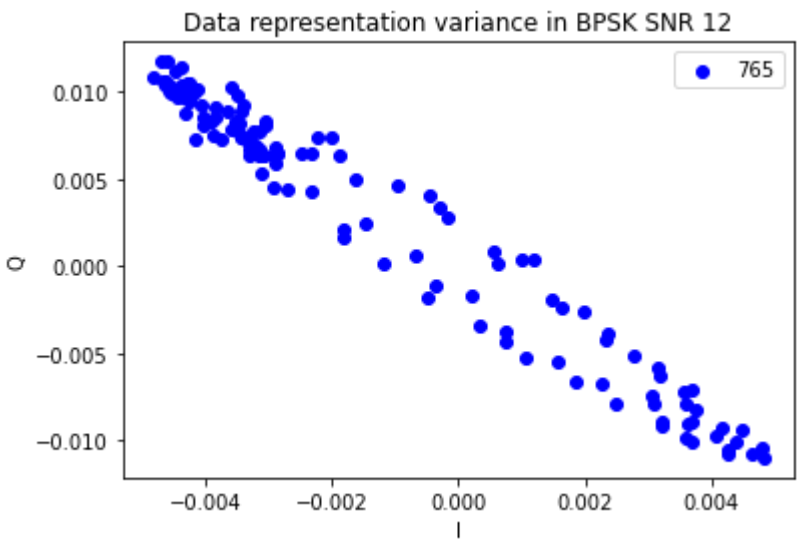
Data representation variance in BPSK SNR 12
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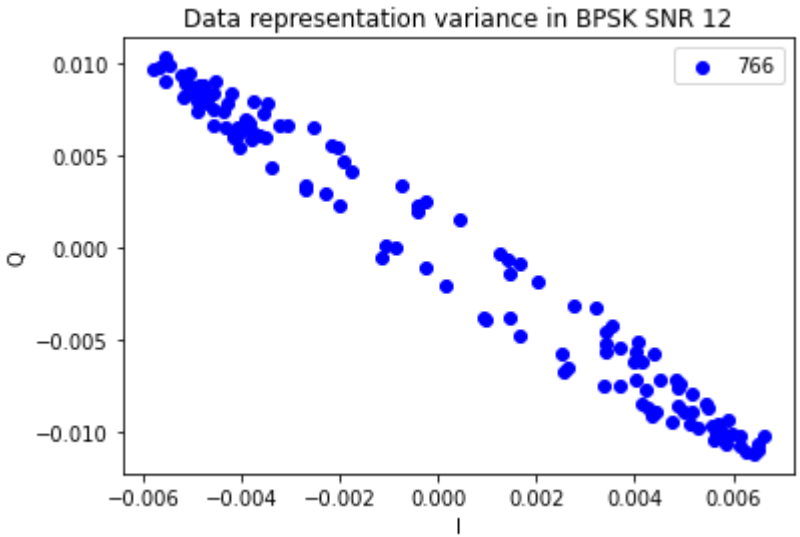
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
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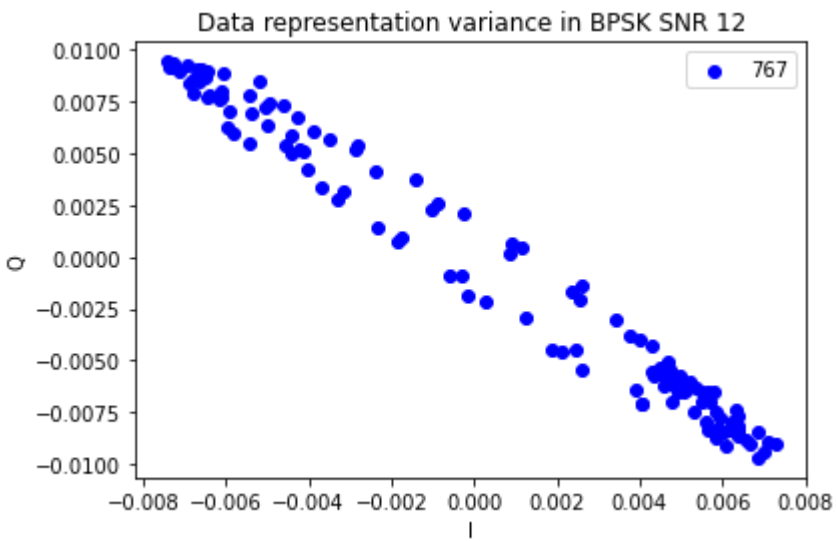
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
767
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
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−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
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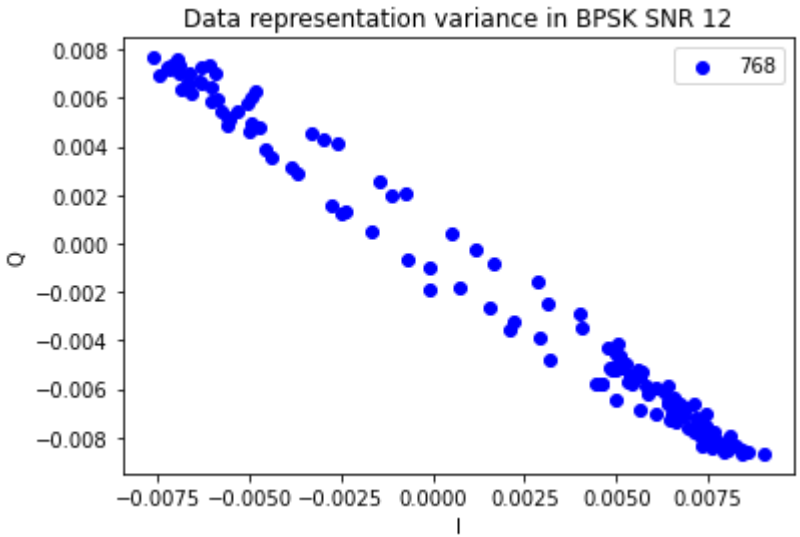
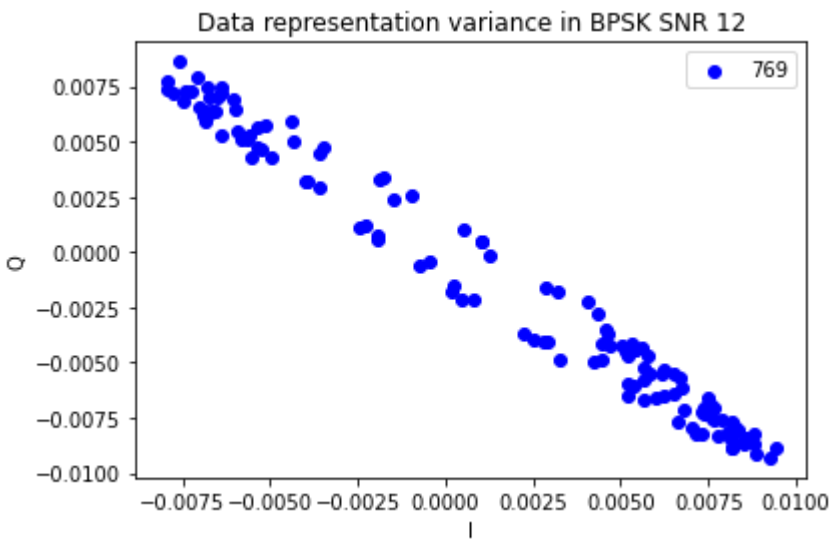

Data representation variance in BPSK SNR 12
768
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
769
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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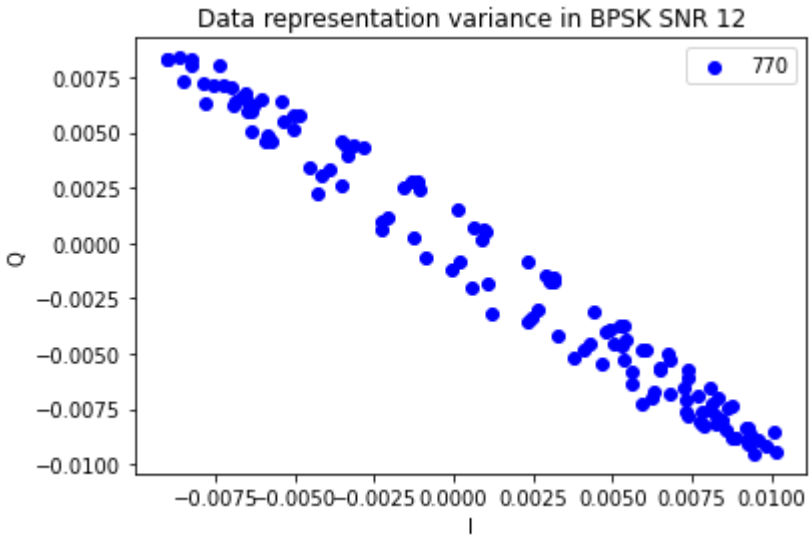
Data representation variance in BPSK SNR 12
770
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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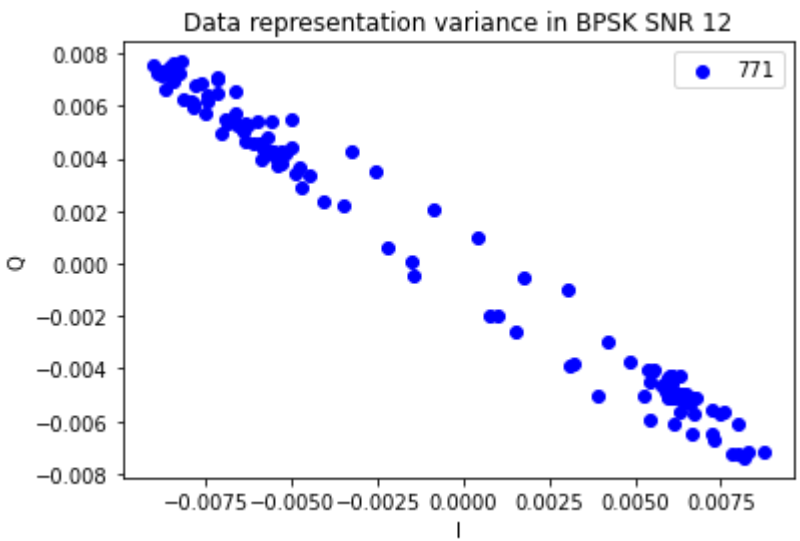
Data representation variance in BPSK SNR 12
771
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
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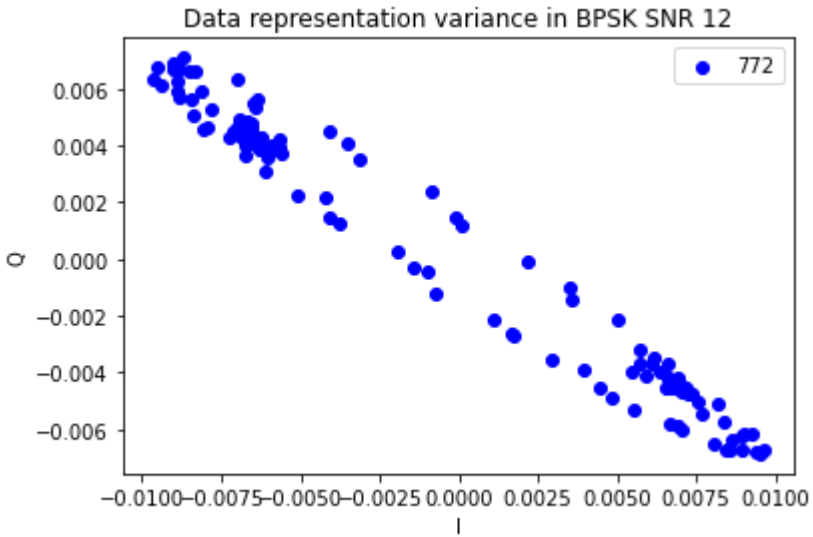
Data representation variance in BPSK SNR 12
772
0.006
0.004
0.002
0.000
−0.002
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−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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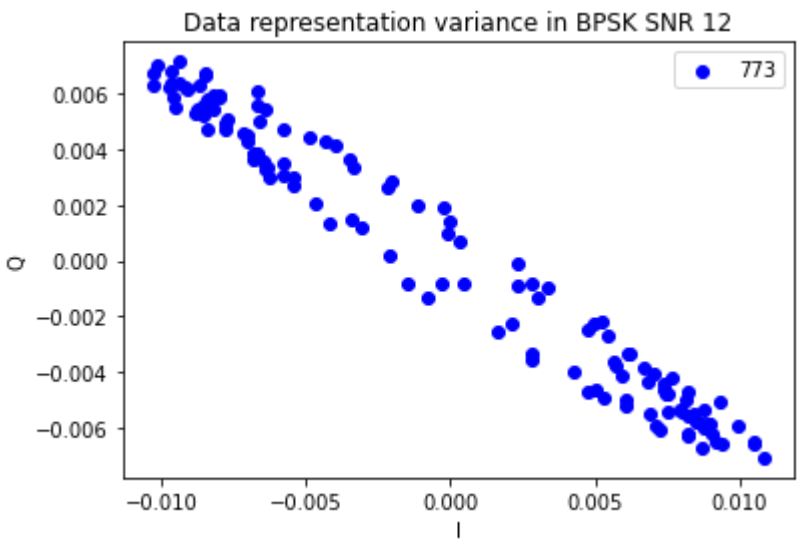
Data representation variance in BPSK SNR 12
773
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010 −0.005 0.000 0.005 0.010
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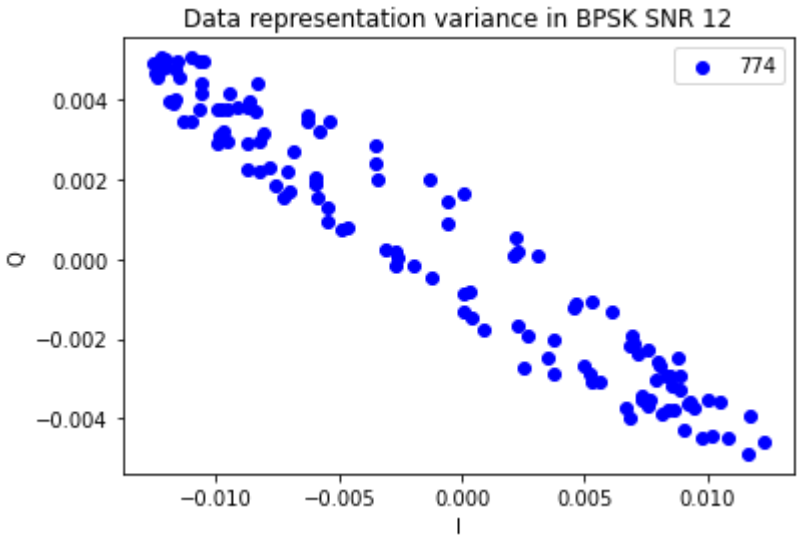
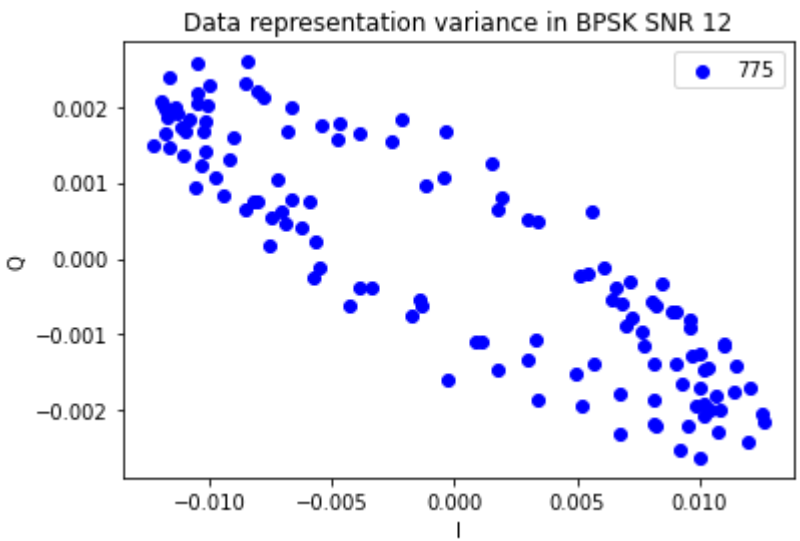
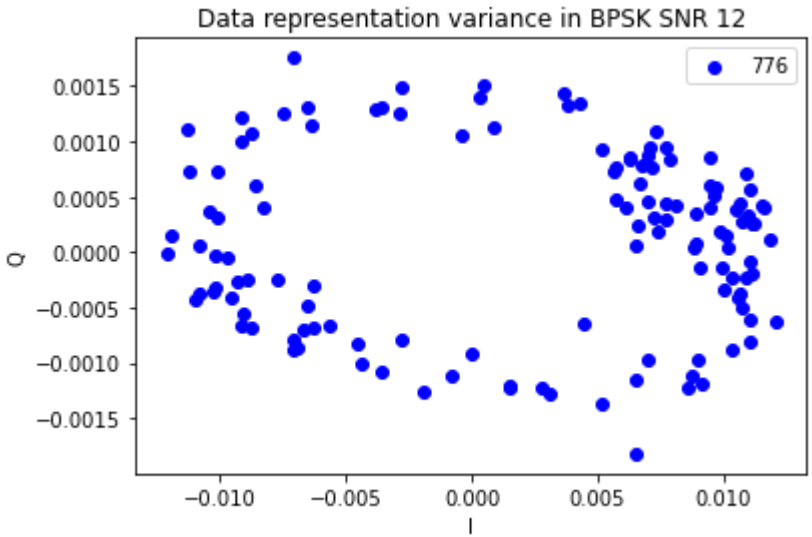
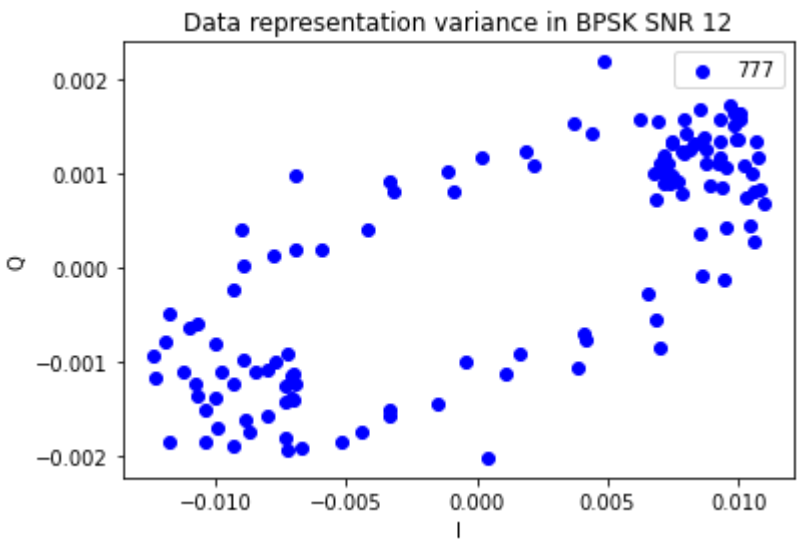

Data representation variance in BPSK SNR 12
774
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
775
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
776
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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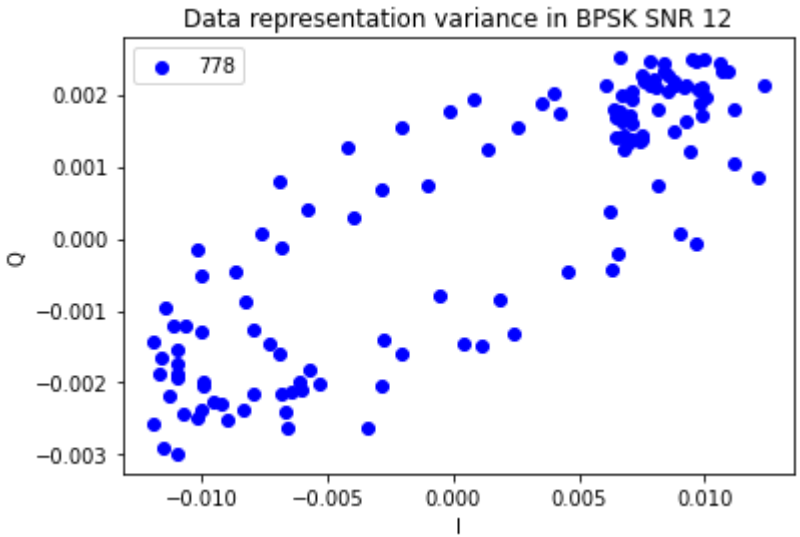
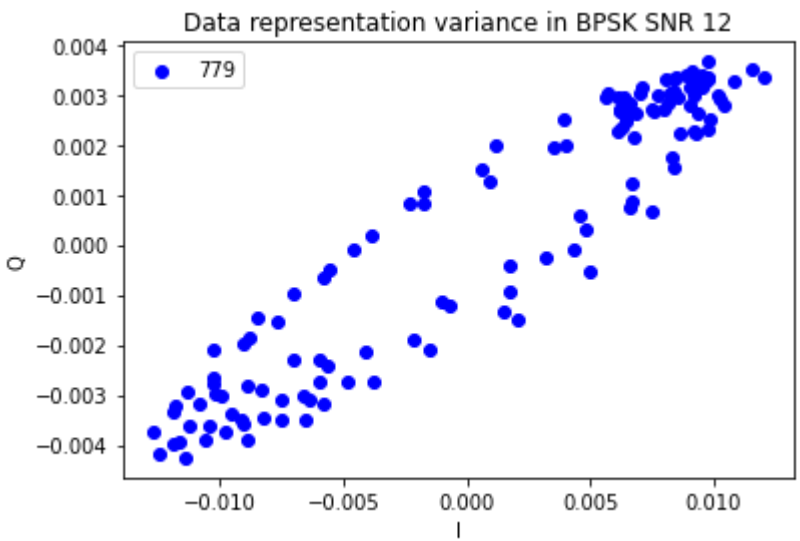
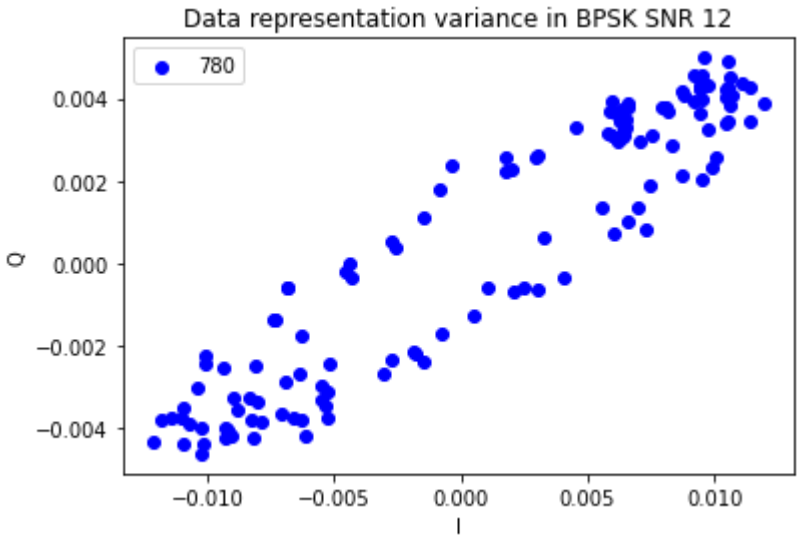
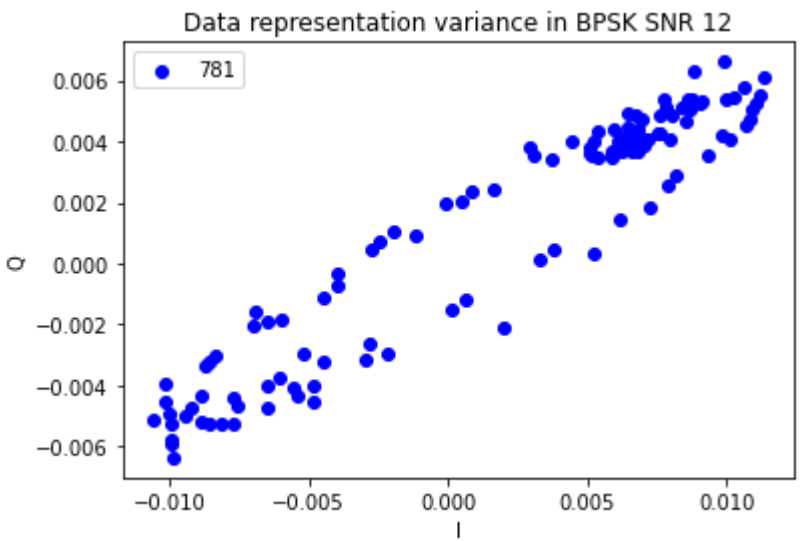
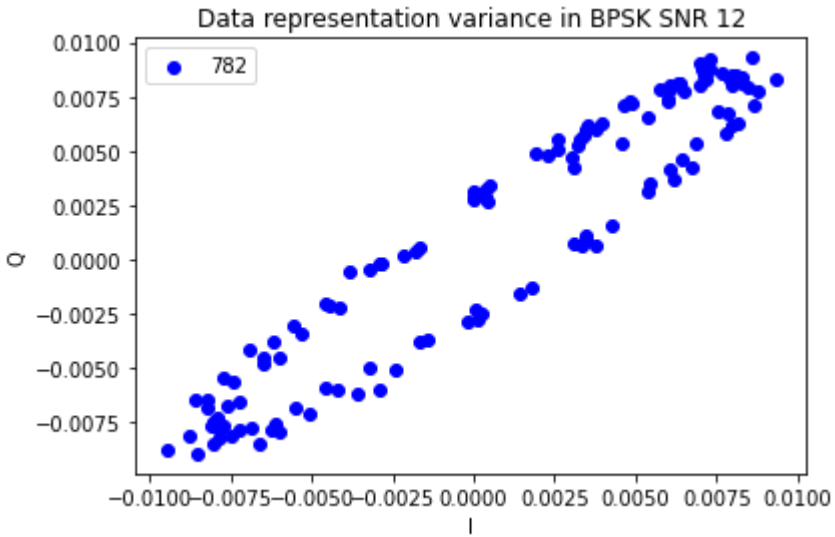
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
778
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
779
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
780
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
781
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
782
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0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
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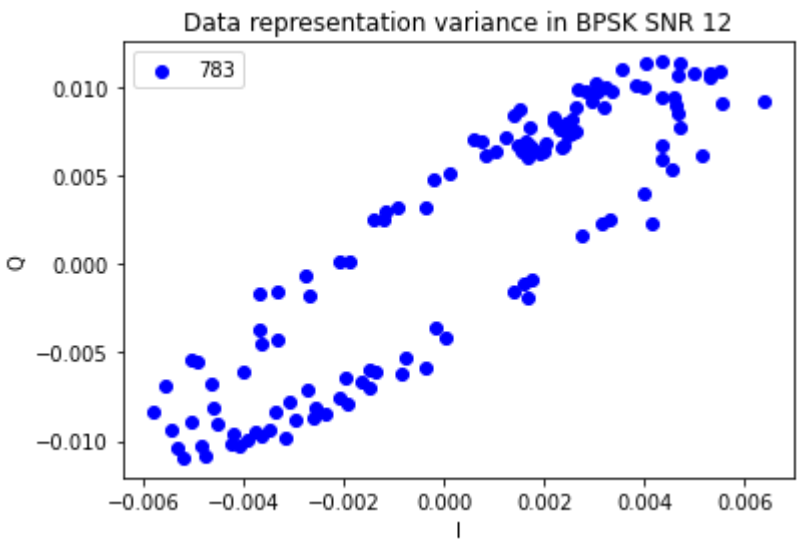
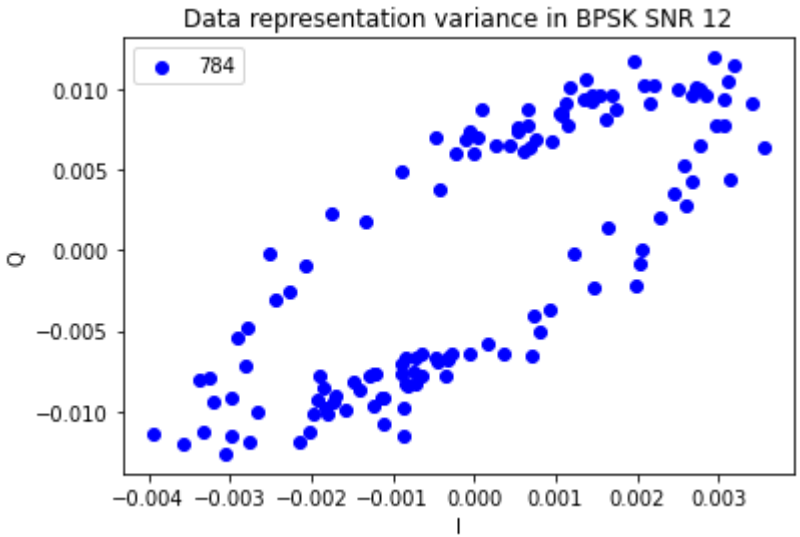

Data representation variance in BPSK SNR 12
783
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I


Data representation variance in BPSK SNR 12
784
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0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003
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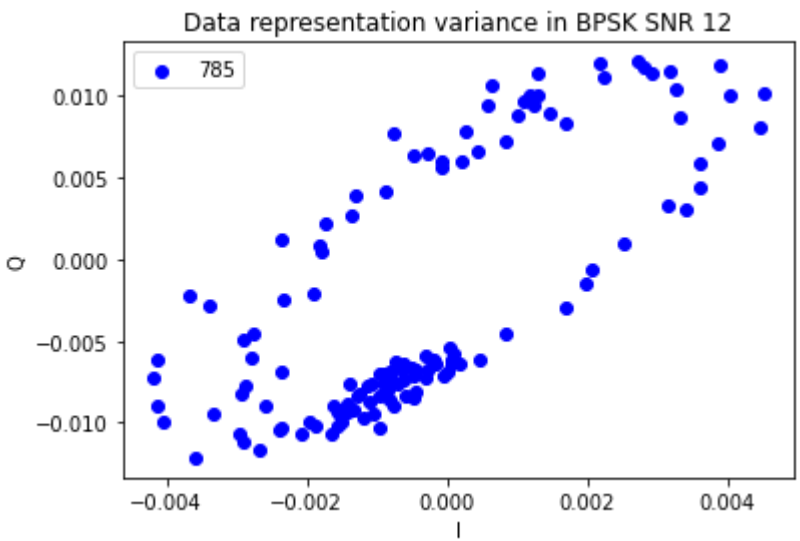
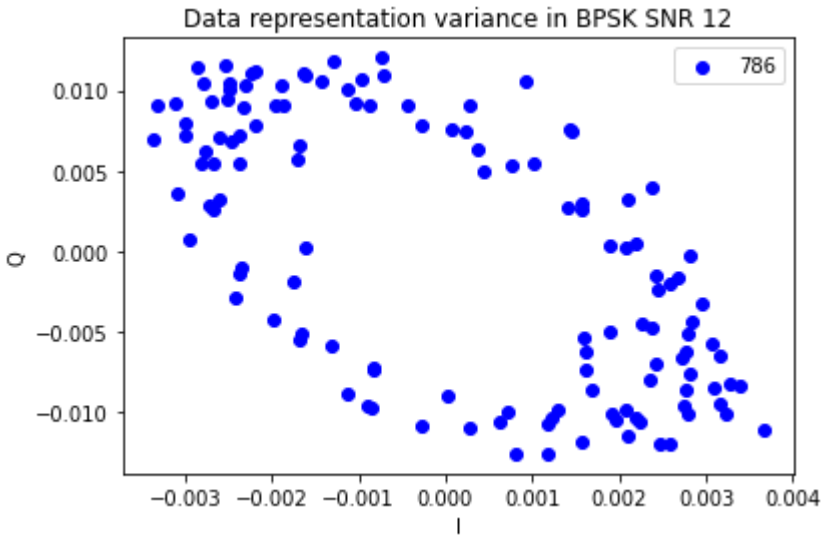
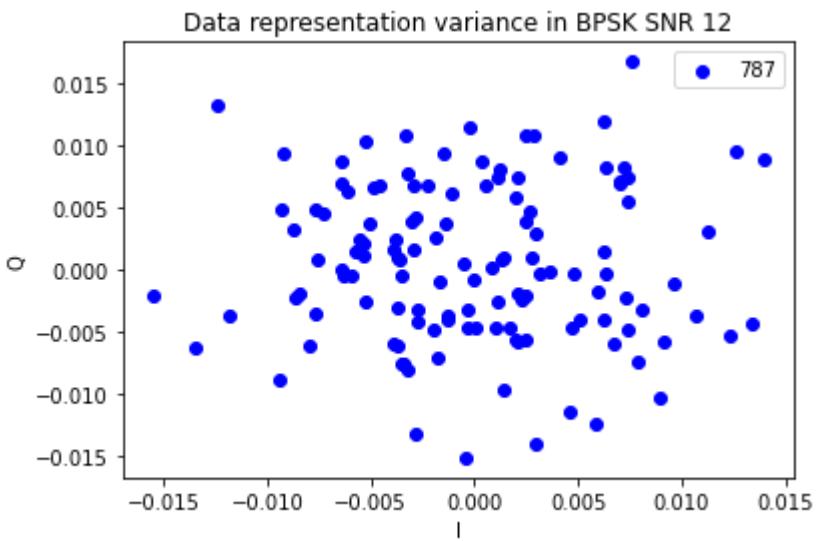

Data representation variance in BPSK SNR 12
785
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I


Data representation variance in BPSK SNR 12
786
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I


Data representation variance in BPSK SNR 12
787
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
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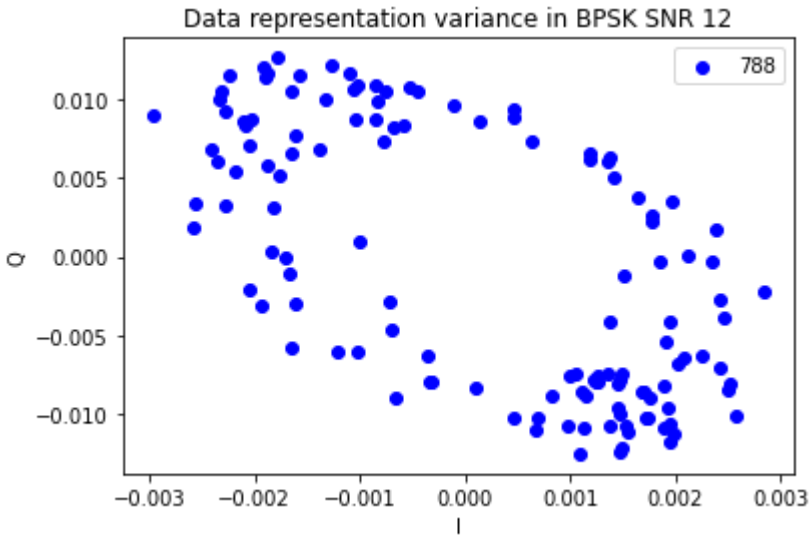
−0.010
−0.005
0.000
0.005
0.010
0.015
I


Data representation variance in BPSK SNR 12
788
0.010
0.005
0.000
−0.005
−0.010
Q
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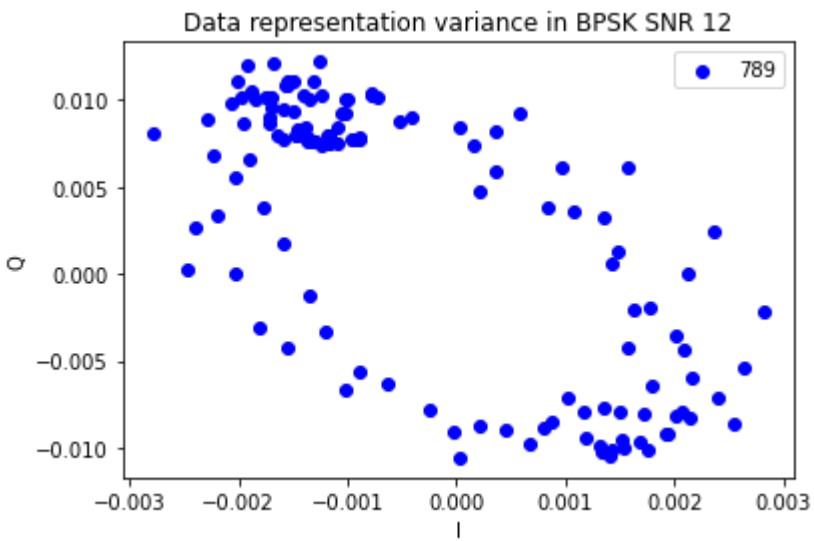
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
789
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0.005
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−0.010
Q
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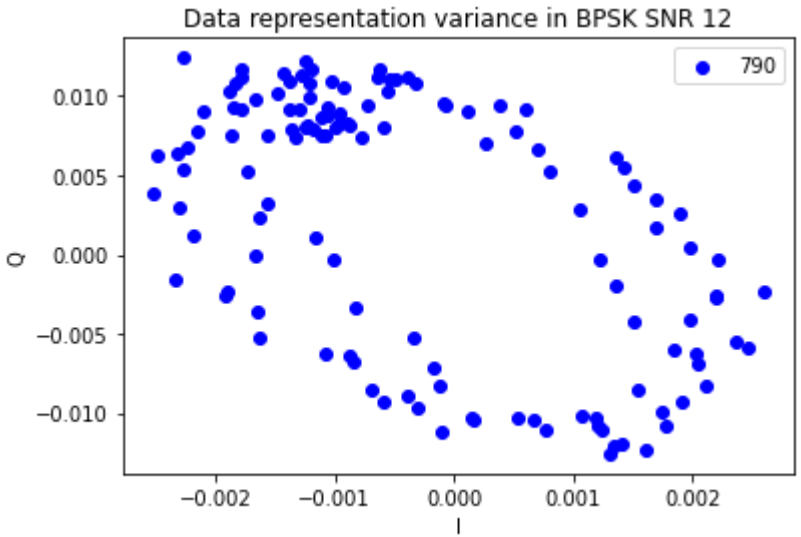
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
790
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
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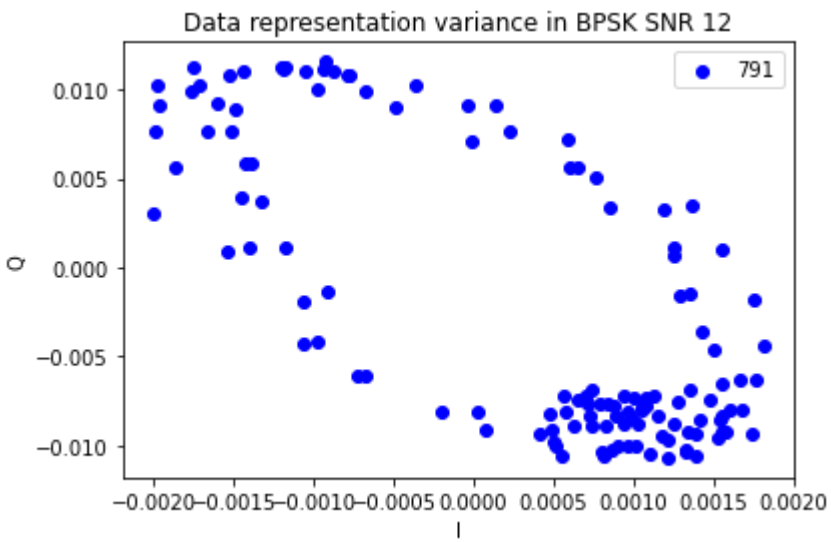
Data representation variance in BPSK SNR 12
791
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.0010
−0.0005
0.0000
0.0005
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0.0015
0.0020
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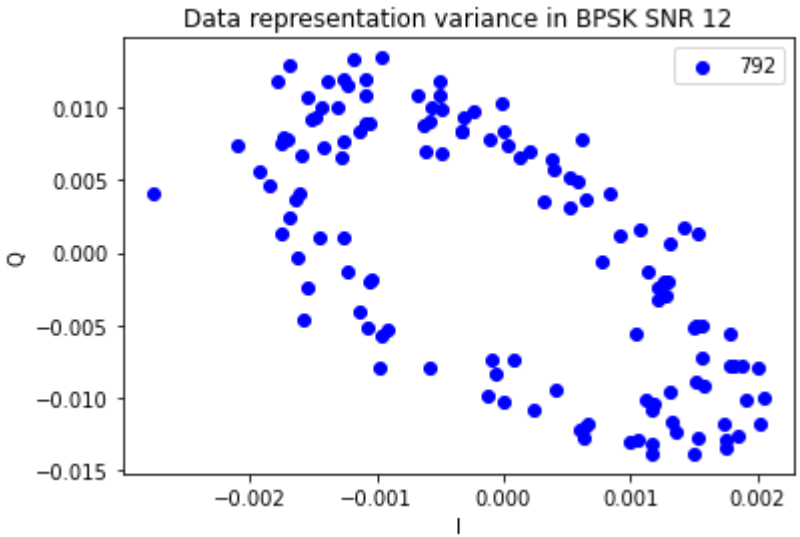
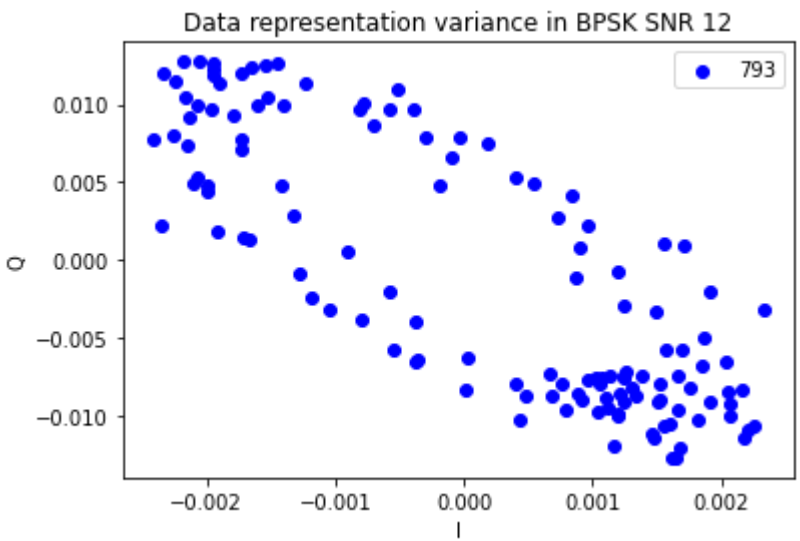
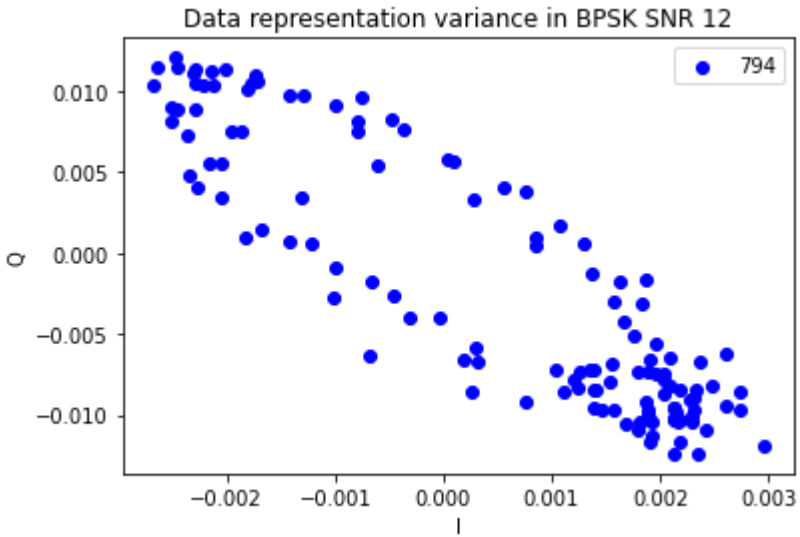
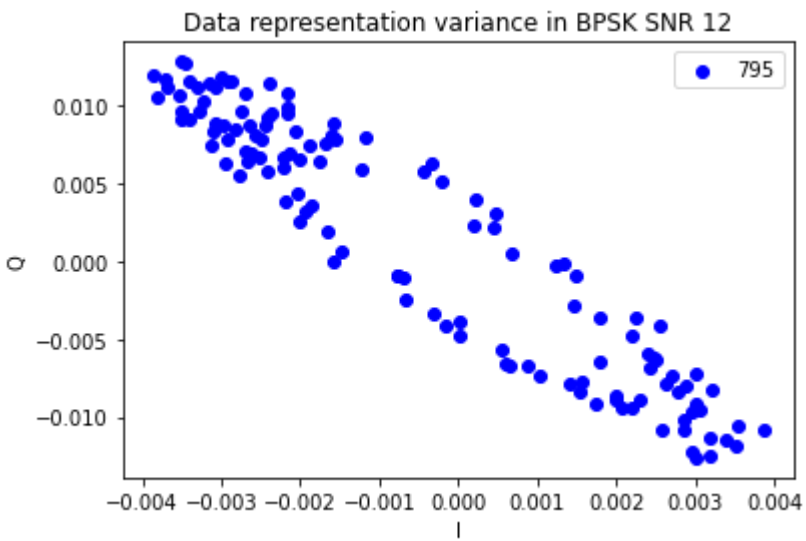

Data representation variance in BPSK SNR 12
792
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
793
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
794
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
795
0.010
0.005
0.000
−0.005
−0.010
Q
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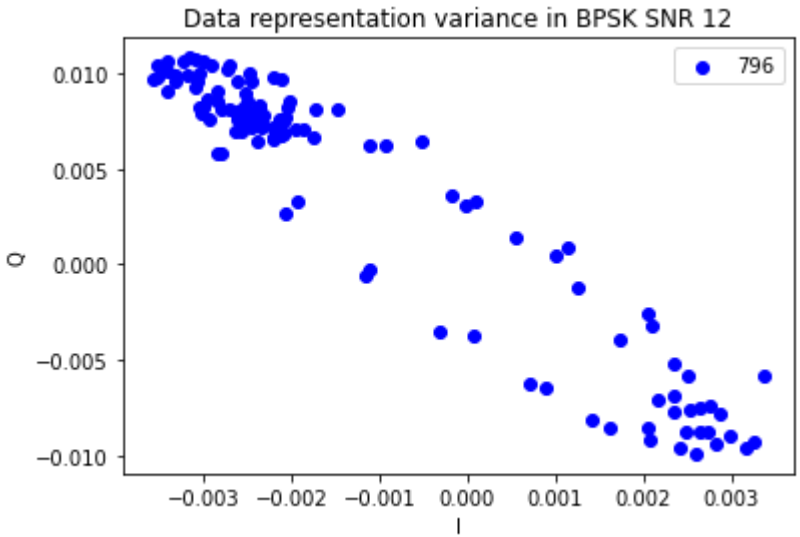
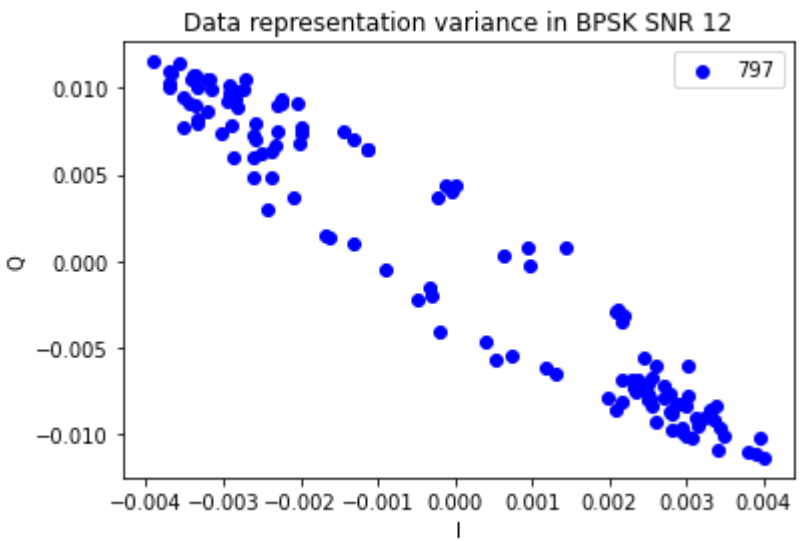
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I


Data representation variance in BPSK SNR 12
796
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
797
0.010
0.005
0.000
−0.005
−0.010
Q
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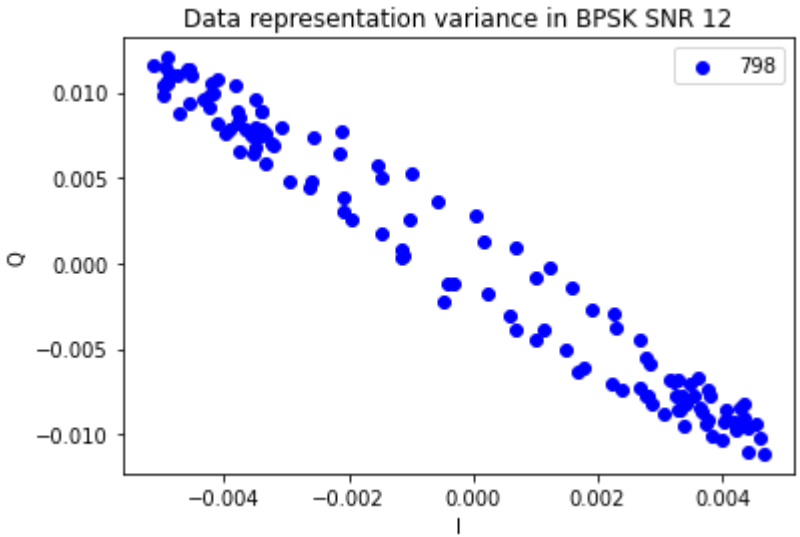
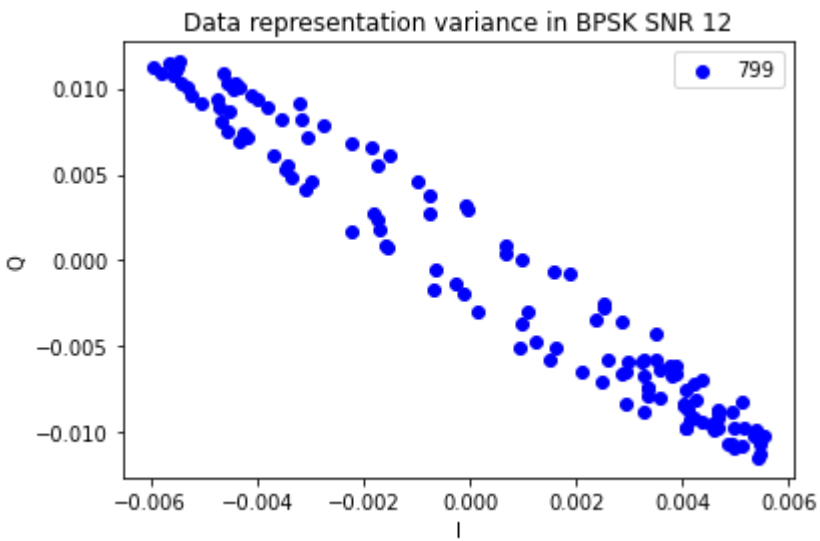
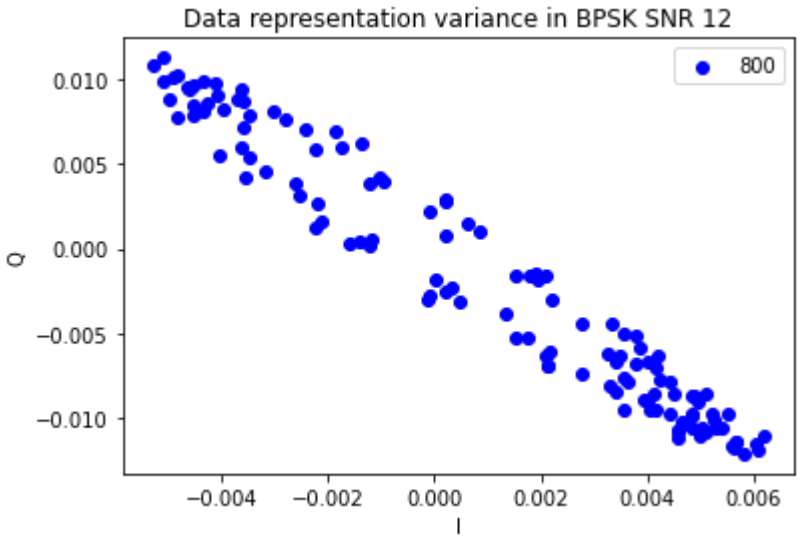
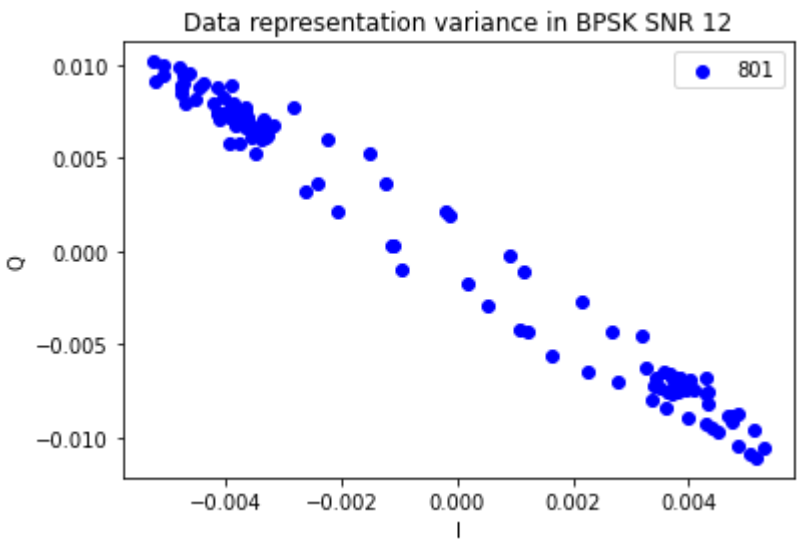
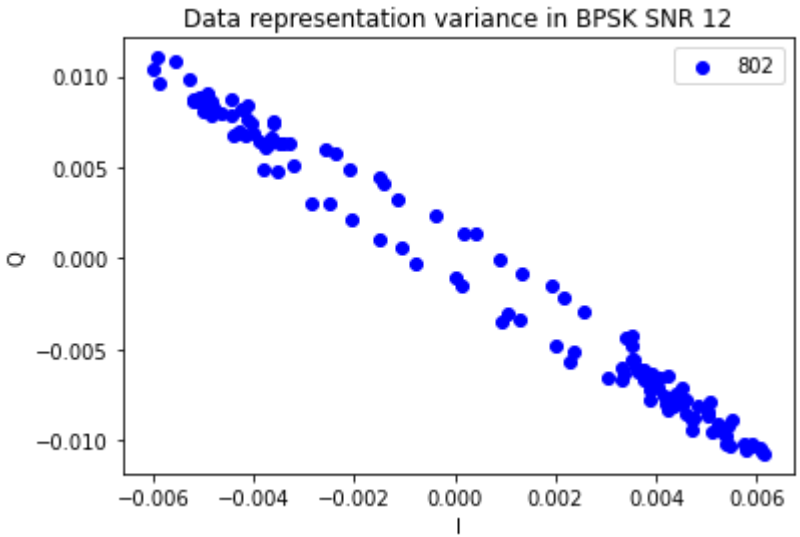
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I

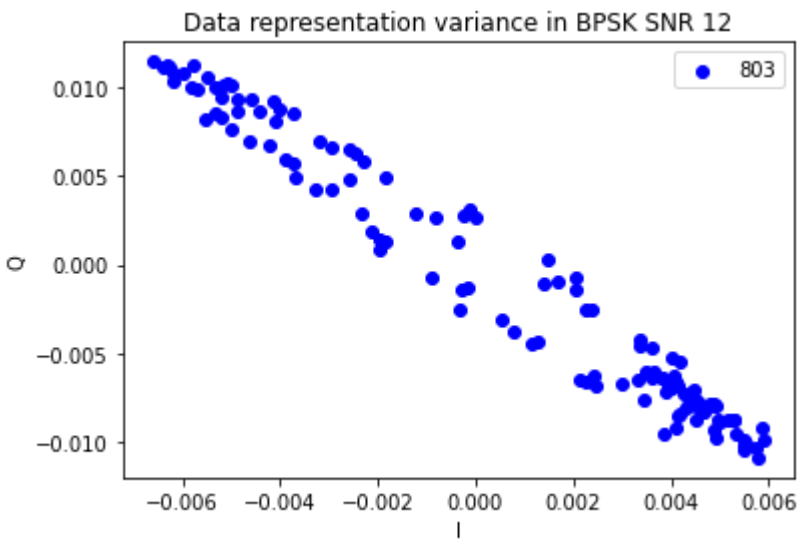

Data representation variance in BPSK SNR 12
798
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

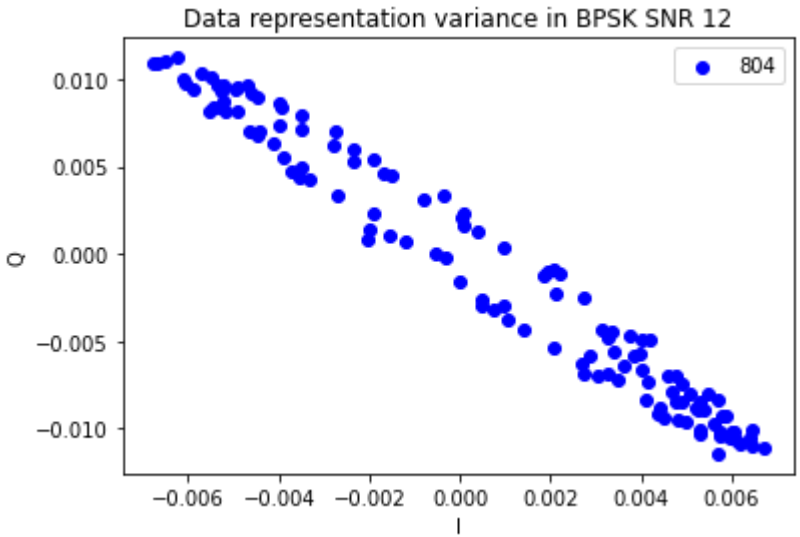

Data representation variance in BPSK SNR 12
799
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

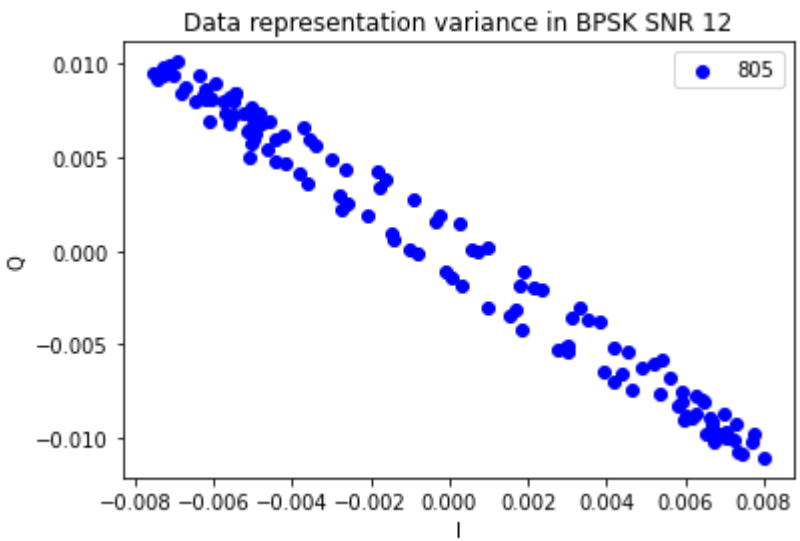

Data representation variance in BPSK SNR 12
800
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
0.006
I

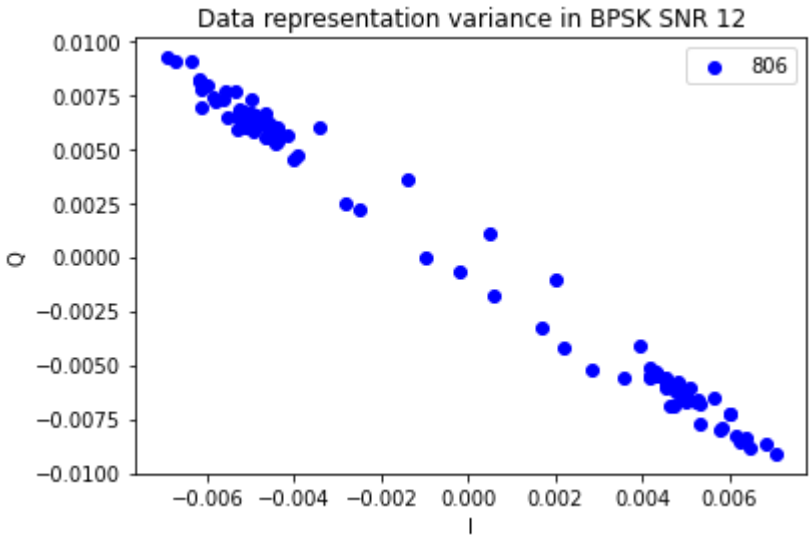

Data representation variance in BPSK SNR 12
801
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

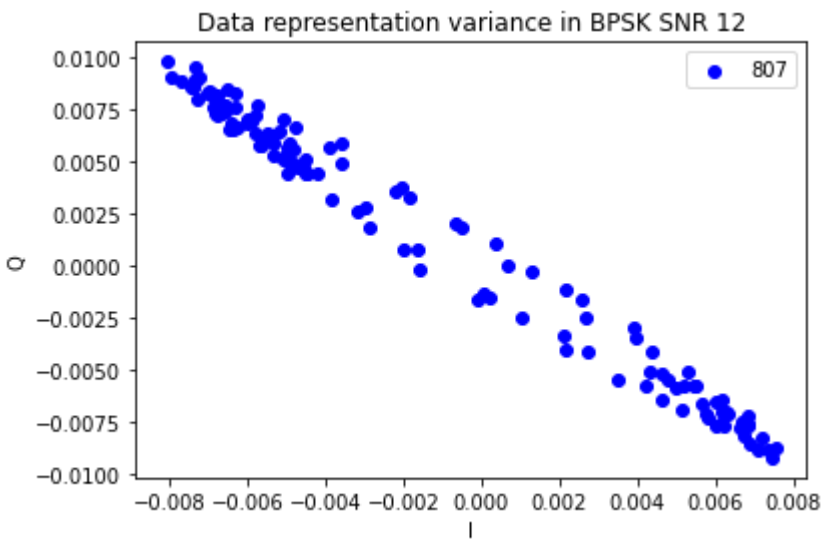

Data representation variance in BPSK SNR 12
802
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

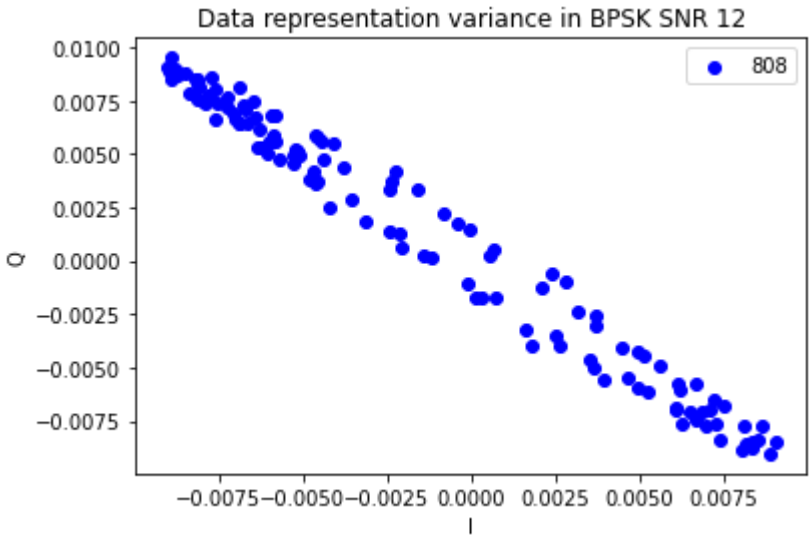

Data representation variance in BPSK SNR 12
803
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

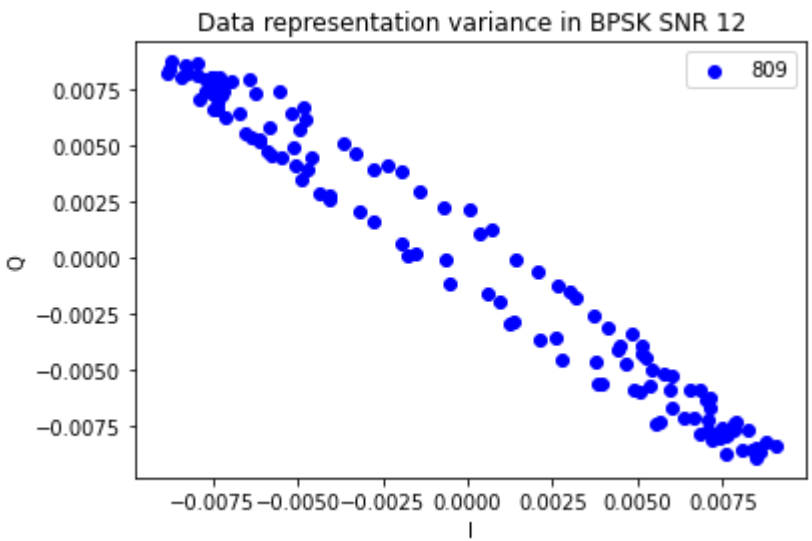

Data representation variance in BPSK SNR 12
804
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

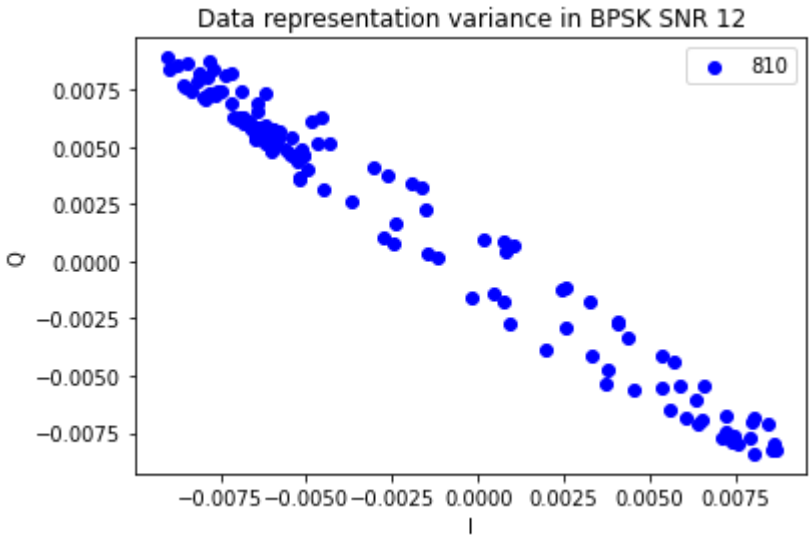

Data representation variance in BPSK SNR 12
805
0.010
0.005
0.000
−0.005
−0.010
Q
−0.008
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I

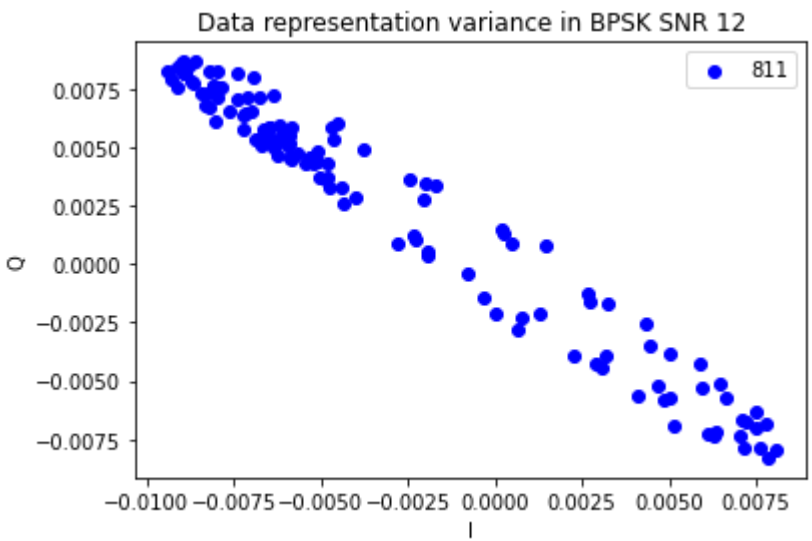

Data representation variance in BPSK SNR 12
806
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

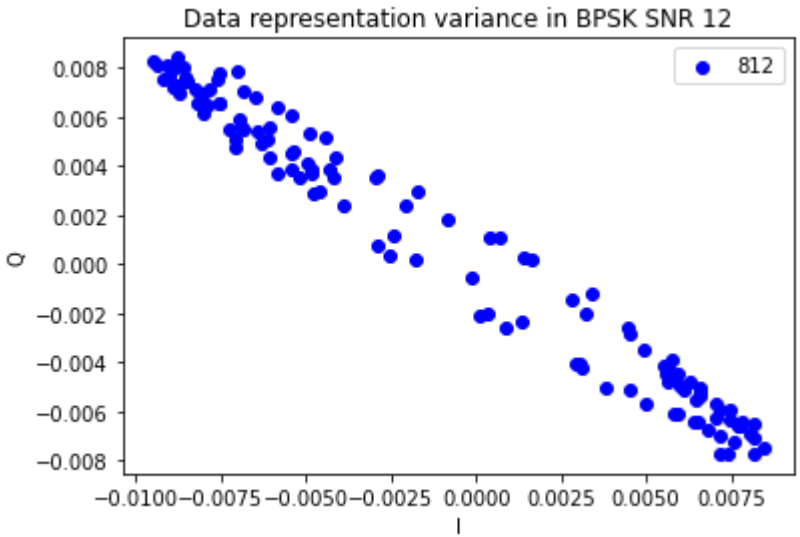

Data representation variance in BPSK SNR 12
807
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I

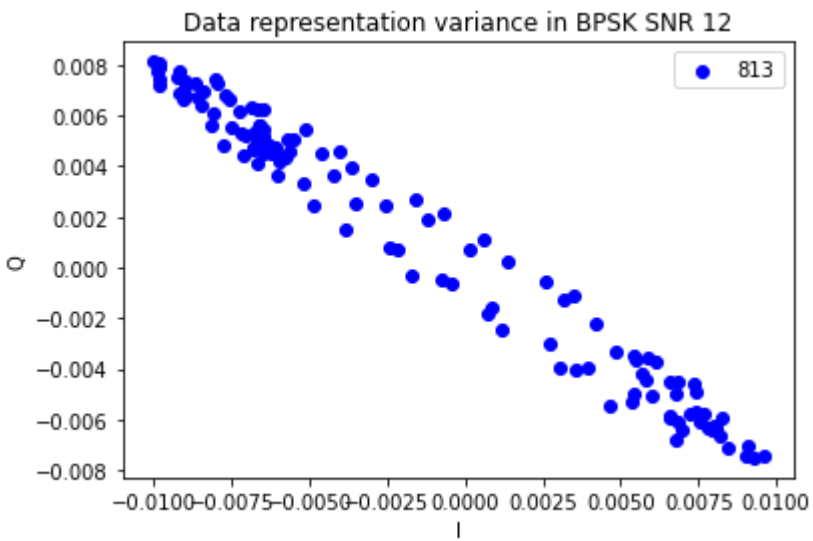

Data representation variance in BPSK SNR 12
808
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

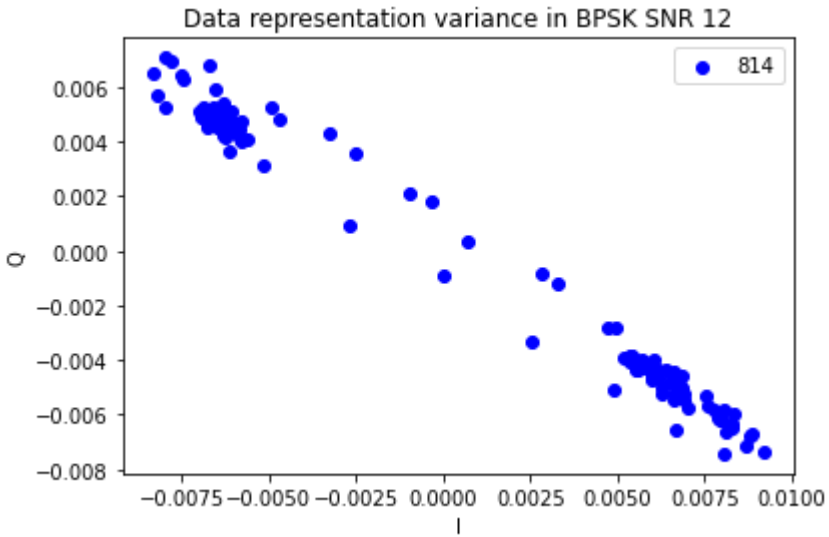

Data representation variance in BPSK SNR 12
809
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

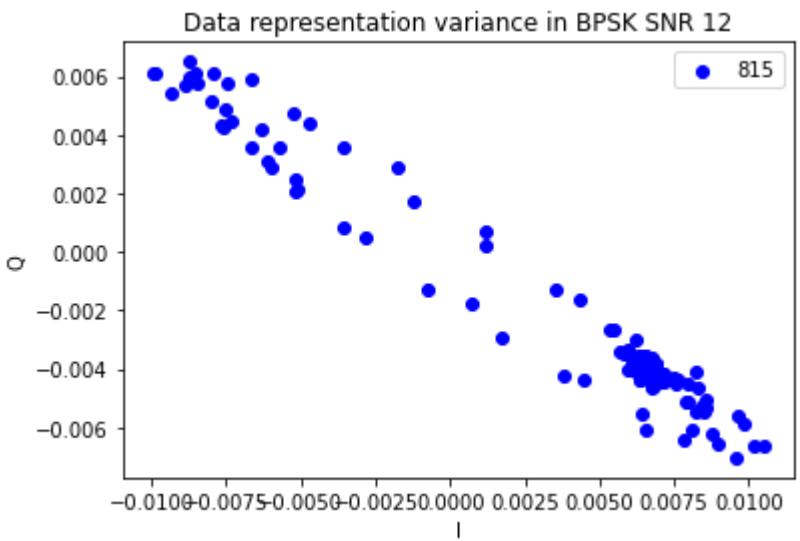

Data representation variance in BPSK SNR 12
810
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

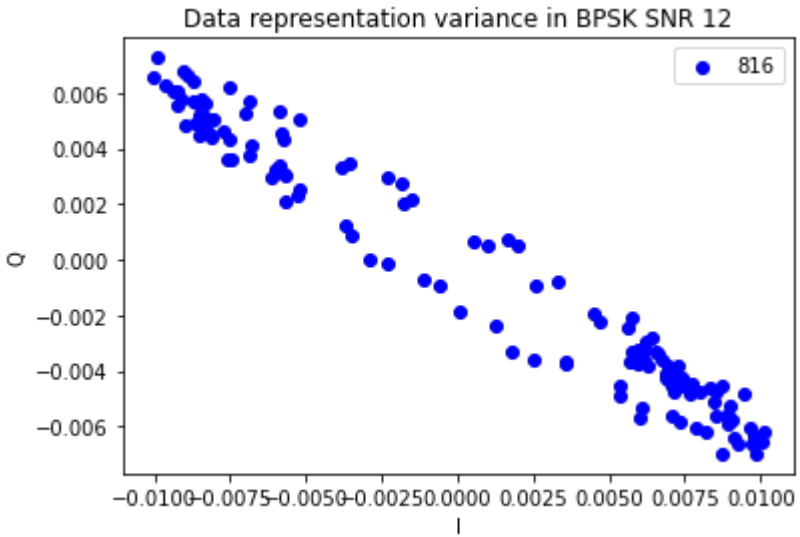

Data representation variance in BPSK SNR 12
811
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

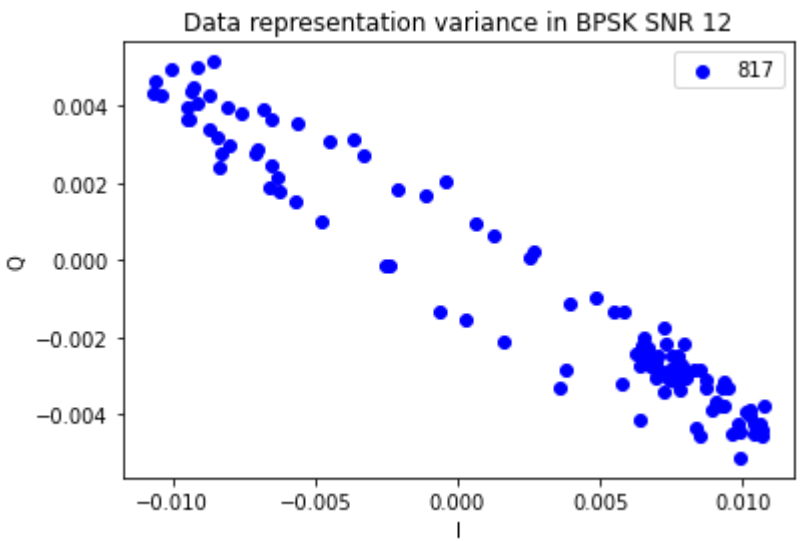

Data representation variance in BPSK SNR 12
812
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

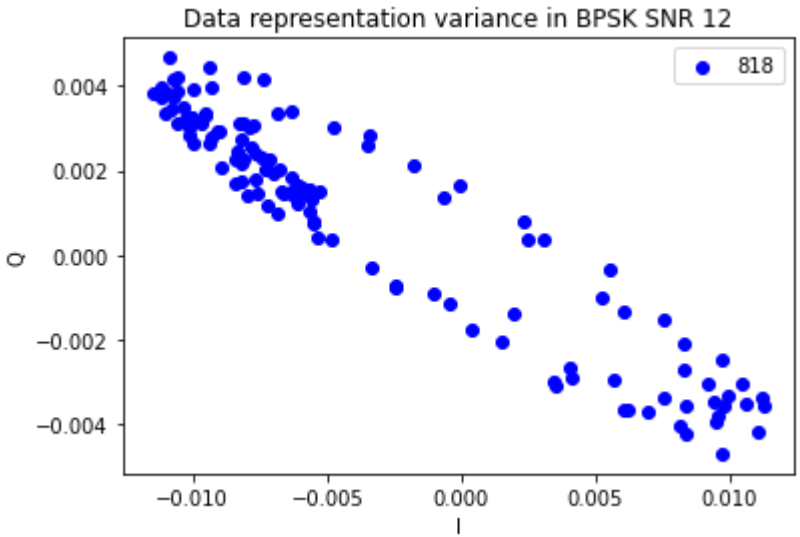

Data representation variance in BPSK SNR 12
813
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

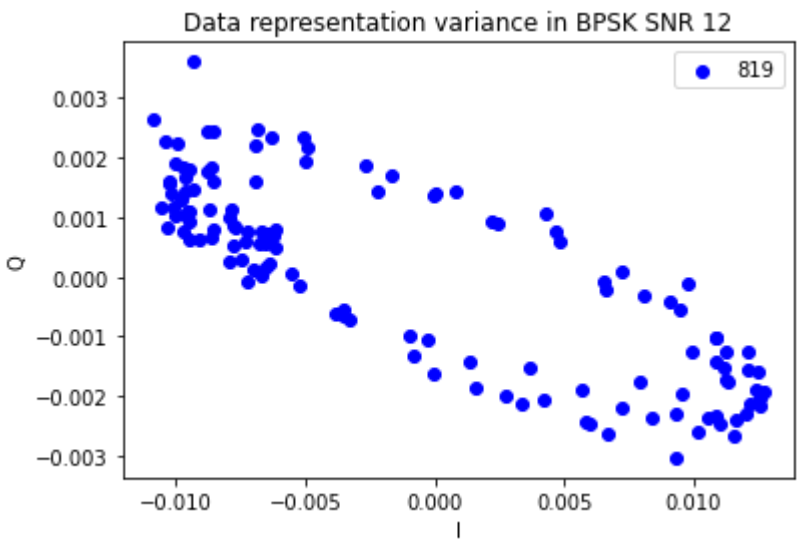

Data representation variance in BPSK SNR 12
814
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

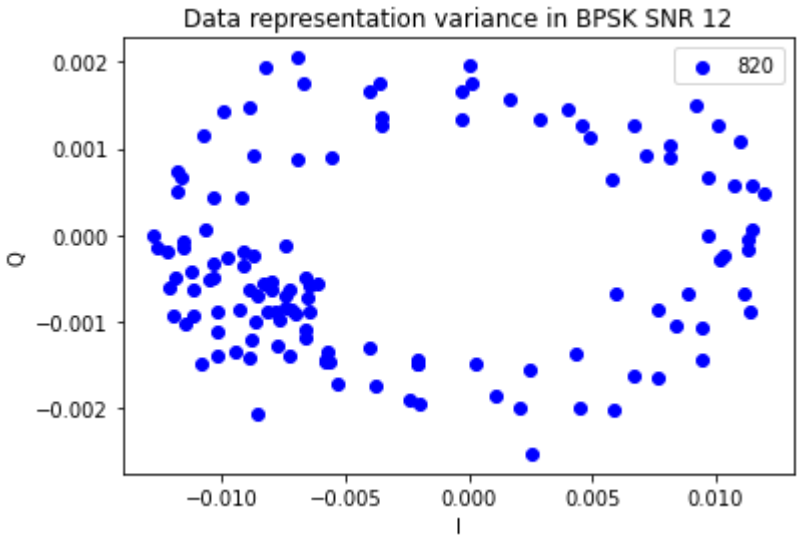

Data representation variance in BPSK SNR 12
815
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

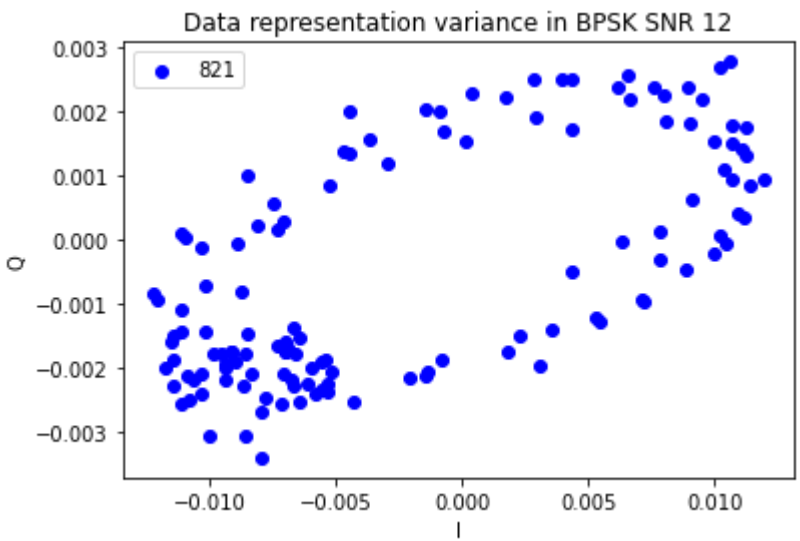

Data representation variance in BPSK SNR 12
816
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

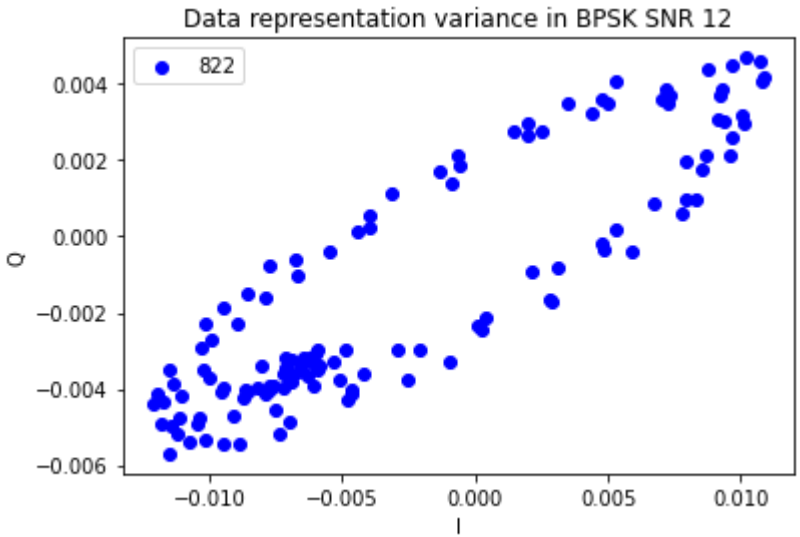

Data representation variance in BPSK SNR 12
817
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010 −0.005 0.000 0.005 0.010
I

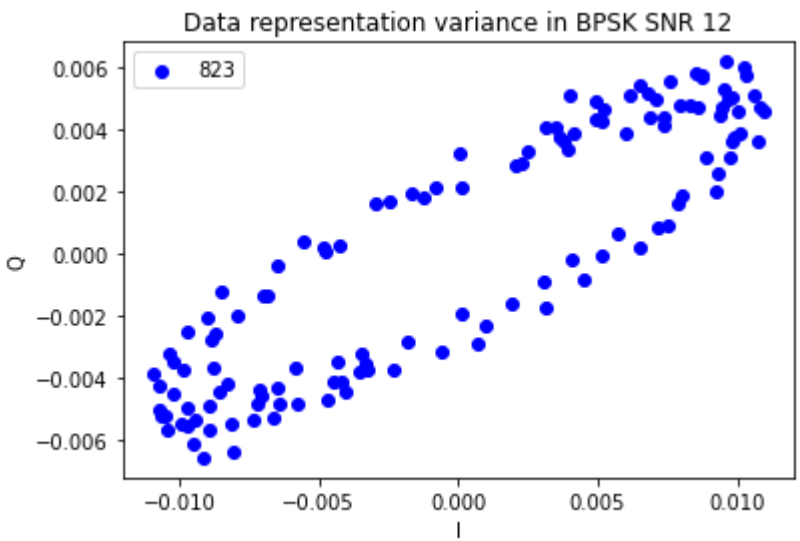

Data representation variance in BPSK SNR 12
818
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

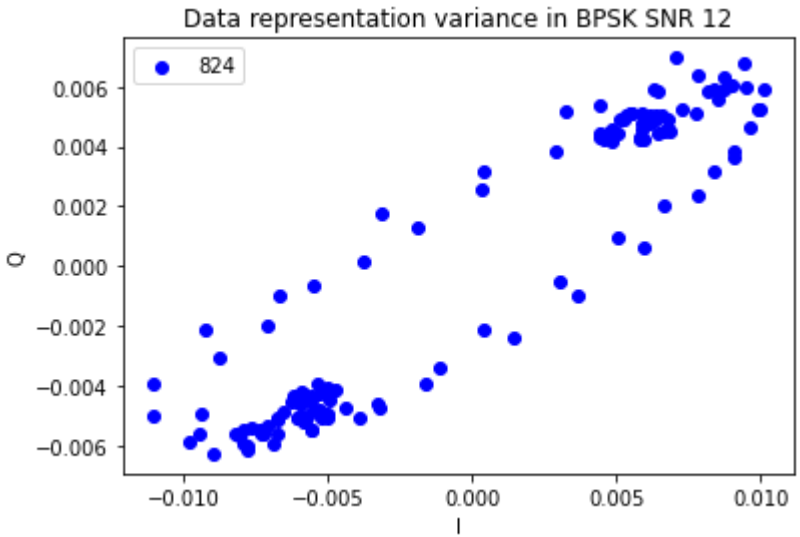

Data representation variance in BPSK SNR 12
819
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

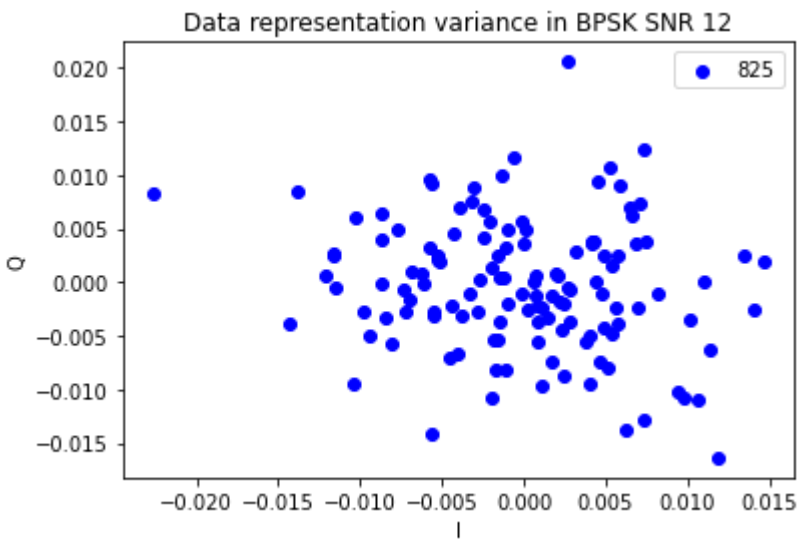

Data representation variance in BPSK SNR 12
820
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

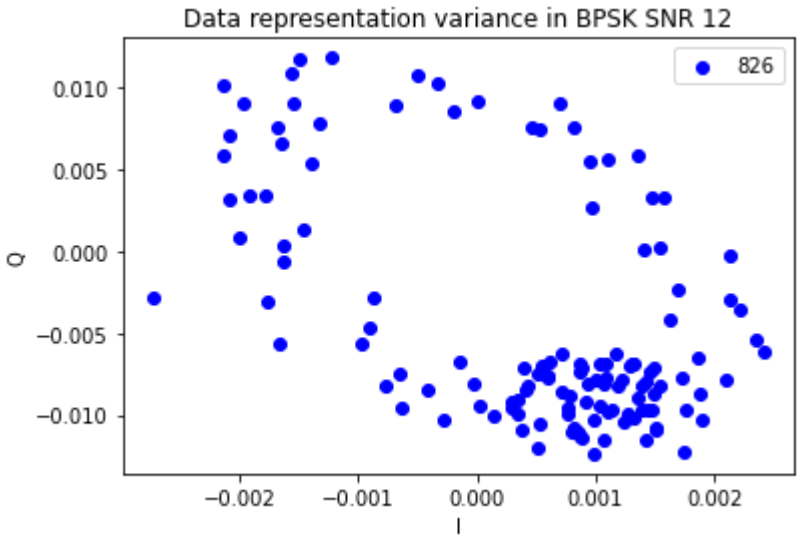

Data representation variance in BPSK SNR 12
821
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

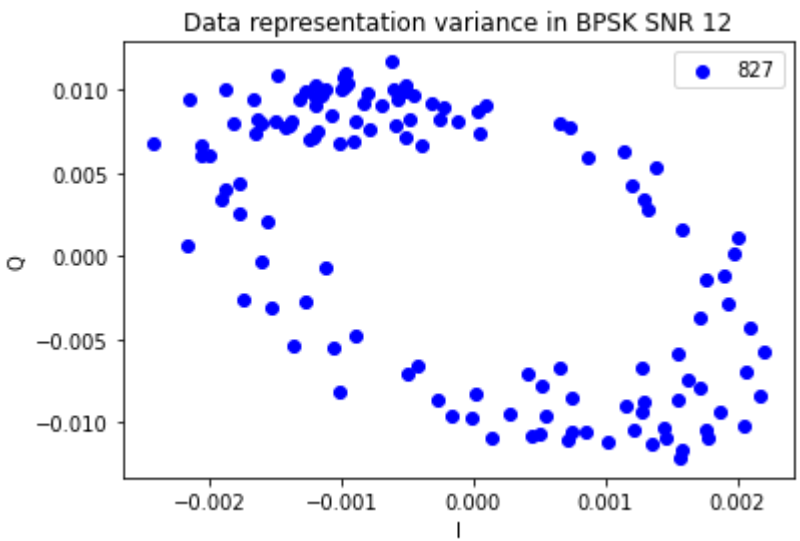

Data representation variance in BPSK SNR 12
822
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

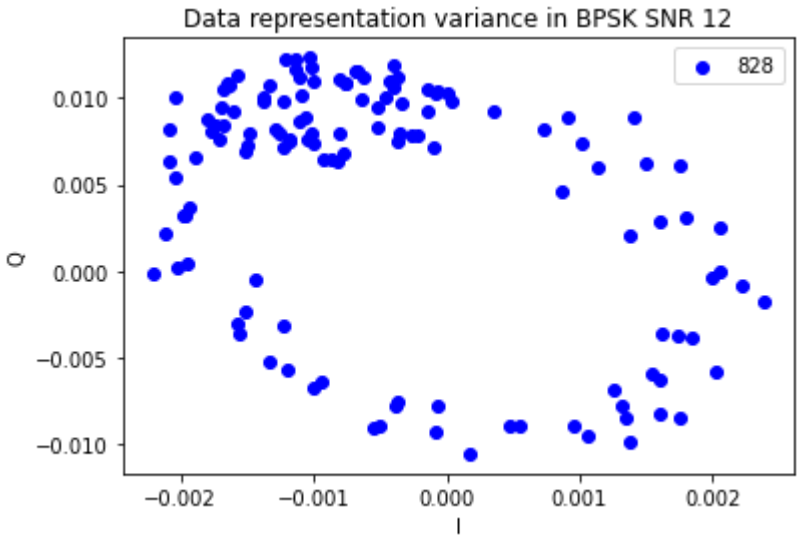

Data representation variance in BPSK SNR 12
823
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

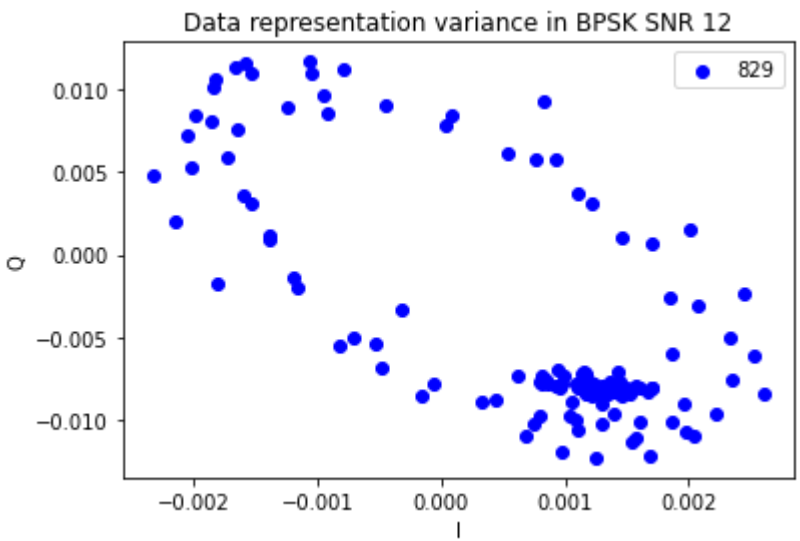

Data representation variance in BPSK SNR 12
824
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

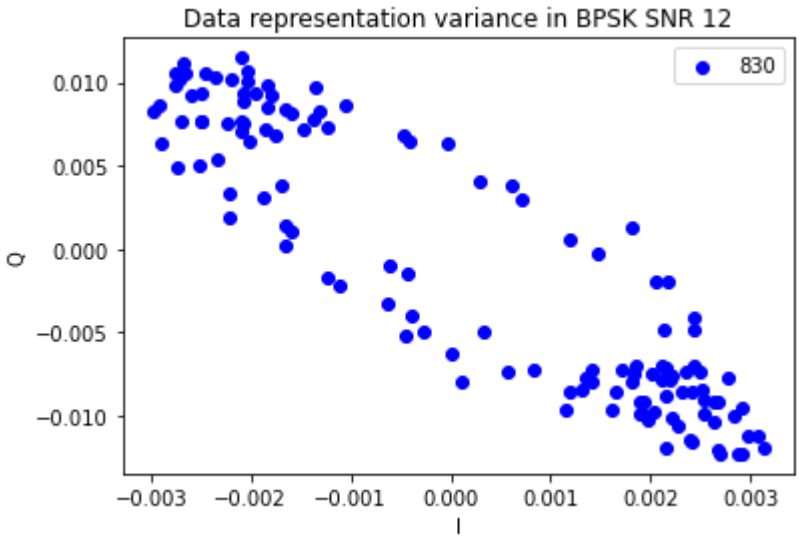

Data representation variance in BPSK SNR 12
825
0.020
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.020
−0.015
−0.010
−0.005
0.000
0.005
0.010
0.015
I

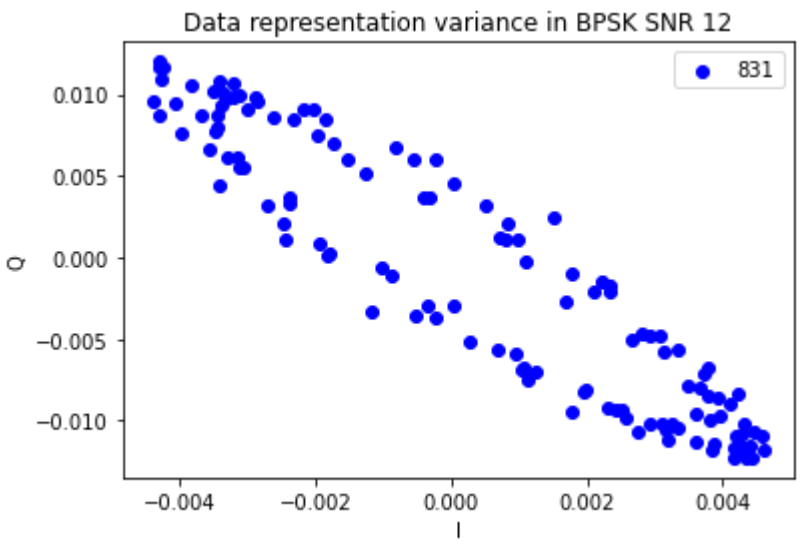

Data representation variance in BPSK SNR 12
826
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

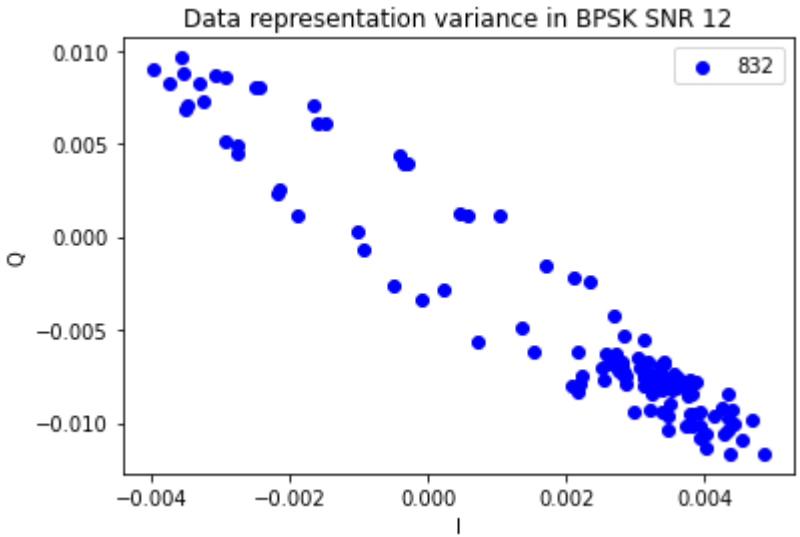

Data representation variance in BPSK SNR 12
827
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

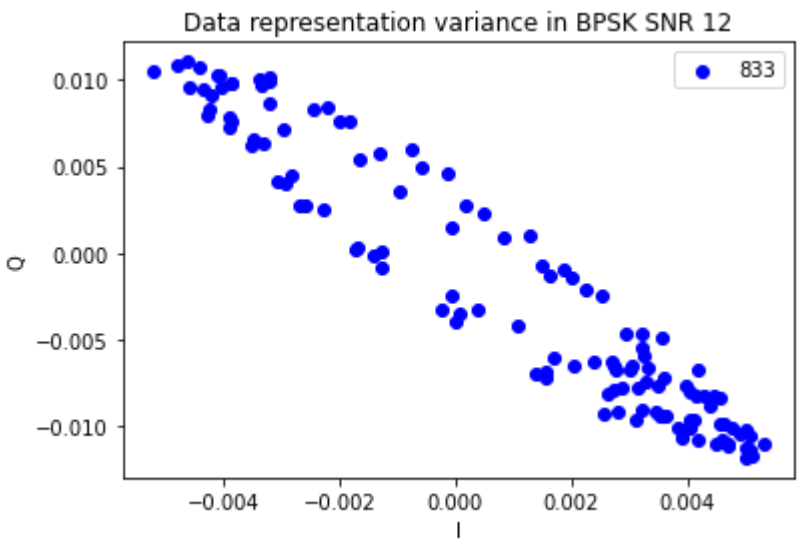

Data representation variance in BPSK SNR 12
828
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

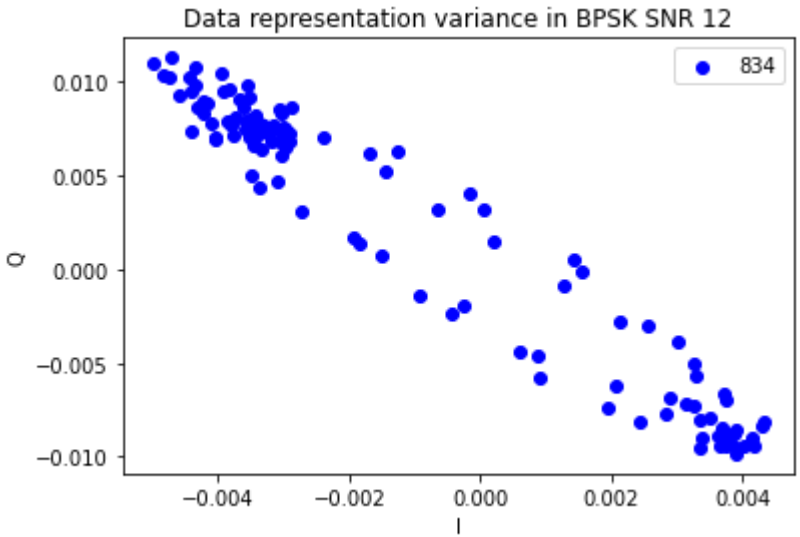

Data representation variance in BPSK SNR 12
829
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I

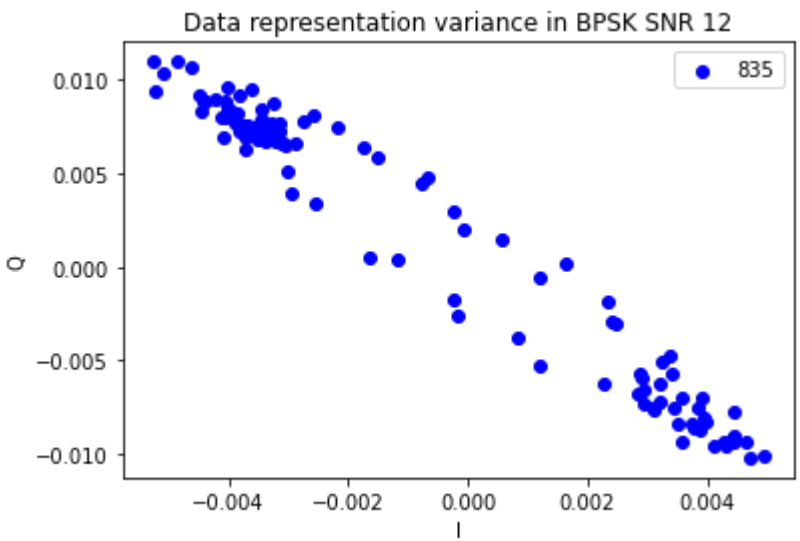

Data representation variance in BPSK SNR 12
830
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

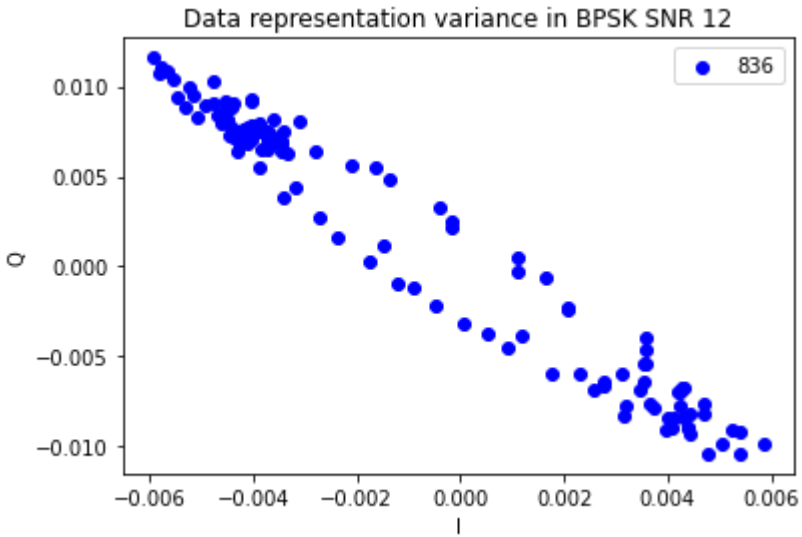

Data representation variance in BPSK SNR 12
831
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

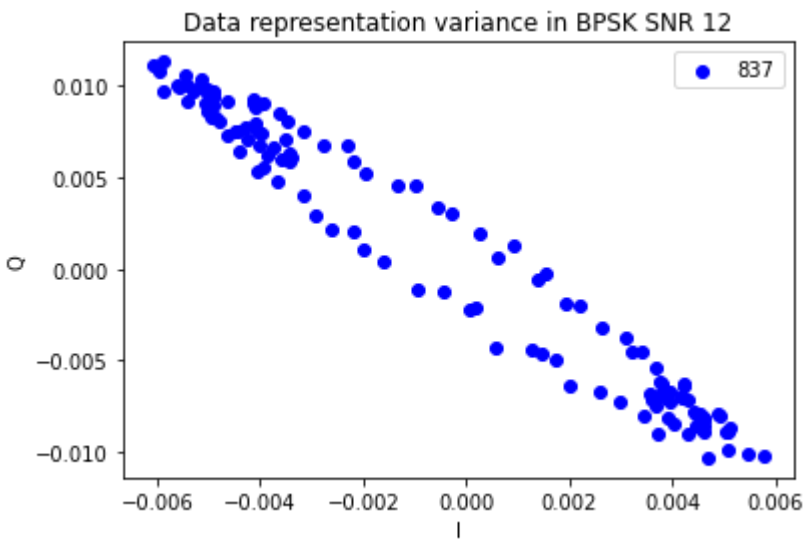

Data representation variance in BPSK SNR 12
832
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

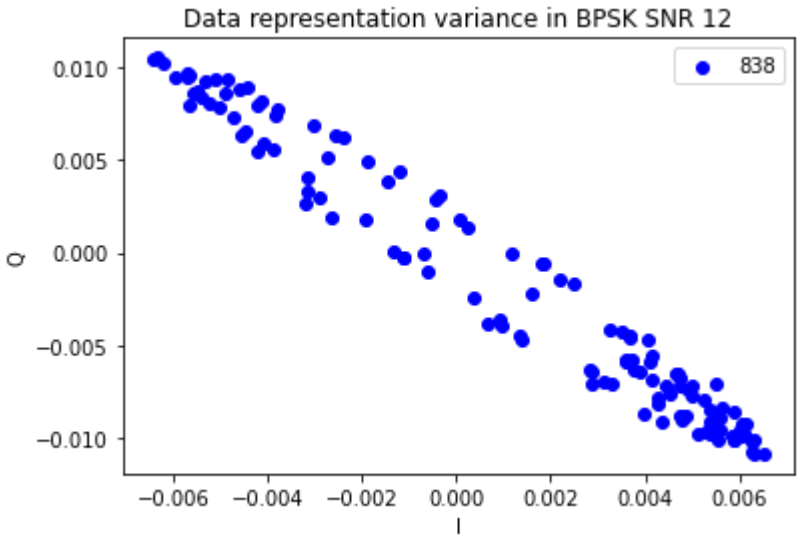

Data representation variance in BPSK SNR 12
833
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

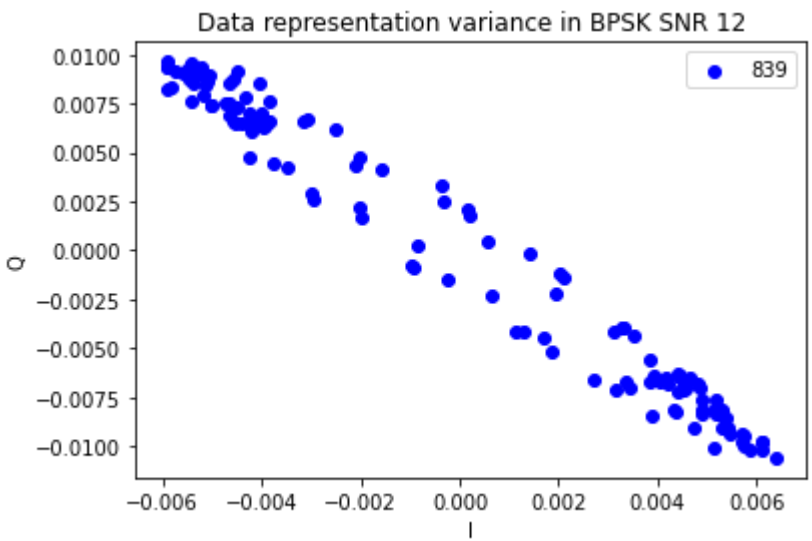

Data representation variance in BPSK SNR 12
834
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

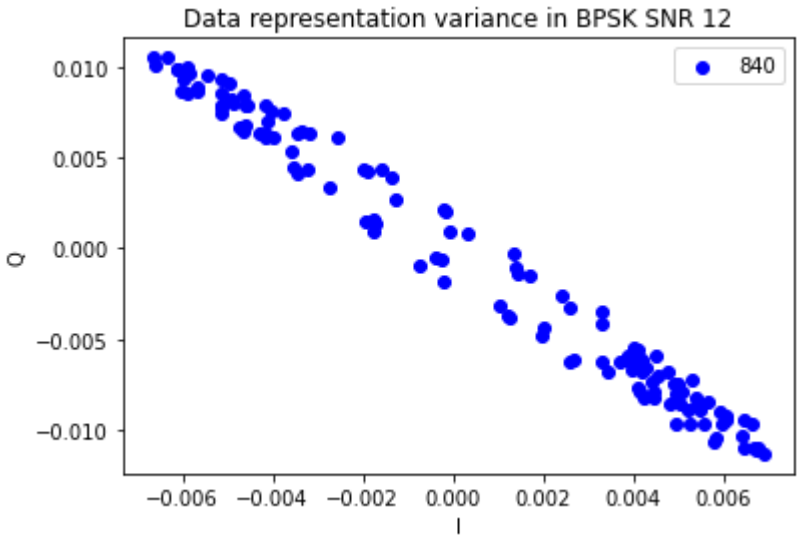

Data representation variance in BPSK SNR 12
835
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

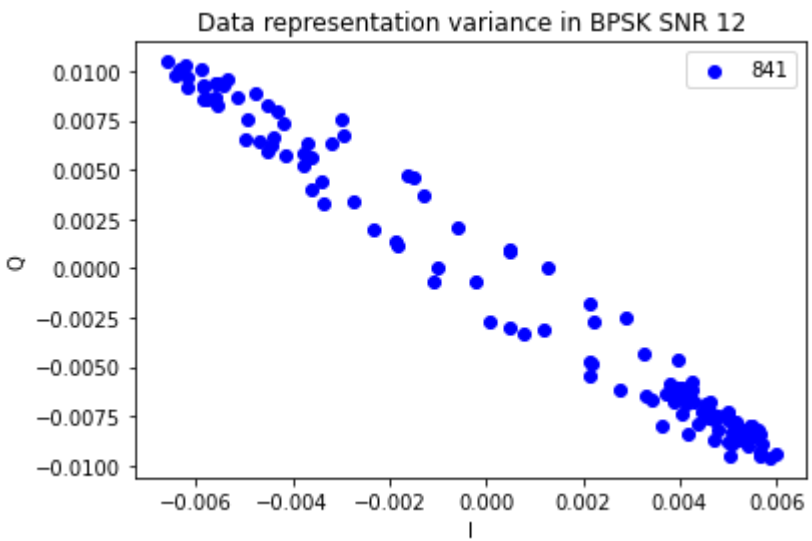

Data representation variance in BPSK SNR 12
836
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

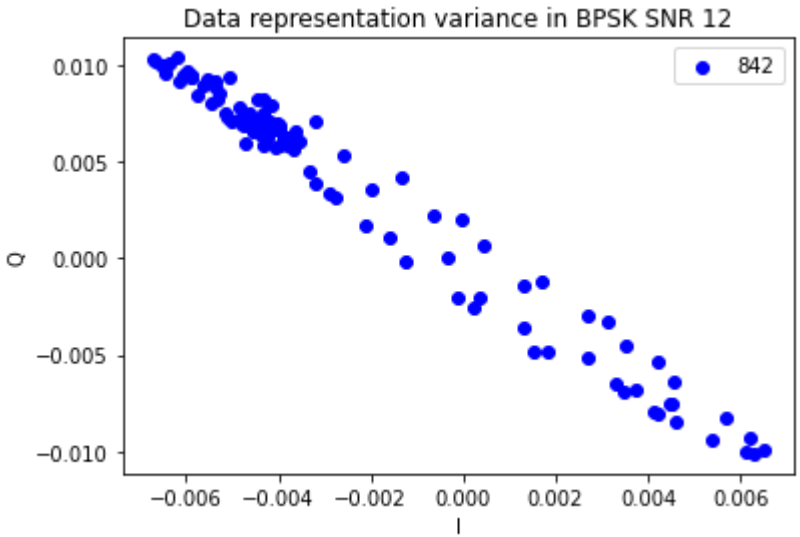

Data representation variance in BPSK SNR 12
837
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

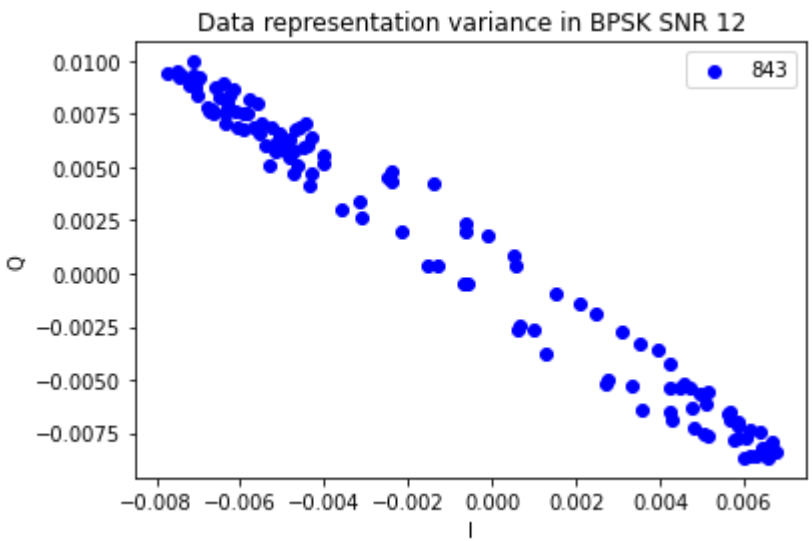

Data representation variance in BPSK SNR 12
838
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

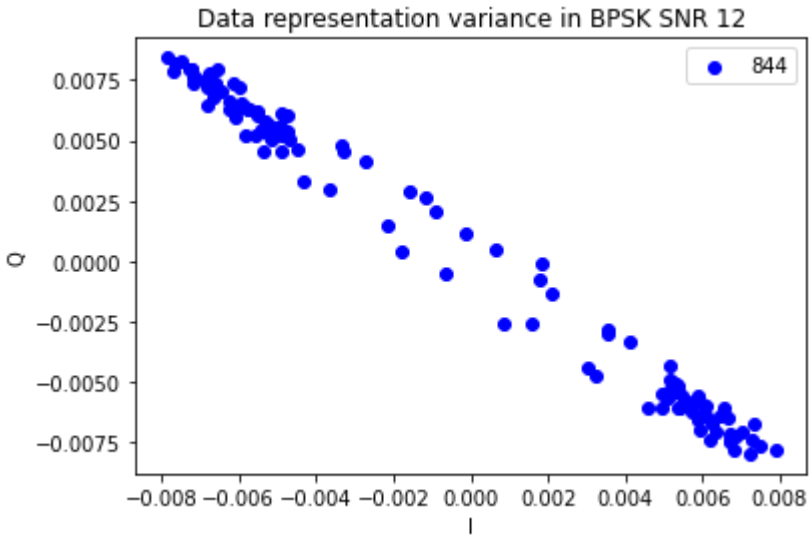

Data representation variance in BPSK SNR 12
839
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

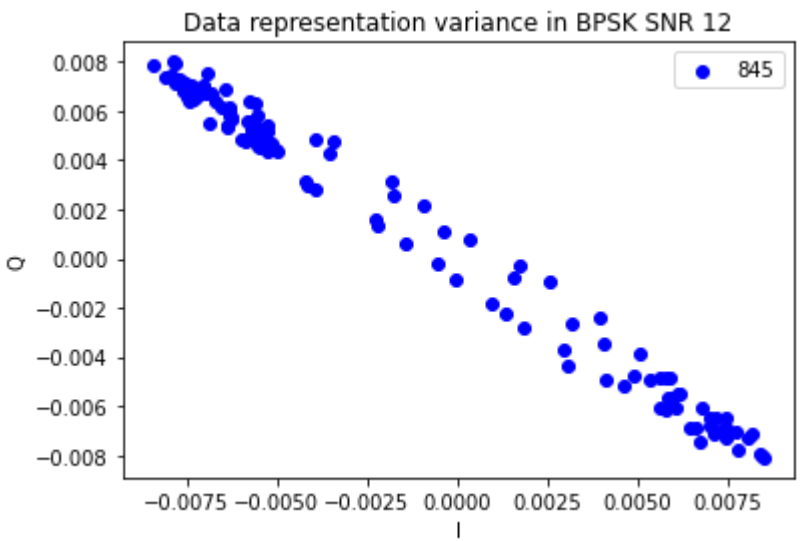

Data representation variance in BPSK SNR 12
840
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

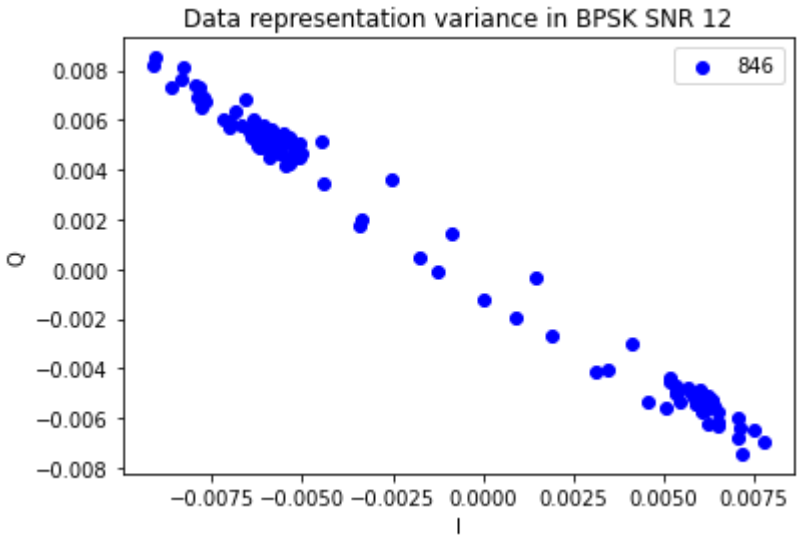

Data representation variance in BPSK SNR 12
841
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

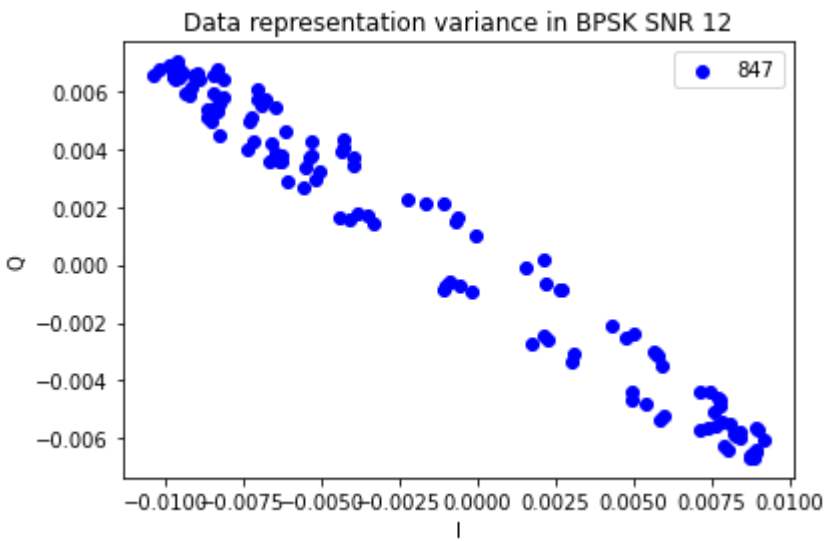

Data representation variance in BPSK SNR 12
842
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

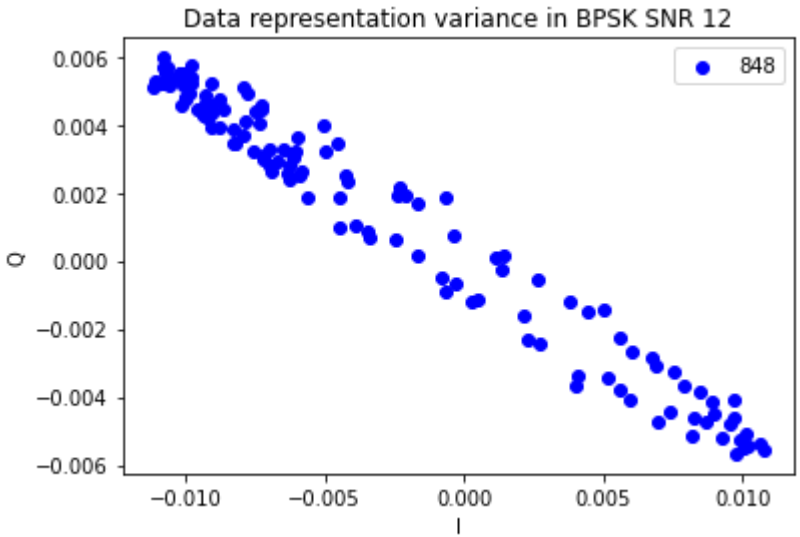

Data representation variance in BPSK SNR 12
843
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.008
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

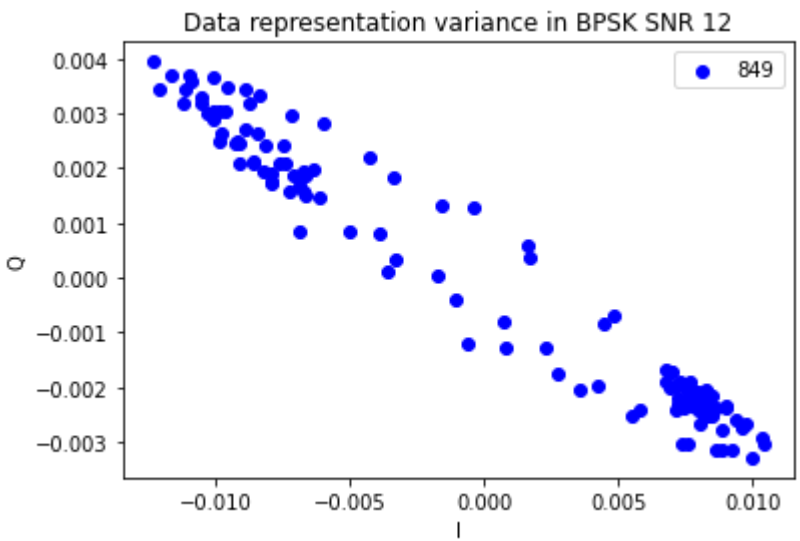

Data representation variance in BPSK SNR 12
844
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

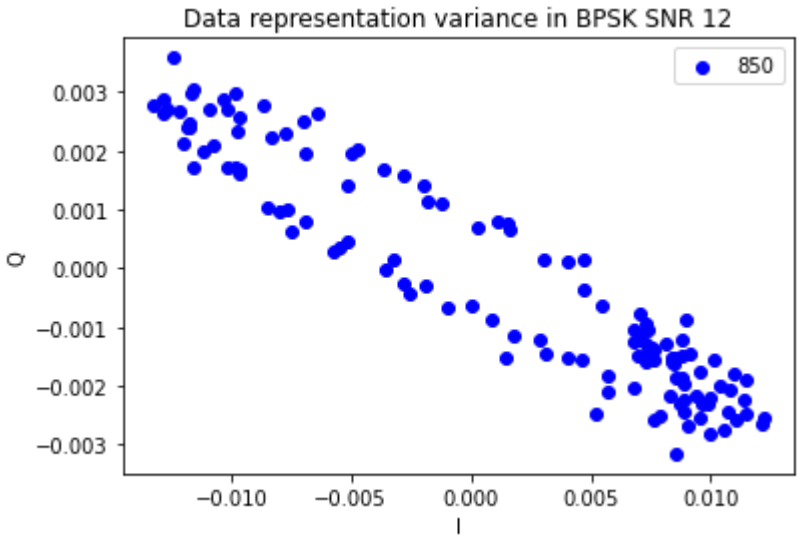

Data representation variance in BPSK SNR 12
845
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

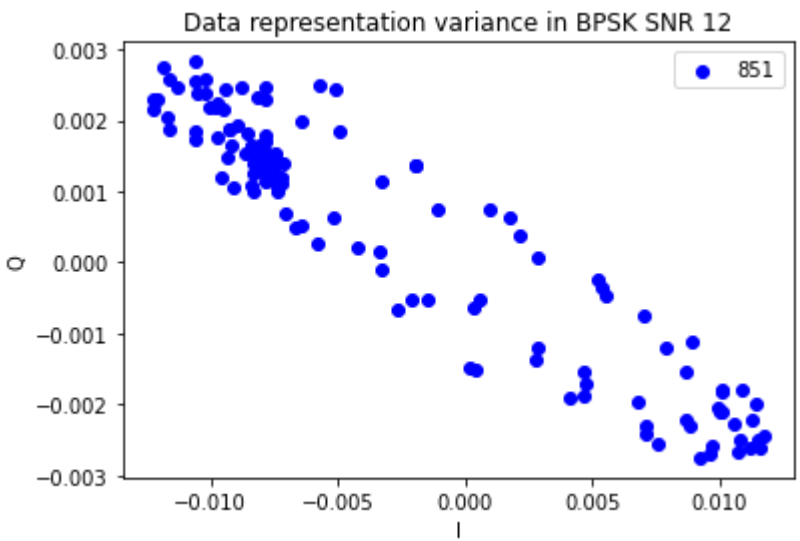

Data representation variance in BPSK SNR 12
846
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

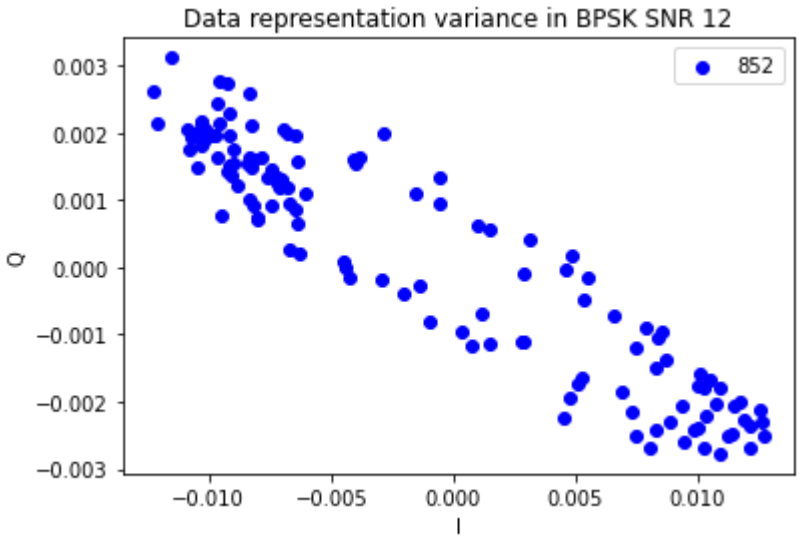

Data representation variance in BPSK SNR 12
847
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

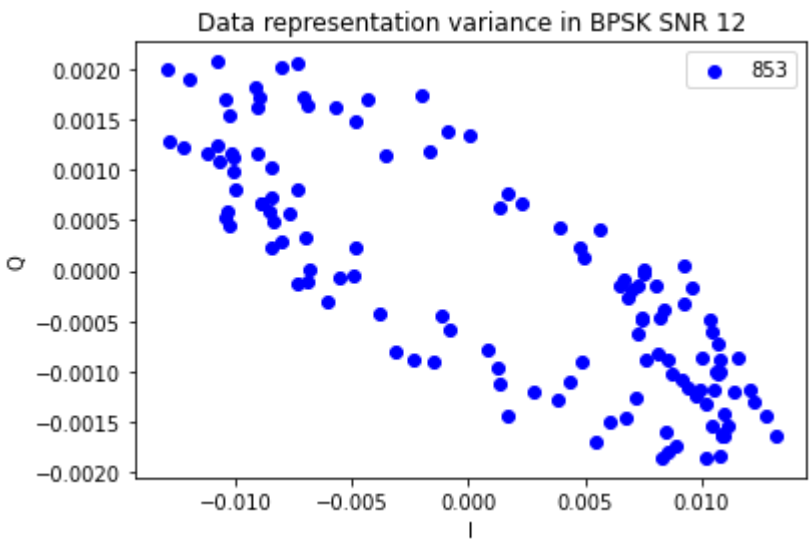

Data representation variance in BPSK SNR 12
848
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

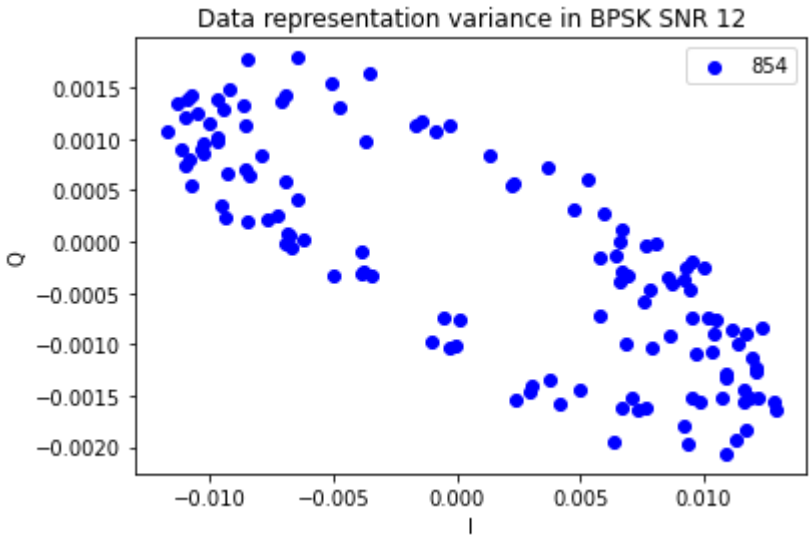

Data representation variance in BPSK SNR 12
849
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

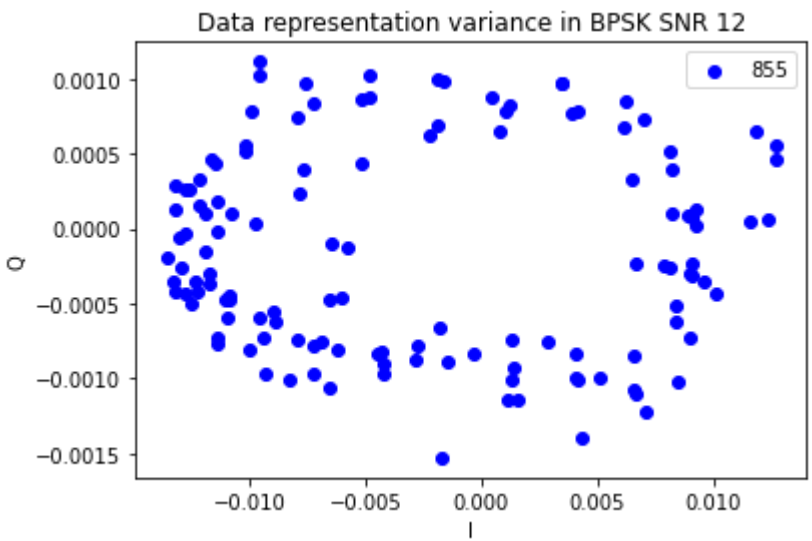

Data representation variance in BPSK SNR 12
850
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

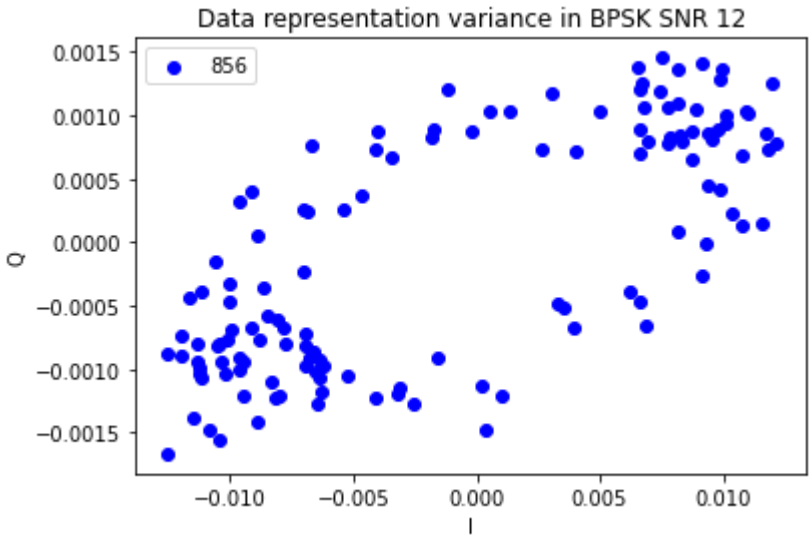

Data representation variance in BPSK SNR 12
851
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

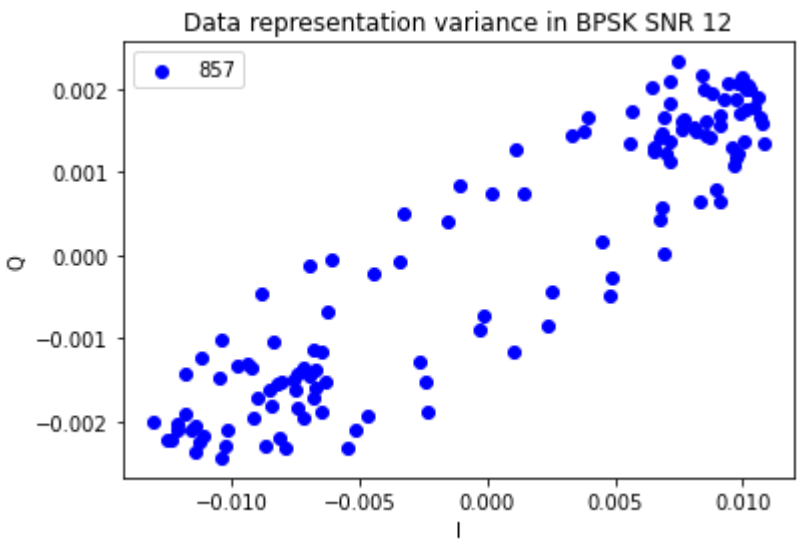

Data representation variance in BPSK SNR 12
852
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

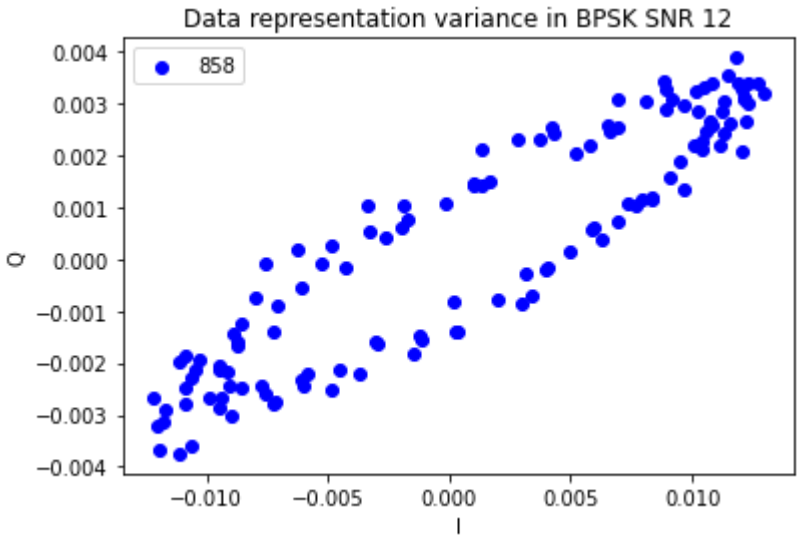

Data representation variance in BPSK SNR 12
853
0.0020
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
−0.0020
Q
−0.010
−0.005
0.000
0.005
0.010
I

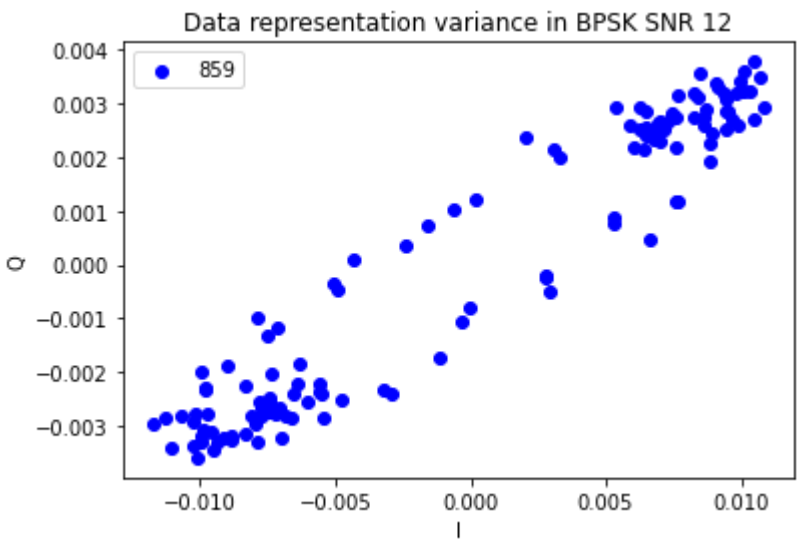

Data representation variance in BPSK SNR 12
854
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
−0.0020
Q
−0.010
−0.005
0.000
0.005
0.010
I

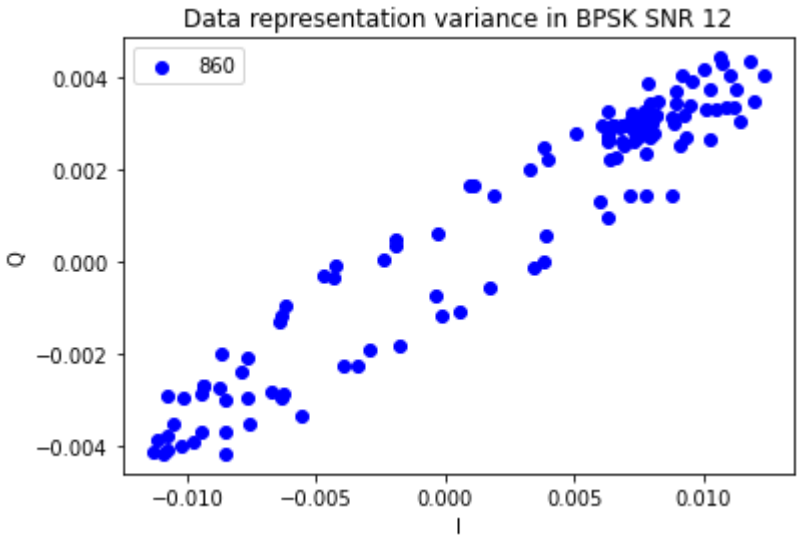

Data representation variance in BPSK SNR 12
855
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
856
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
857
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
858
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
859
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
860
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
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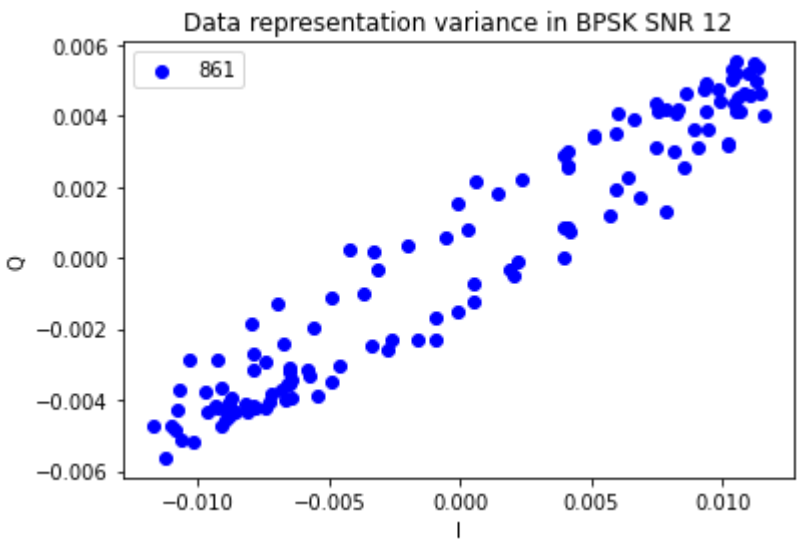
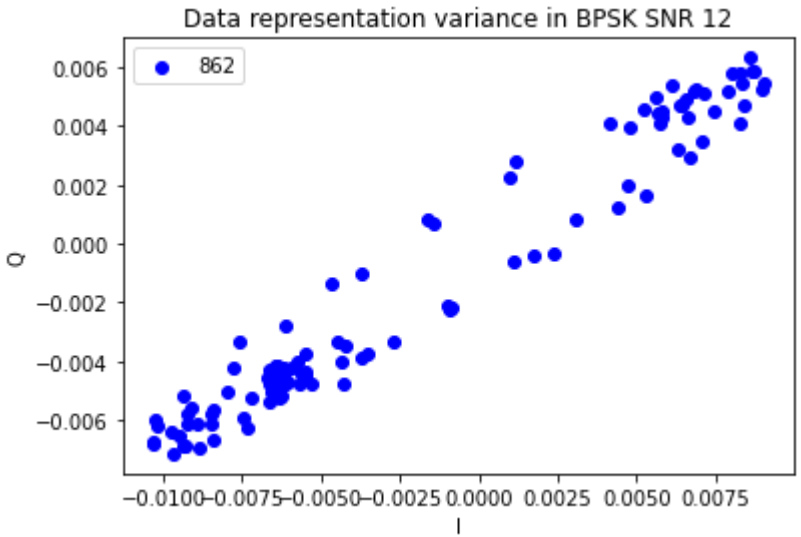
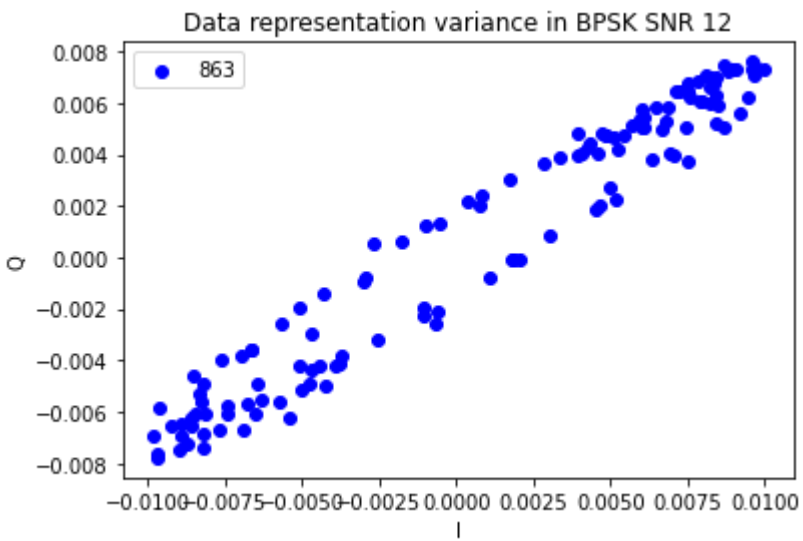
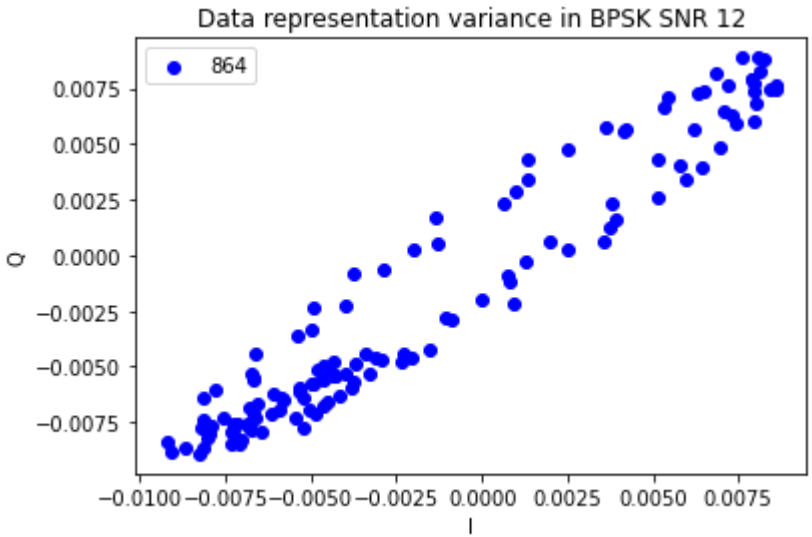
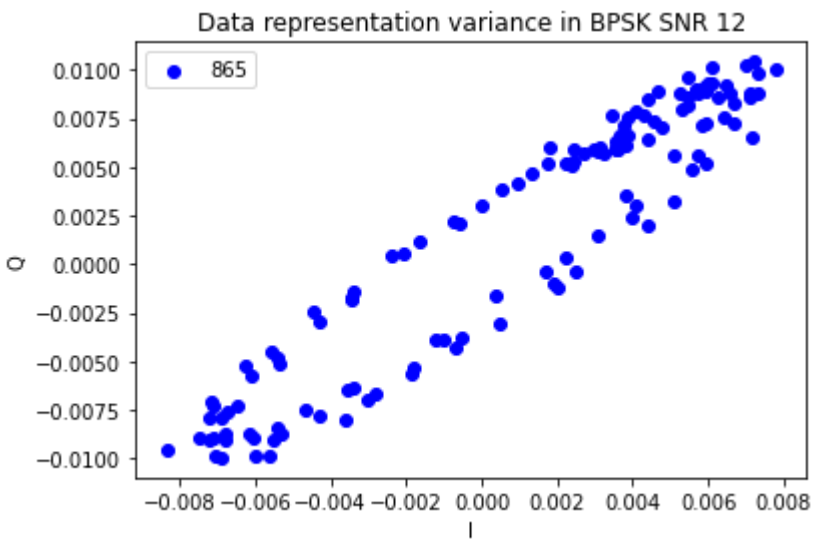
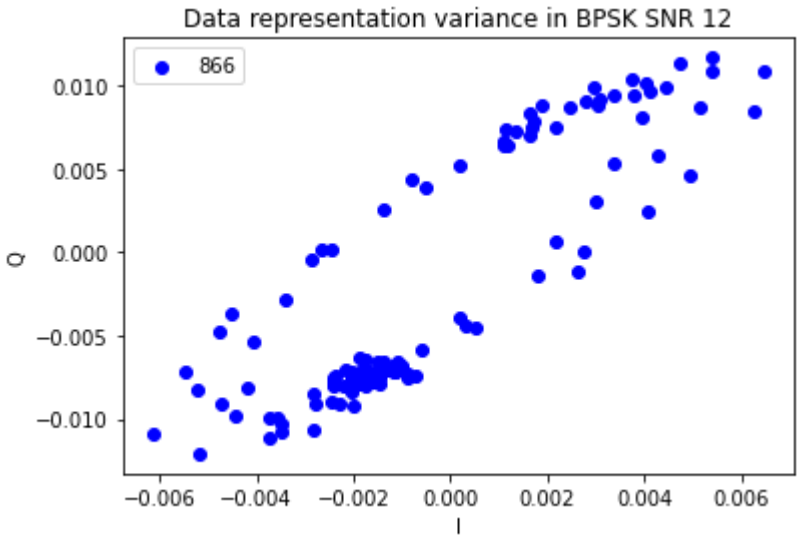

Data representation variance in BPSK SNR 12
861
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

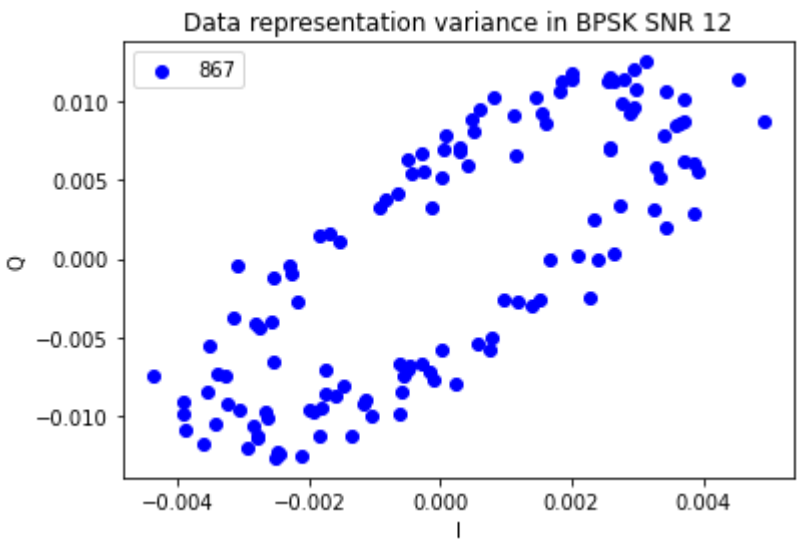

Data representation variance in BPSK SNR 12
862
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
863
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
864
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
865
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I


Data representation variance in BPSK SNR 12
866
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
867
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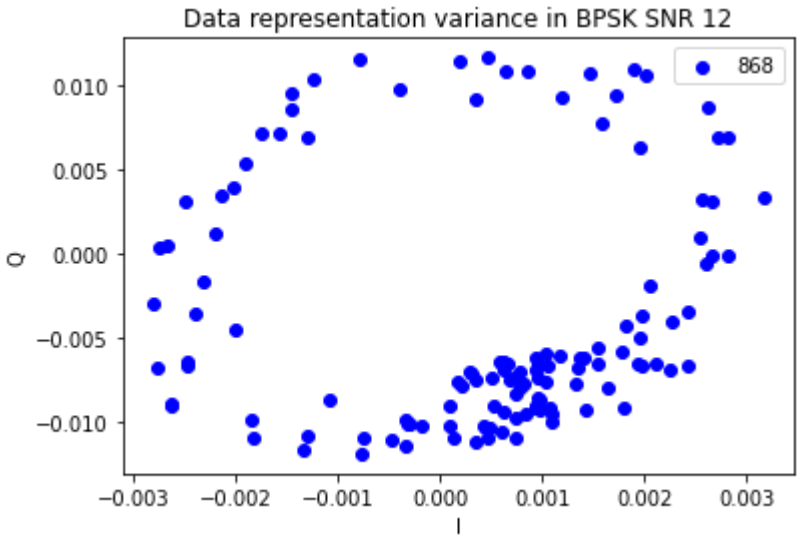
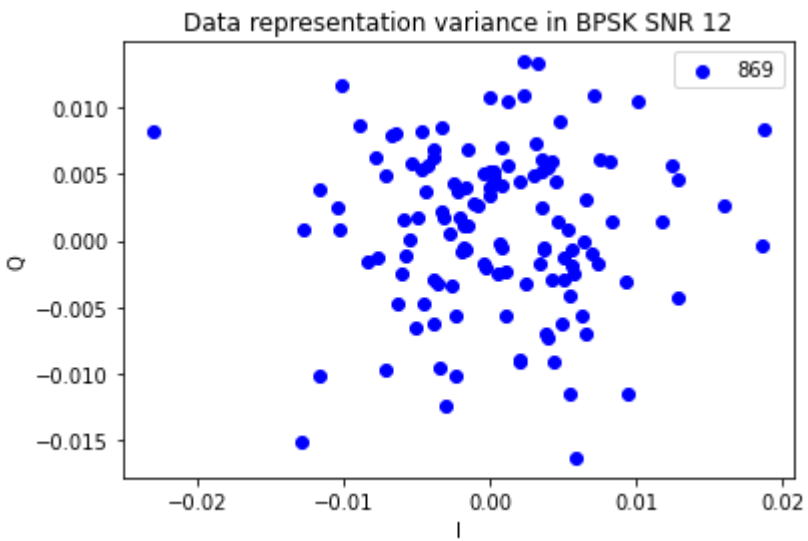
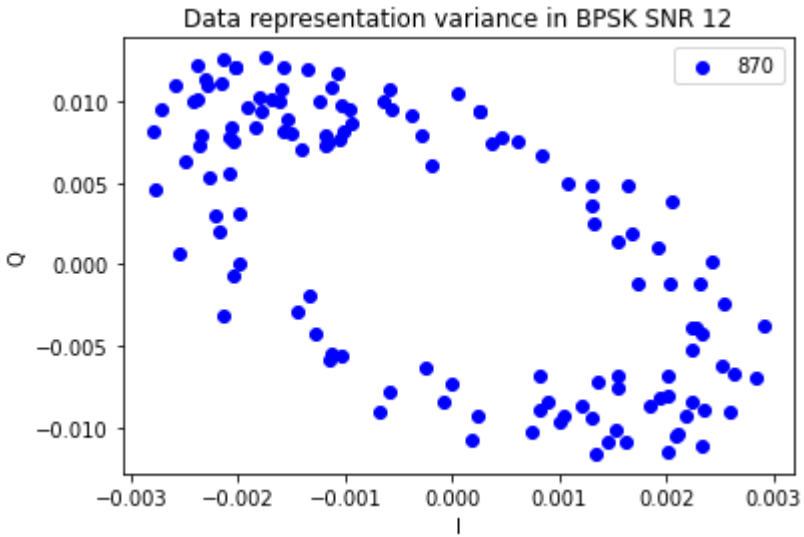
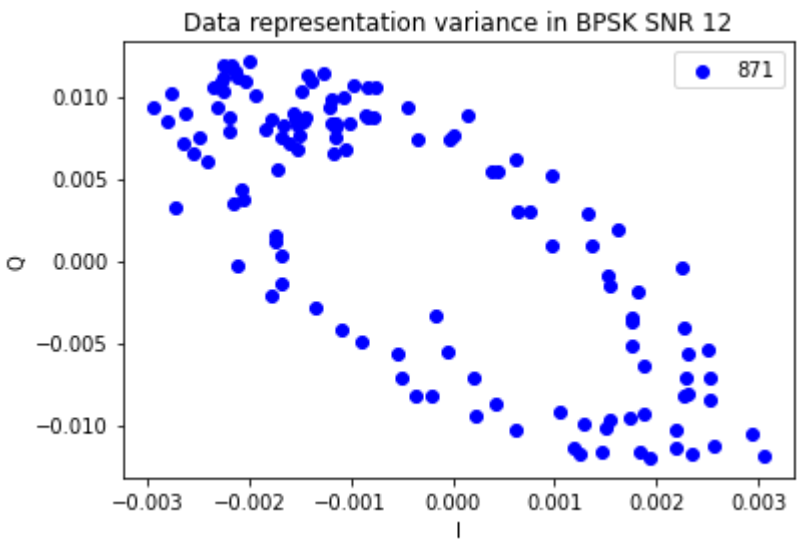
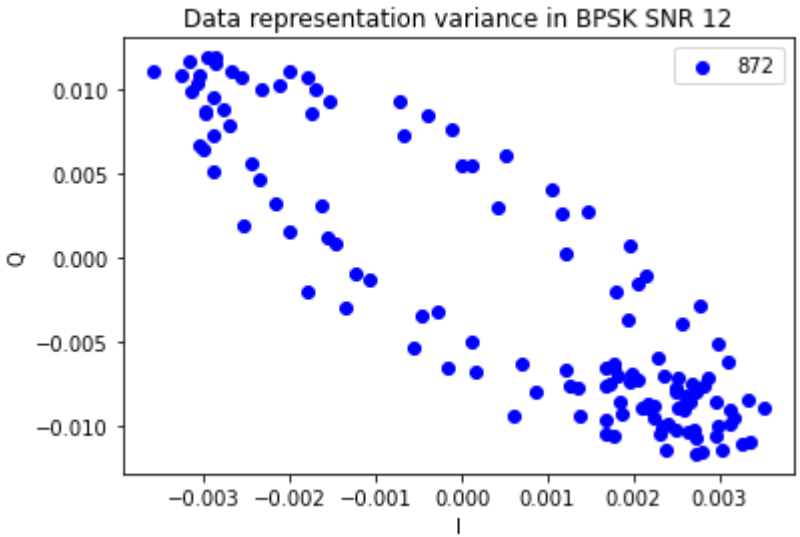
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

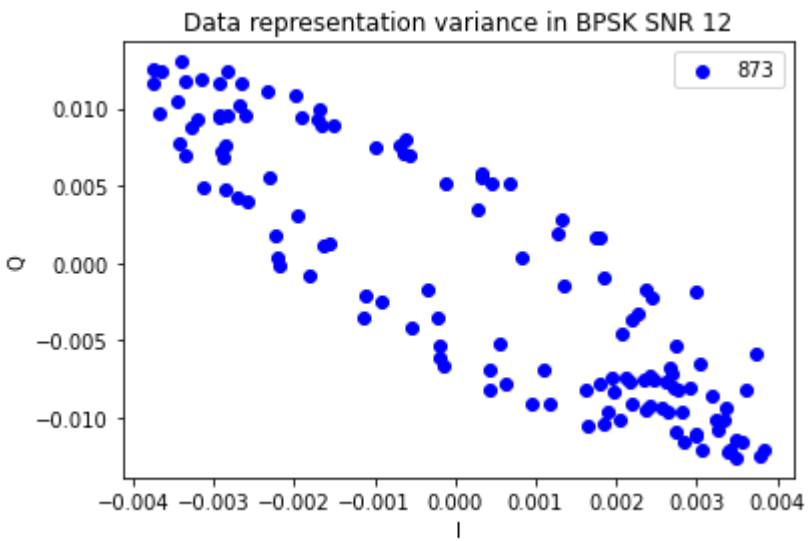

Data representation variance in BPSK SNR 12
868
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

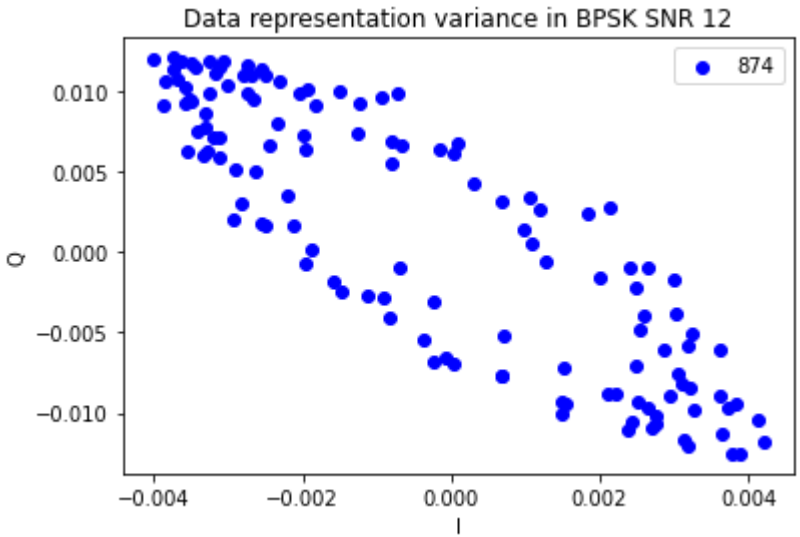

Data representation variance in BPSK SNR 12
869
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.02
−0.01
0.00
0.01
0.02
I

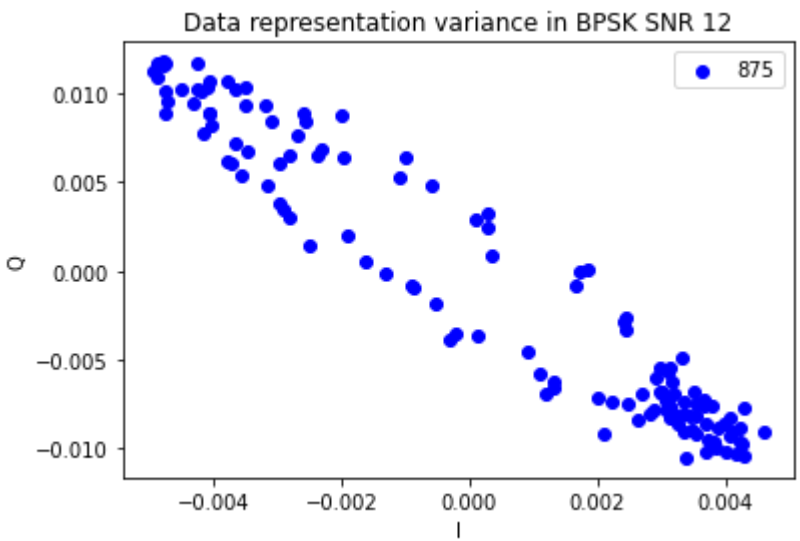

Data representation variance in BPSK SNR 12
870
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

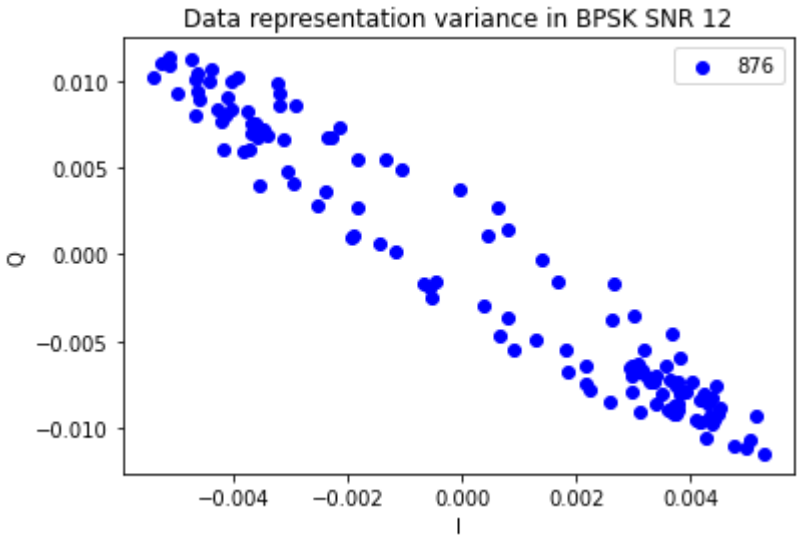

Data representation variance in BPSK SNR 12
871
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

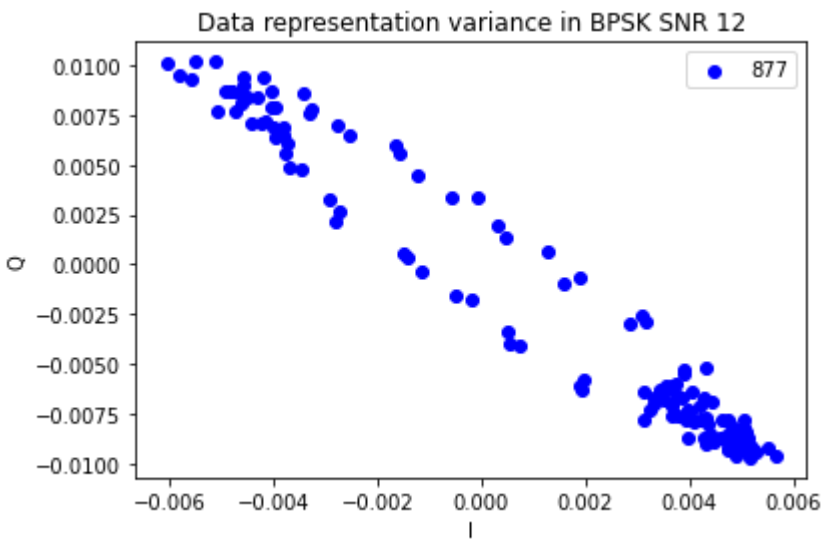

Data representation variance in BPSK SNR 12
872
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

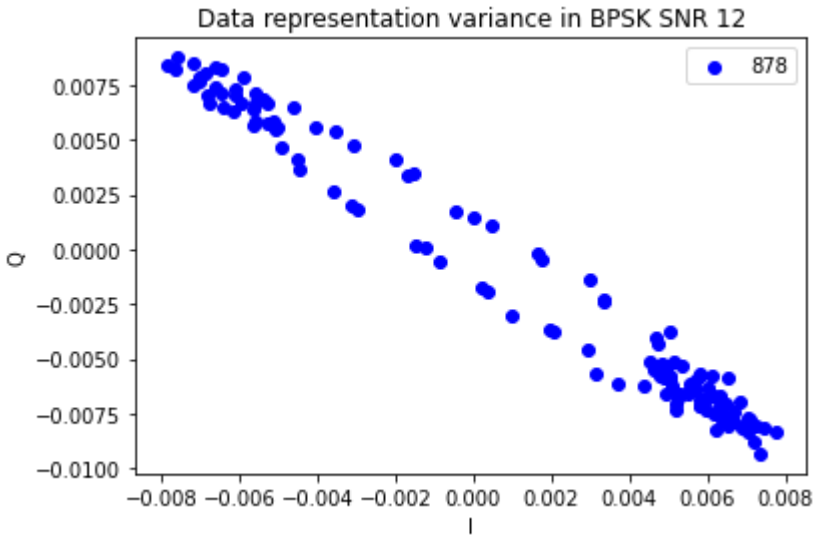

Data representation variance in BPSK SNR 12
873
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I

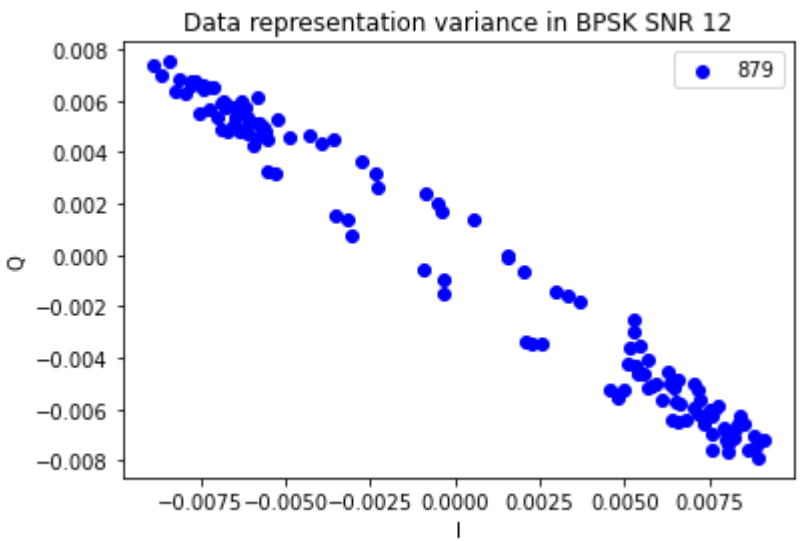

Data representation variance in BPSK SNR 12
874
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
875
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
876
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
877
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
878
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I


Data representation variance in BPSK SNR 12
879
0.008
0.006
0.004
0.002
0.000
−0.002
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−0.006
−0.008
Q
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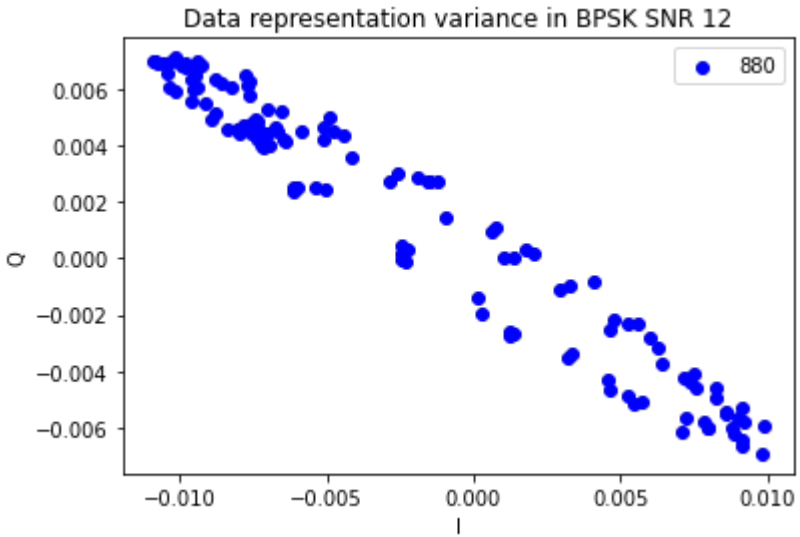
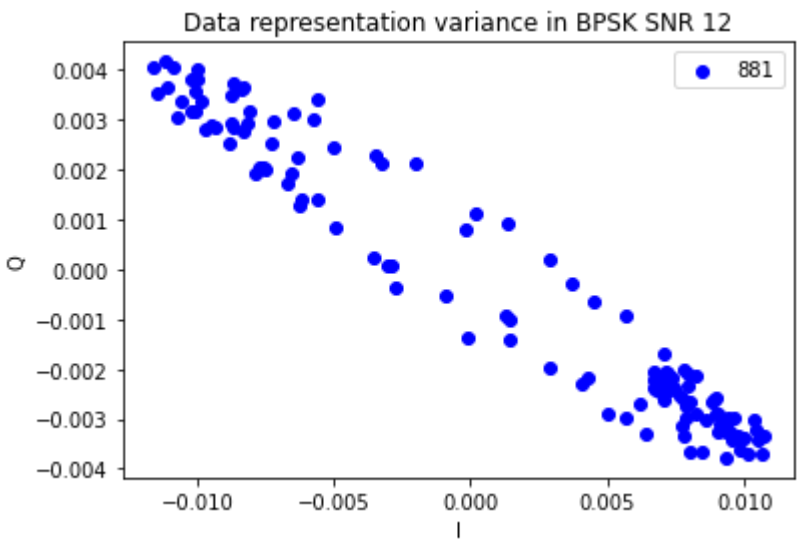
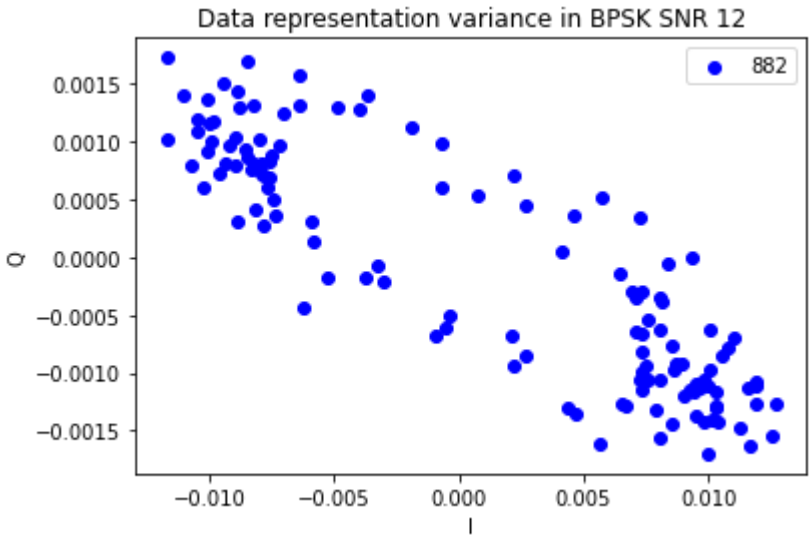

Data representation variance in BPSK SNR 12
880
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
881
0.004
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
882
0.0015
0.0010
0.0005
0.0000
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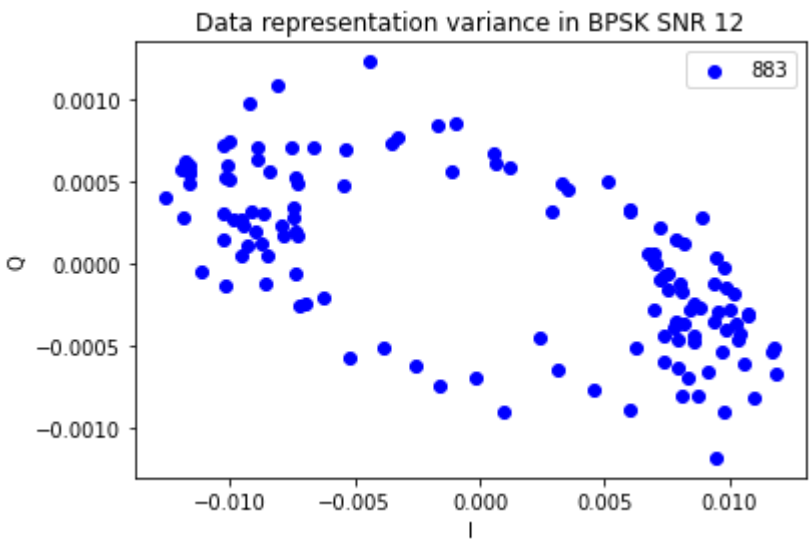
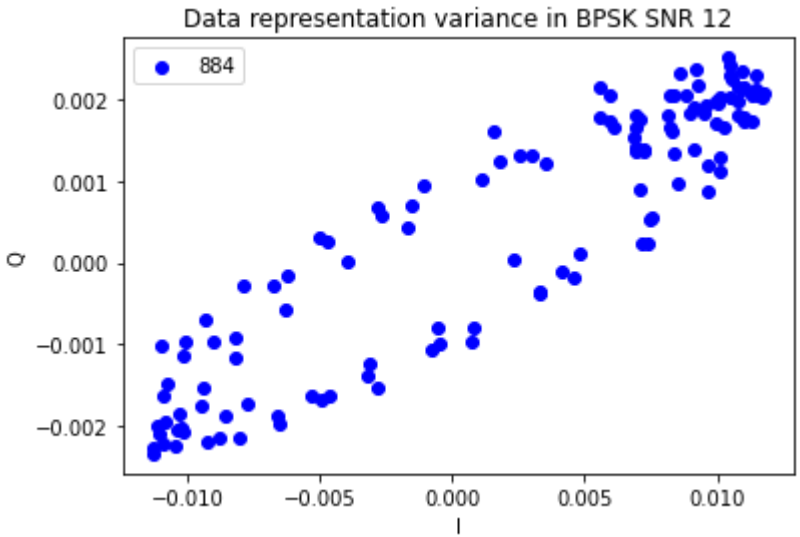
−0.0010
−0.0015
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
883
0.0010
0.0005
0.0000
−0.0005
−0.0010
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
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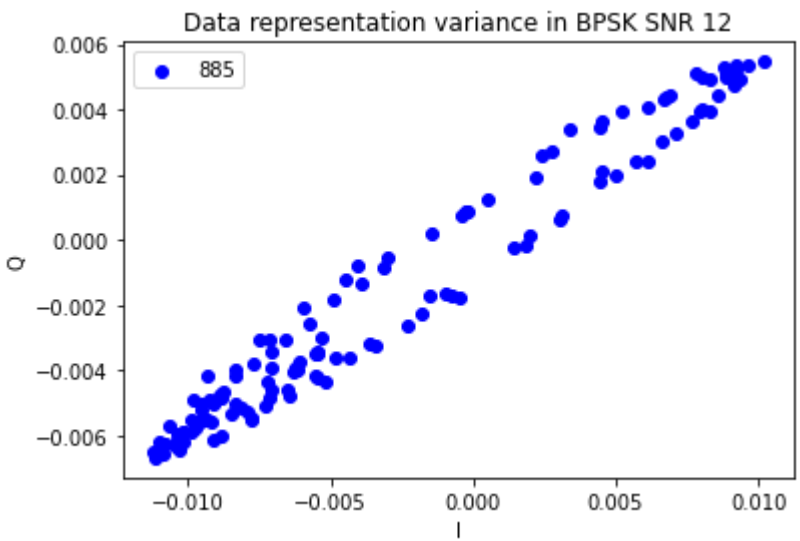
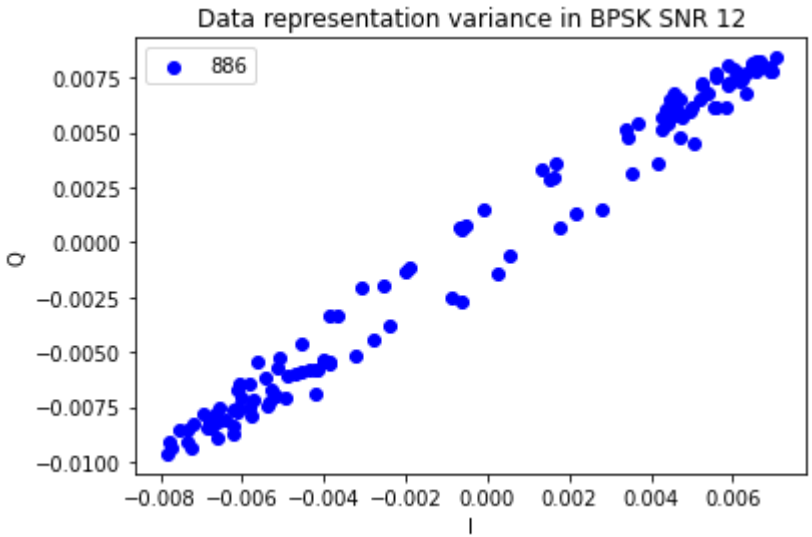
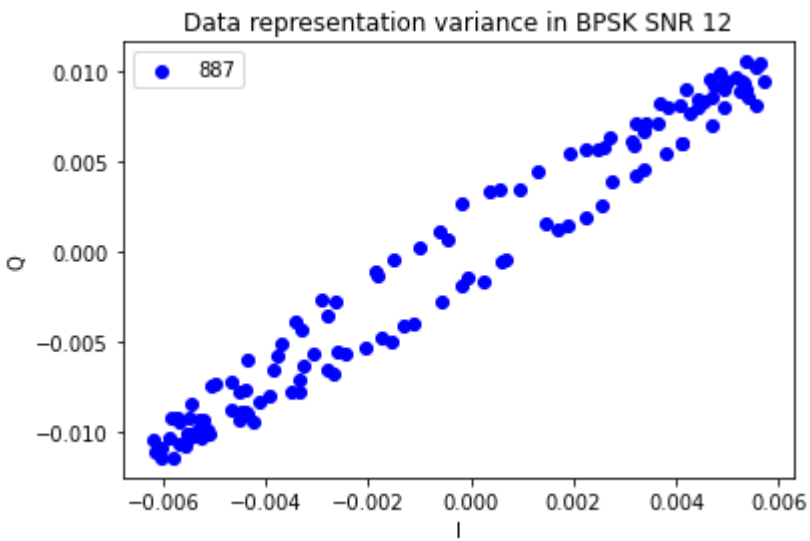
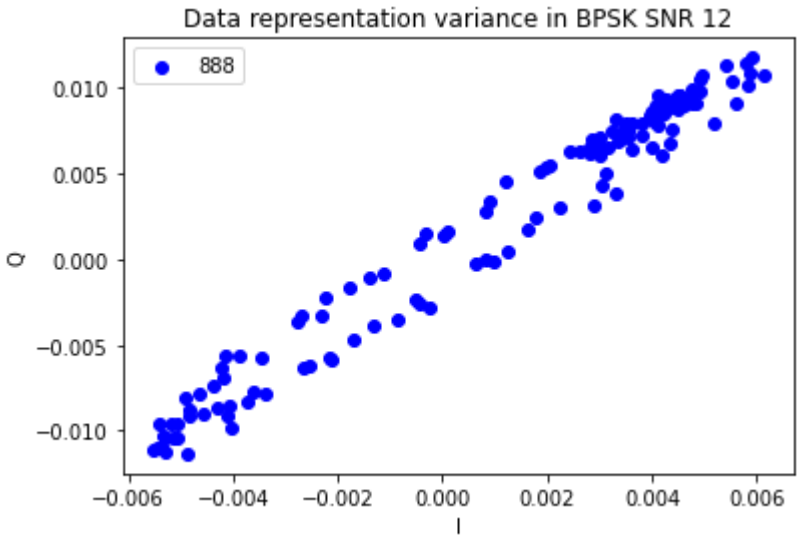
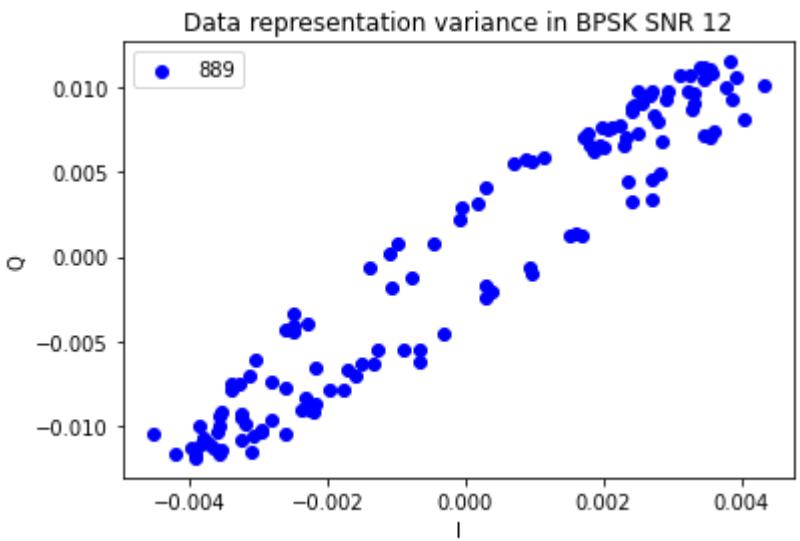
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

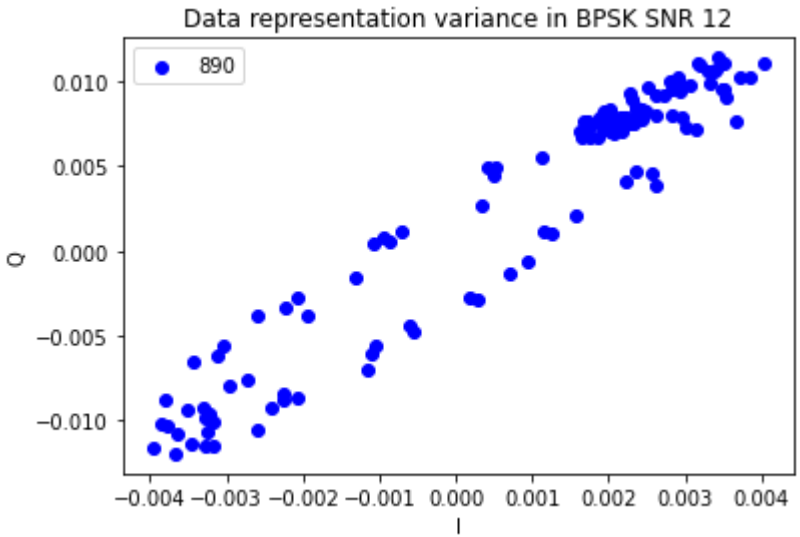

Data representation variance in BPSK SNR 12
885
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

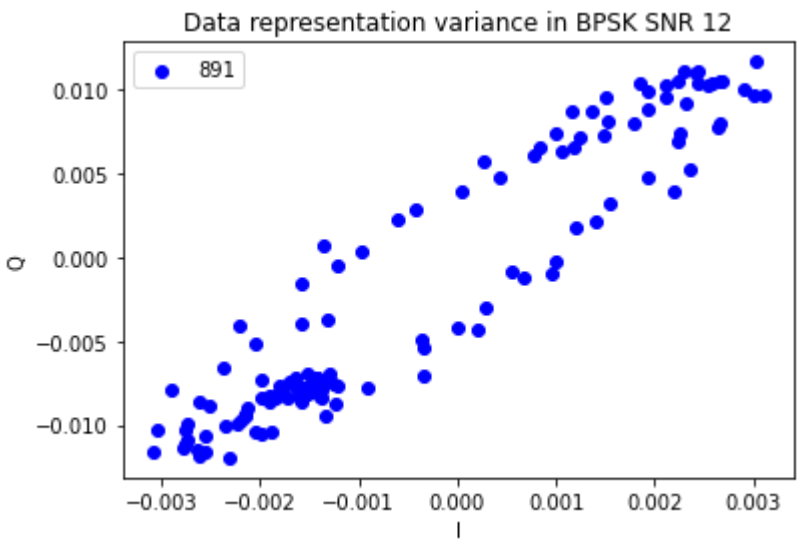

Data representation variance in BPSK SNR 12
886
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I

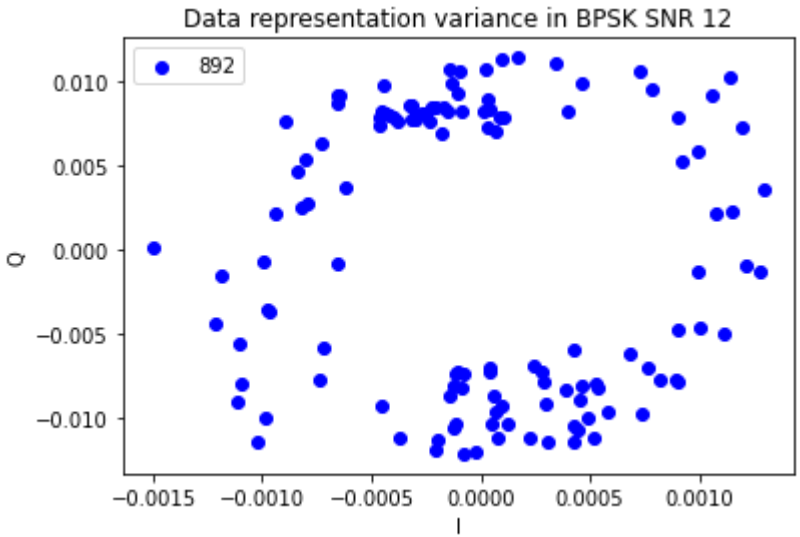

Data representation variance in BPSK SNR 12
887
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006 −0.004 −0.002 0.000 0.002 0.004 0.006
I

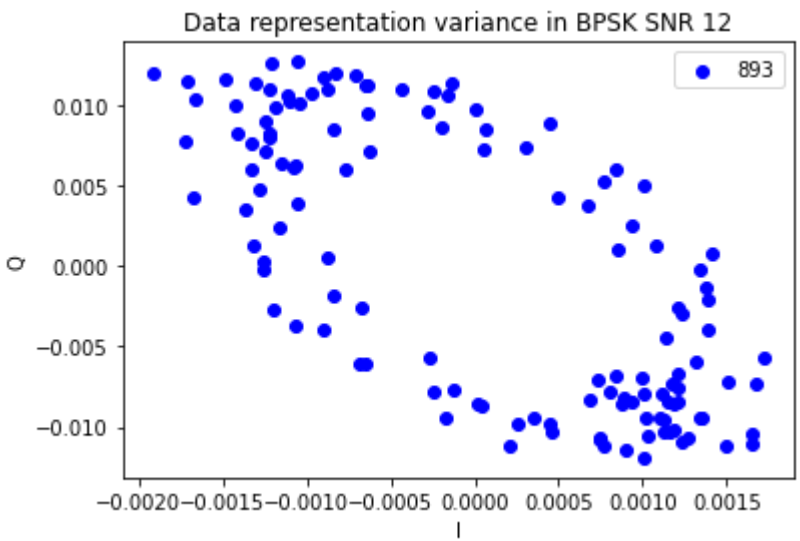

Data representation variance in BPSK SNR 12
888
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
889
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
890
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I


Data representation variance in BPSK SNR 12
891
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003 −0.002 −0.001 0.000 0.001 0.002 0.003
I


Data representation variance in BPSK SNR 12
892
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
I


Data representation variance in BPSK SNR 12
893
0.010
0.005
0.000
−0.005
−0.010
Q
−0.0020
−0.0015
−0.0010
−0.0005
0.0000
0.0005
0.0010
0.0015
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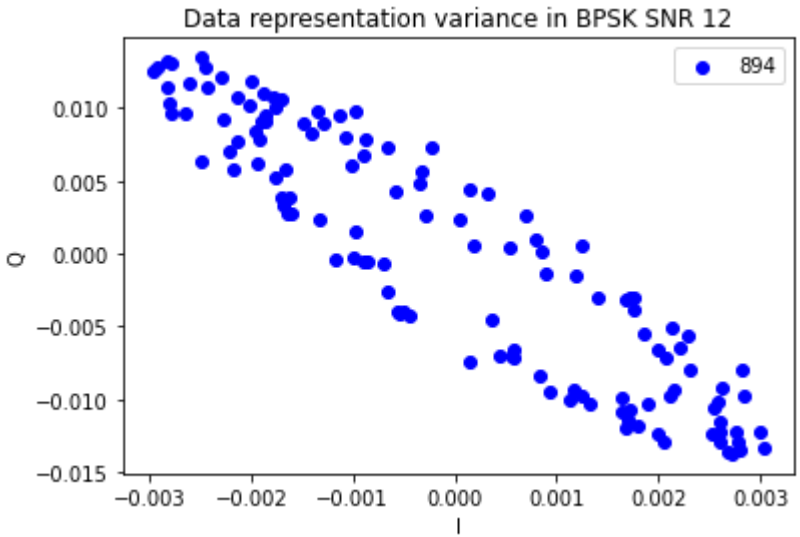
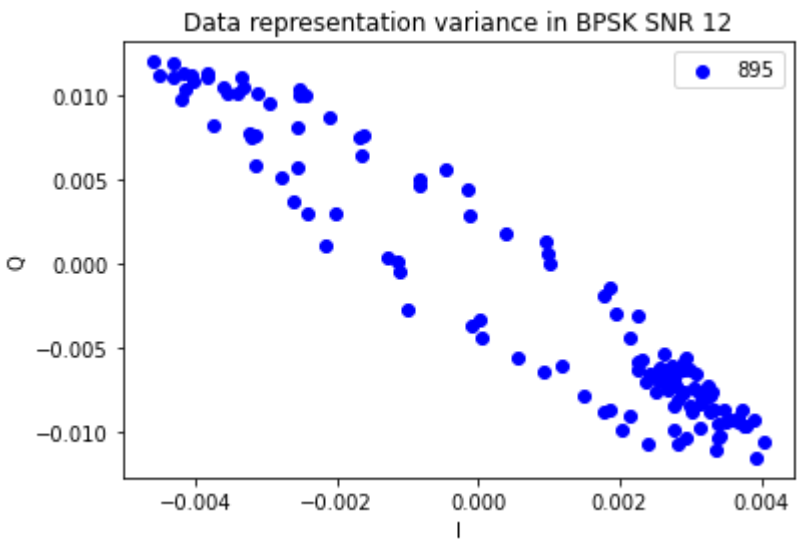

Data representation variance in BPSK SNR 12
894
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
895
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0.000
−0.005
−0.010
Q
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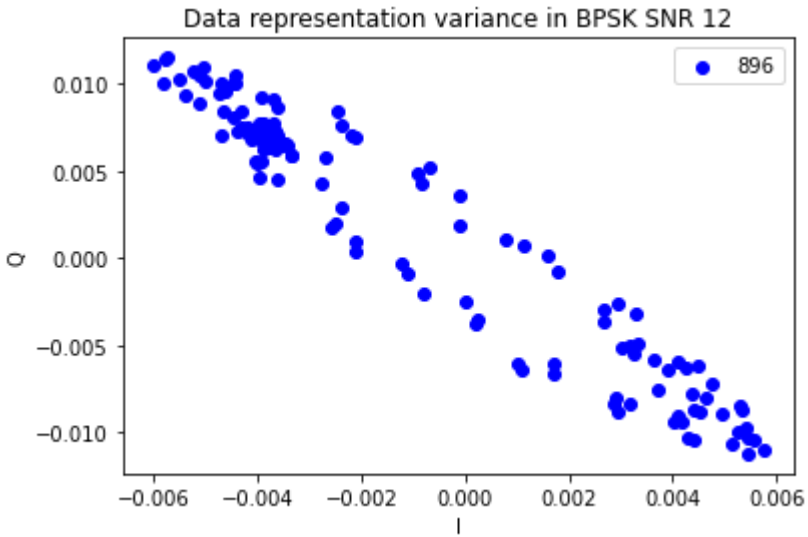
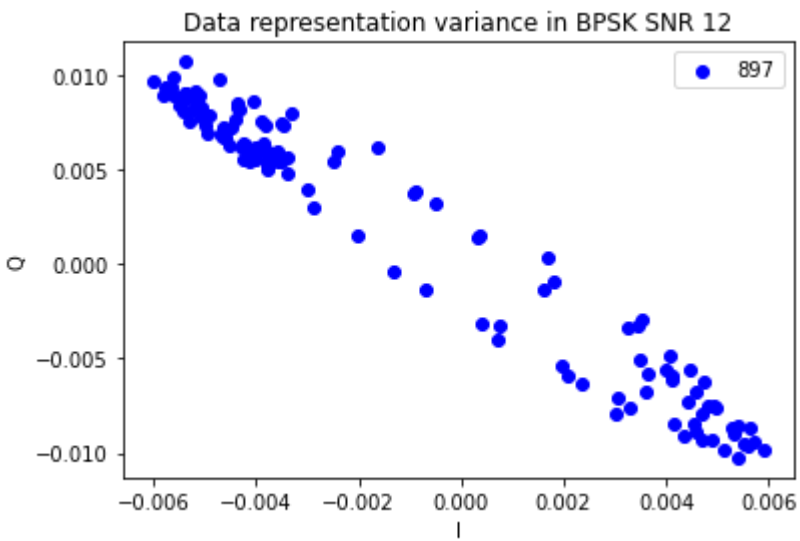
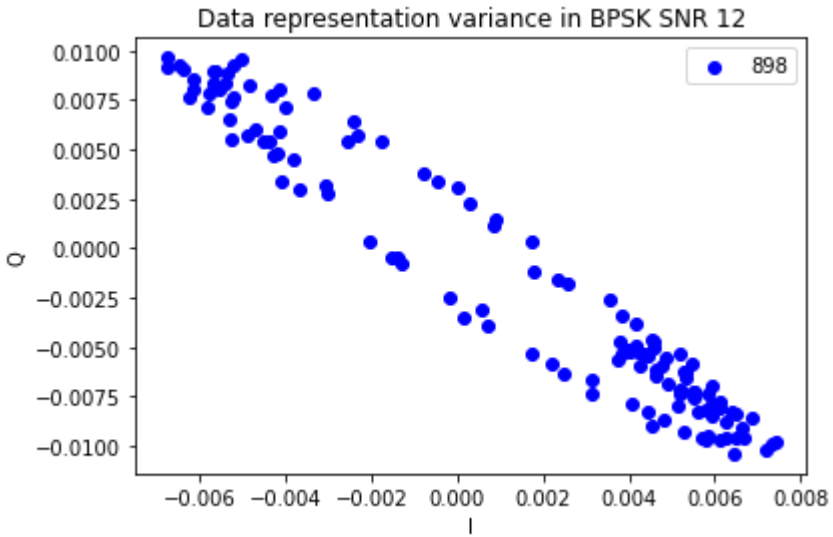
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
896
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
897
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
898
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
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0.002
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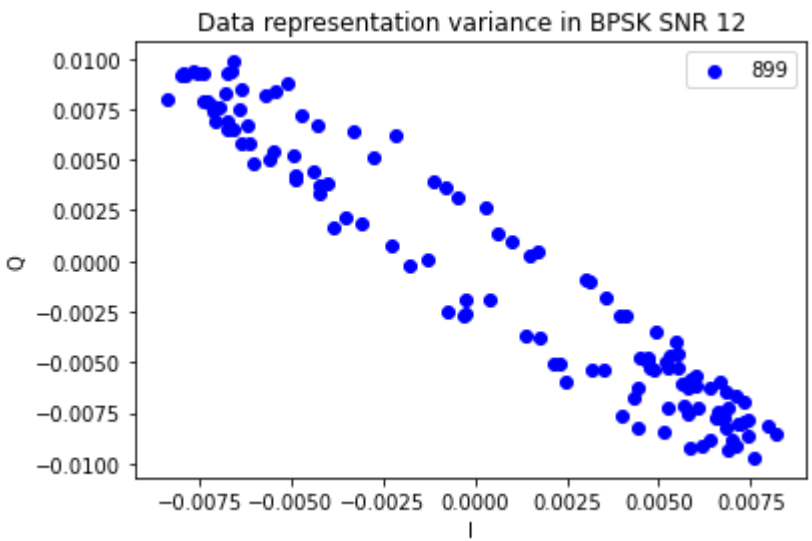
0.006
0.008
I


Data representation variance in BPSK SNR 12
899
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0.0075
0.0050
0.0025
0.0000
−0.0025
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−0.0100
Q
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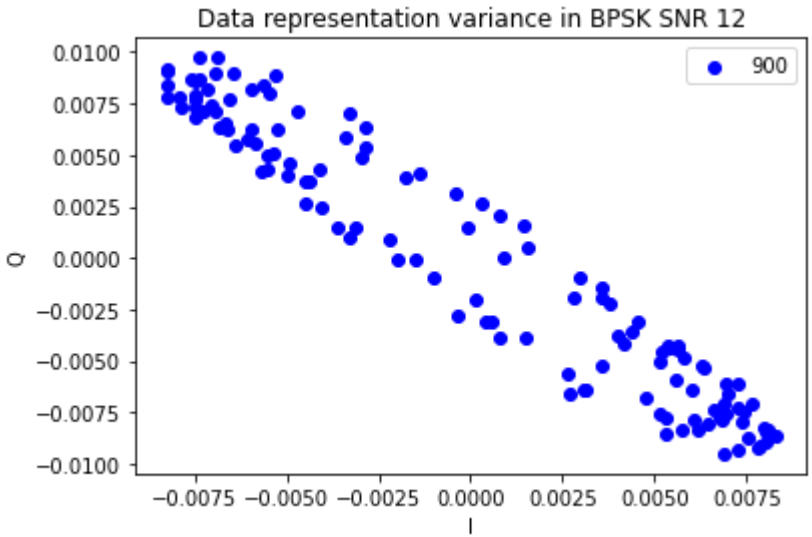
0.0050
0.0075
I


Data representation variance in BPSK SNR 12
900
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
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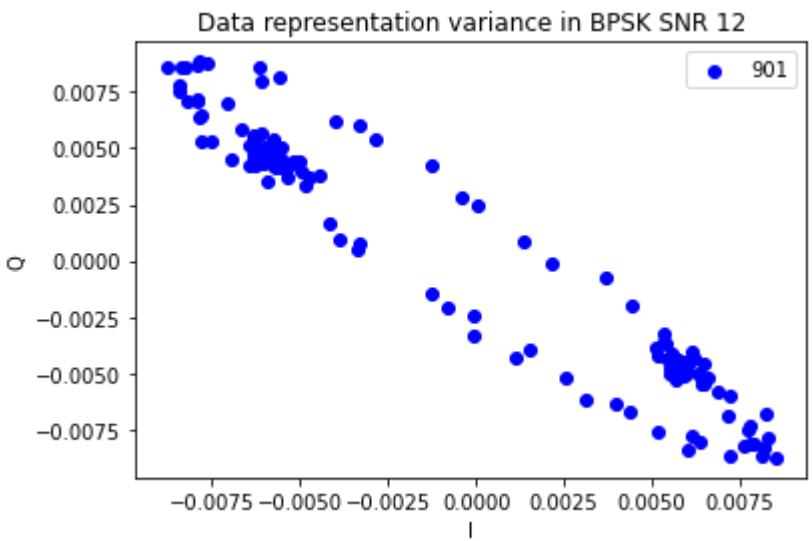
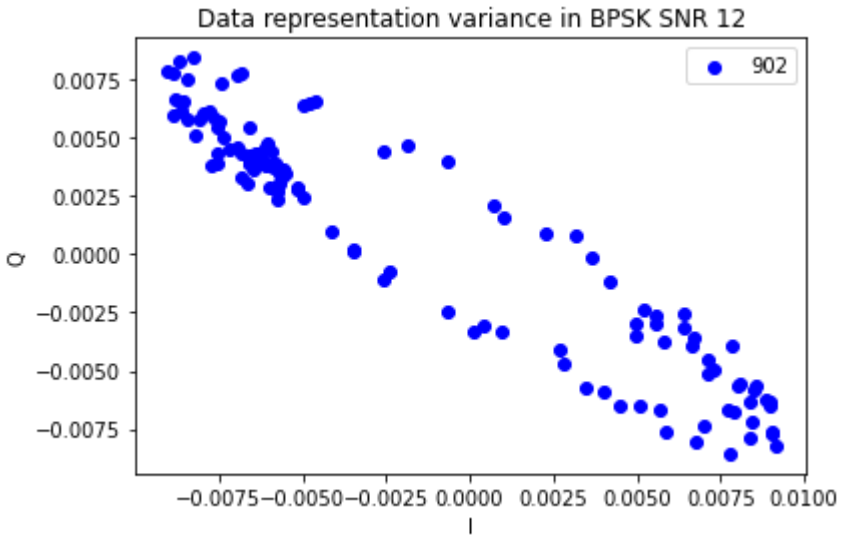
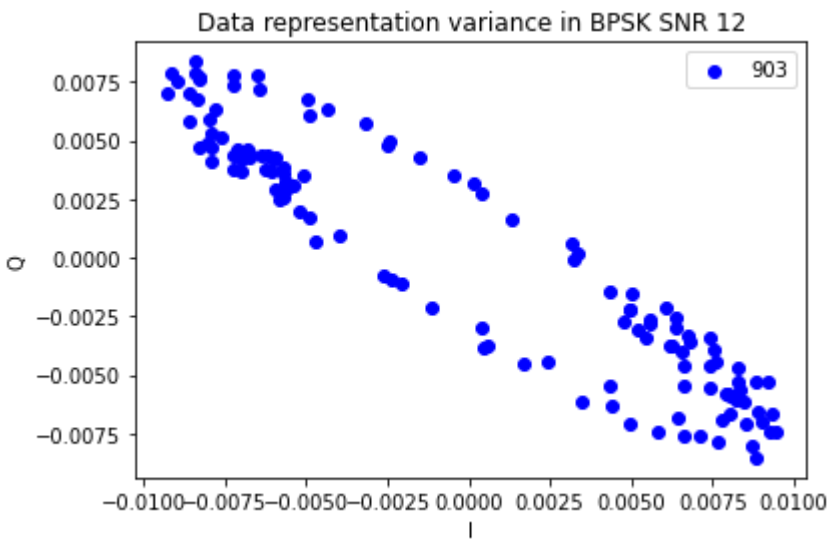

Data representation variance in BPSK SNR 12
901
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I


Data representation variance in BPSK SNR 12
902
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I


Data representation variance in BPSK SNR 12
903
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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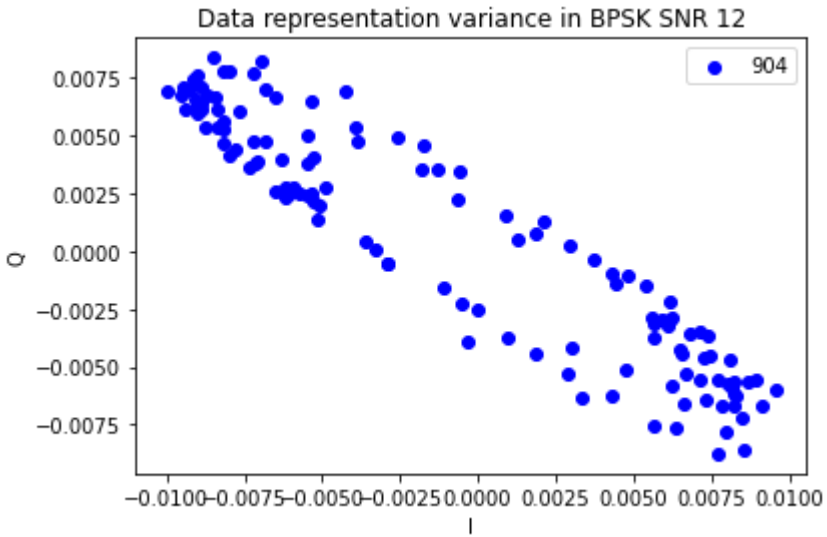
Data representation variance in BPSK SNR 12
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0.0050
0.0025
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−0.0025
−0.0050
−0.0075
Q
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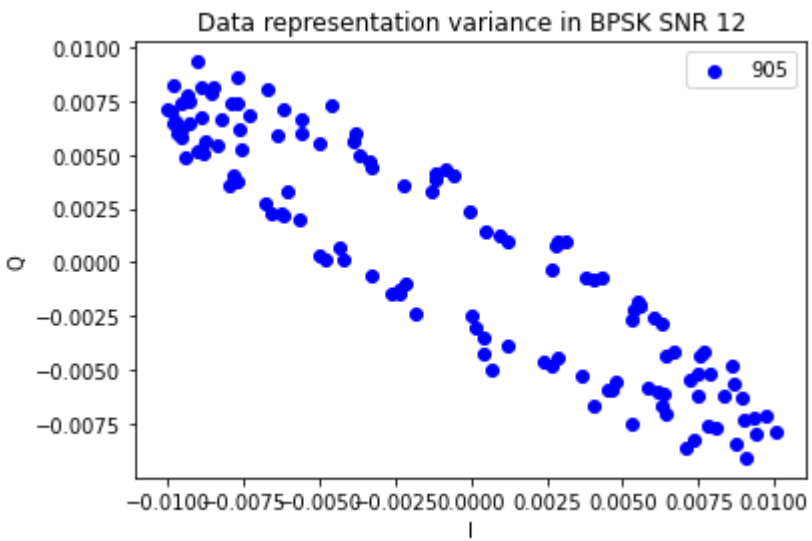
I


Data representation variance in BPSK SNR 12
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0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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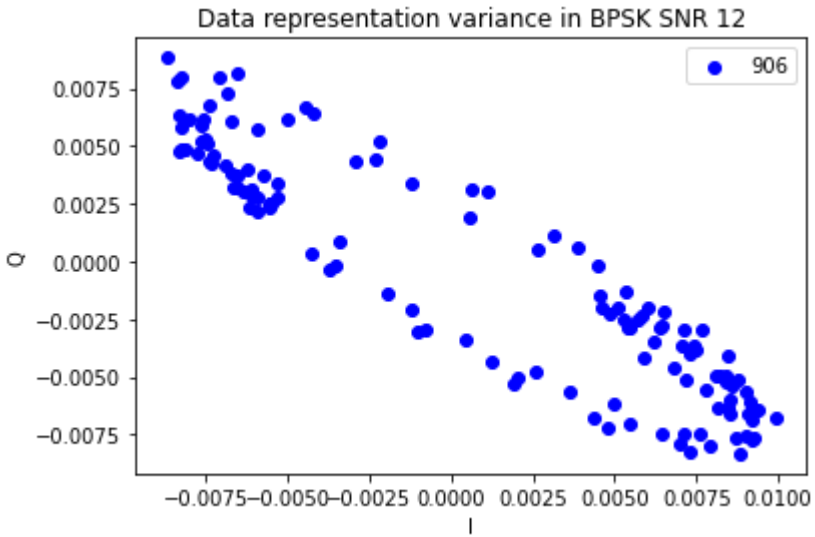
I


Data representation variance in BPSK SNR 12
906
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
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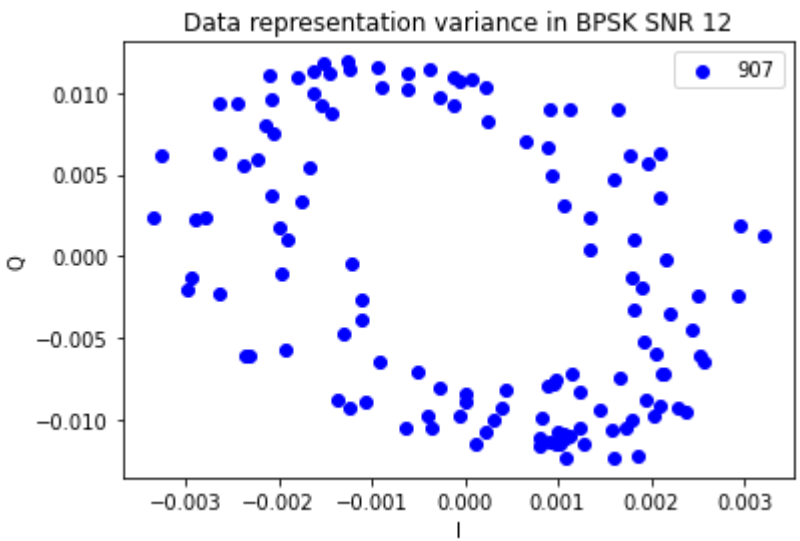
Data representation variance in BPSK SNR 12
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0.005
0.000
−0.005
−0.010
Q
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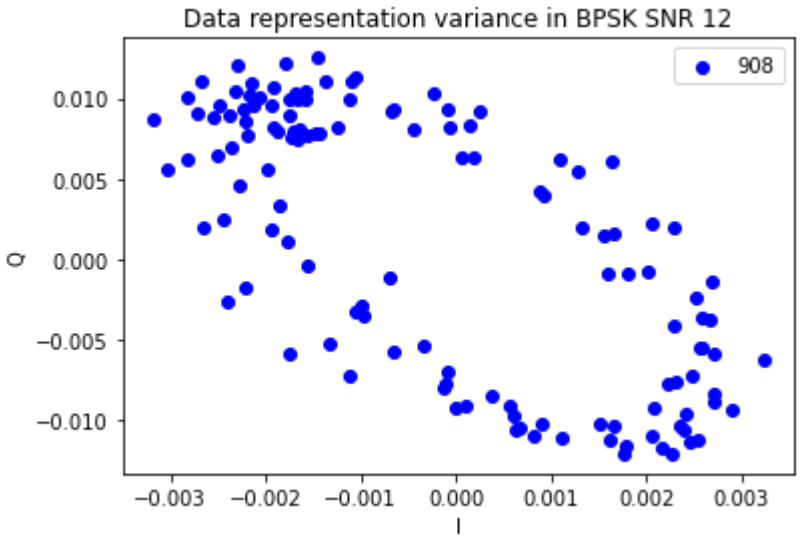
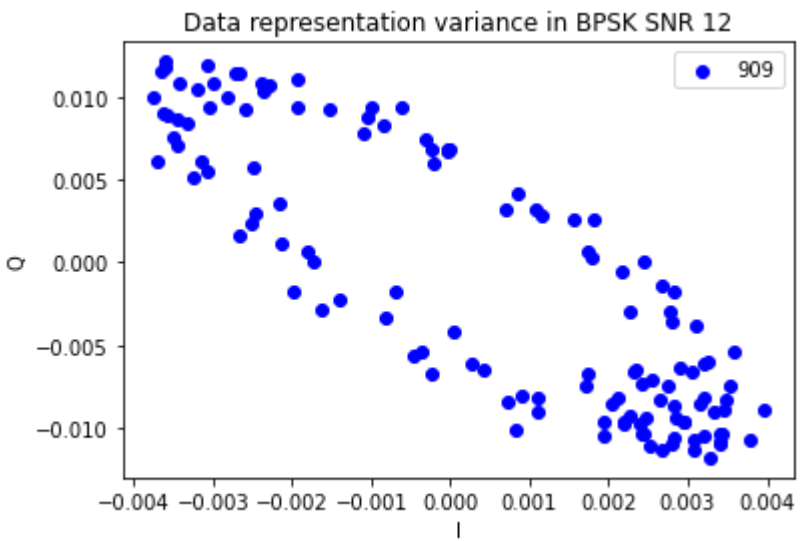
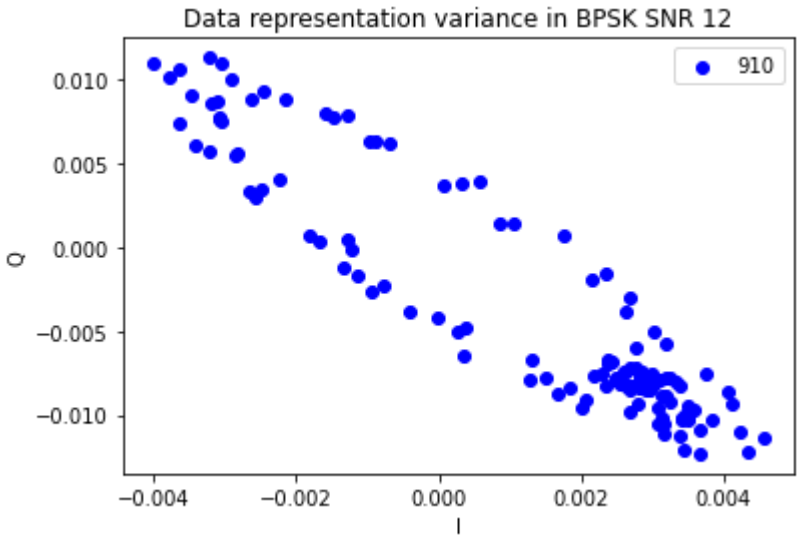
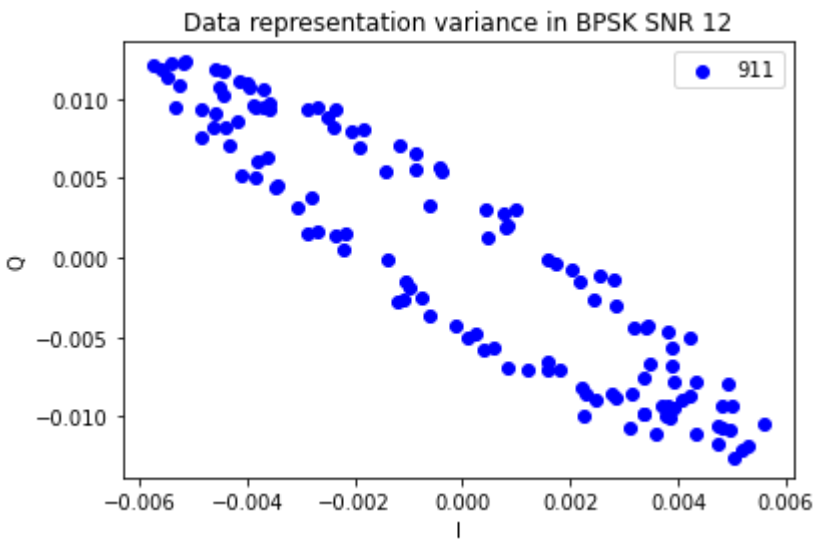
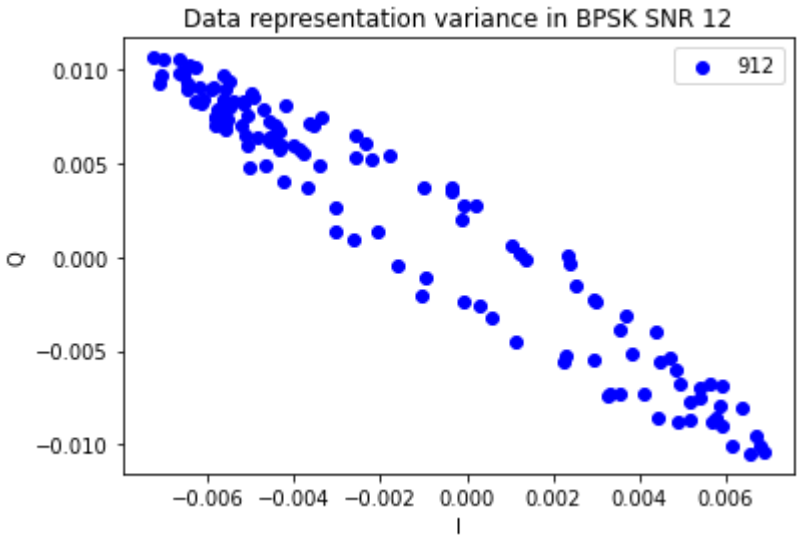
I

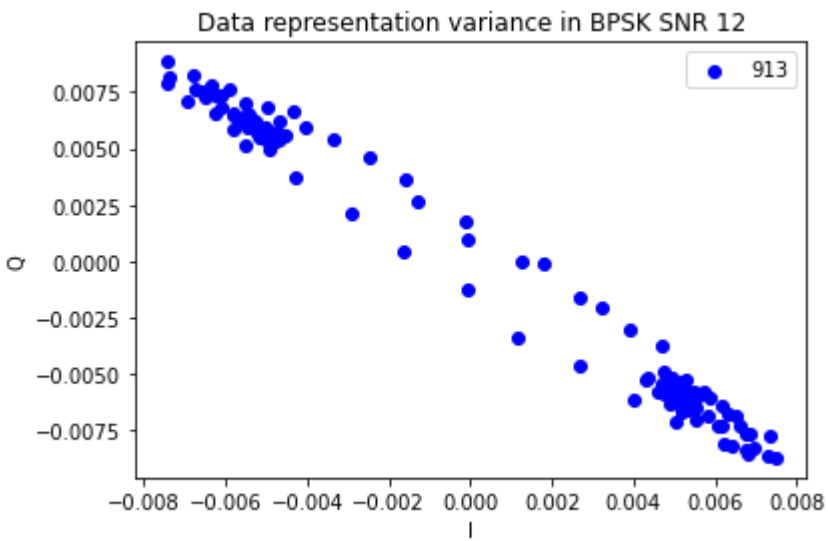

Data representation variance in BPSK SNR 12
908
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

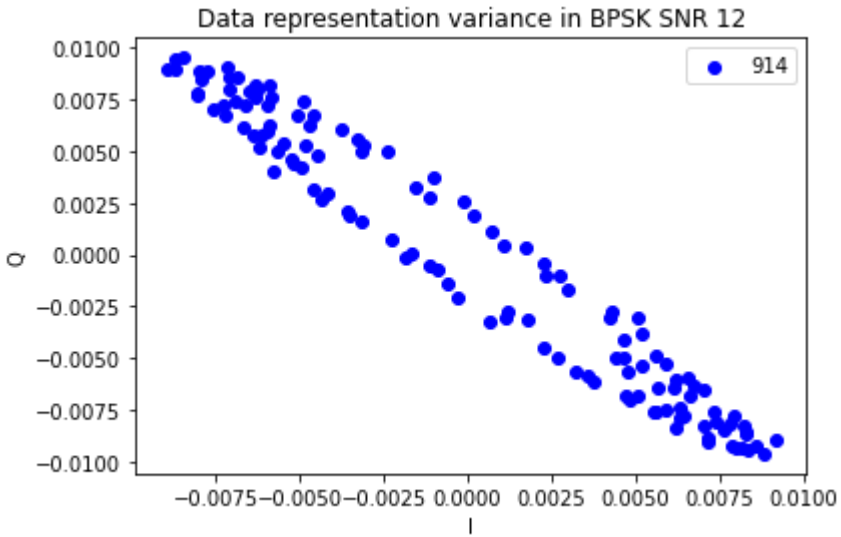

Data representation variance in BPSK SNR 12
909
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I

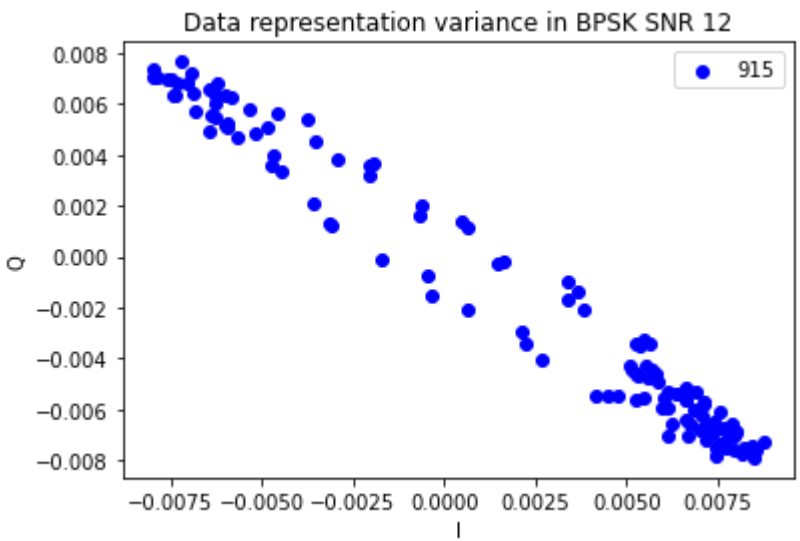

Data representation variance in BPSK SNR 12
910
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

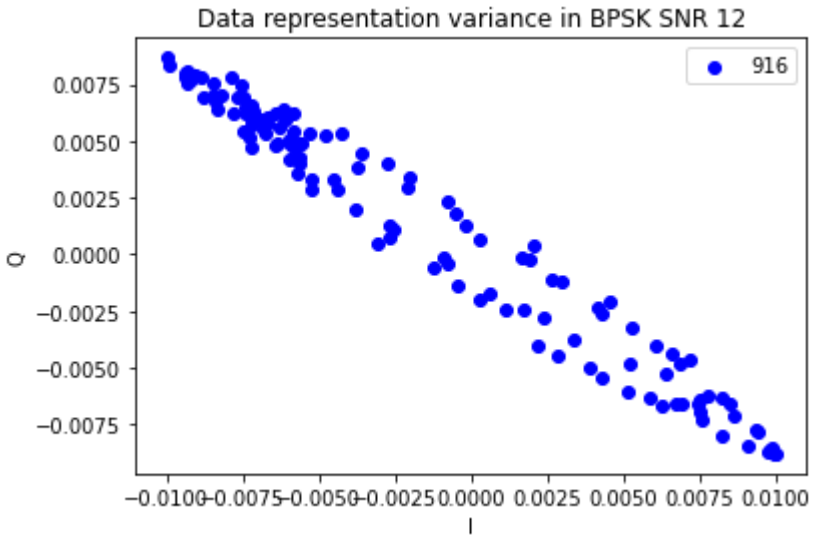

Data representation variance in BPSK SNR 12
911
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

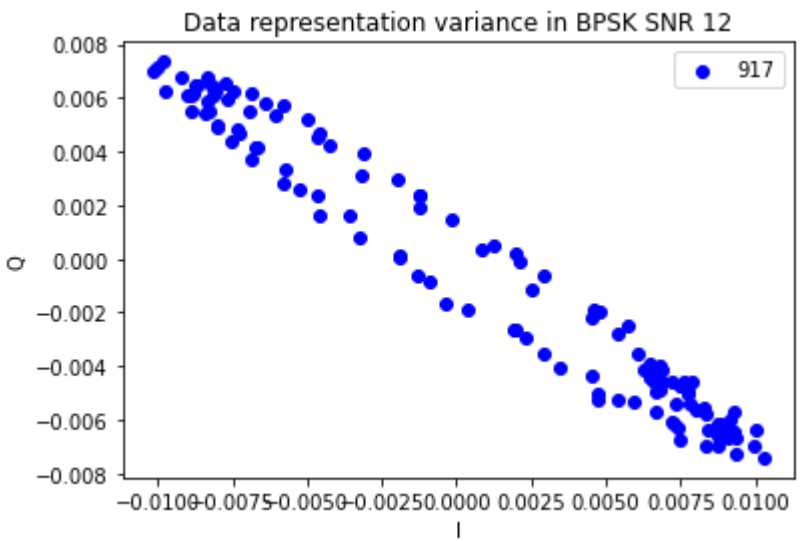

Data representation variance in BPSK SNR 12
912
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

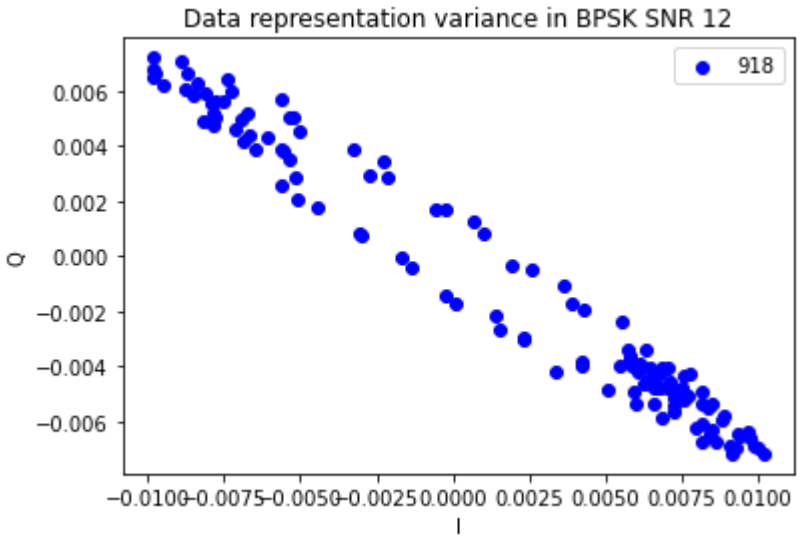

Data representation variance in BPSK SNR 12
913
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.008
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
0.008
I

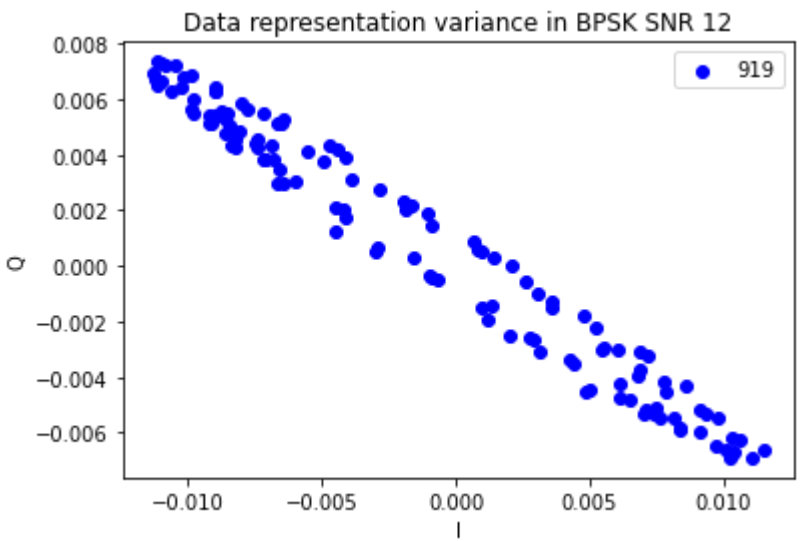

Data representation variance in BPSK SNR 12
914
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

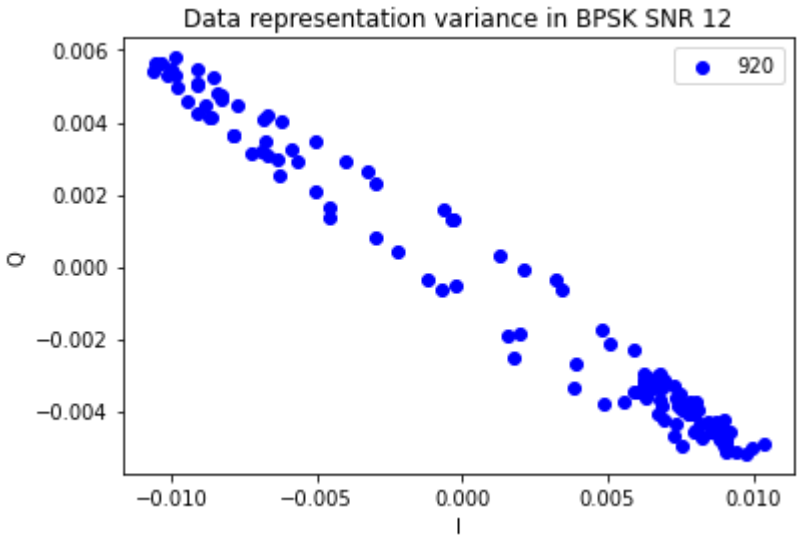

Data representation variance in BPSK SNR 12
915
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

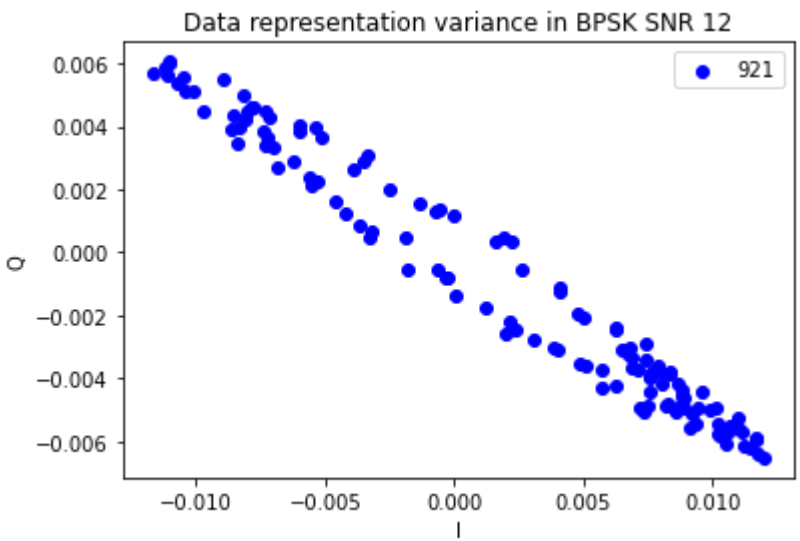

Data representation variance in BPSK SNR 12
916
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

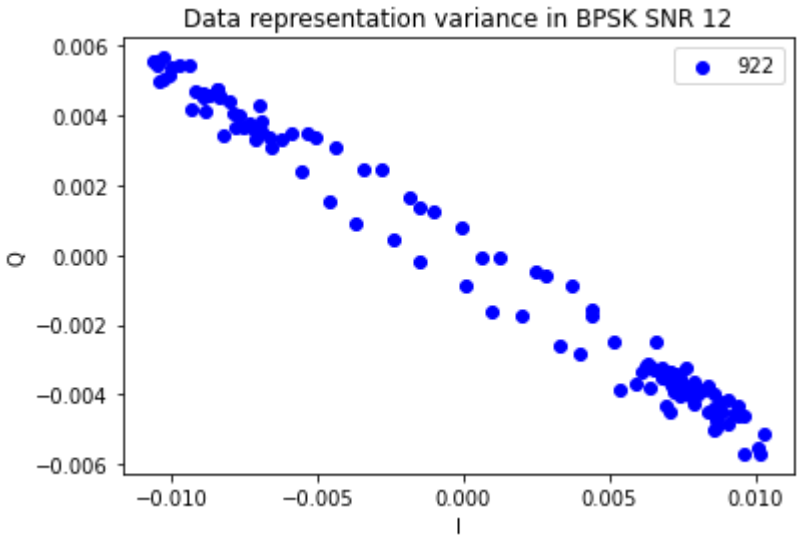

Data representation variance in BPSK SNR 12
917
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
−0.008
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

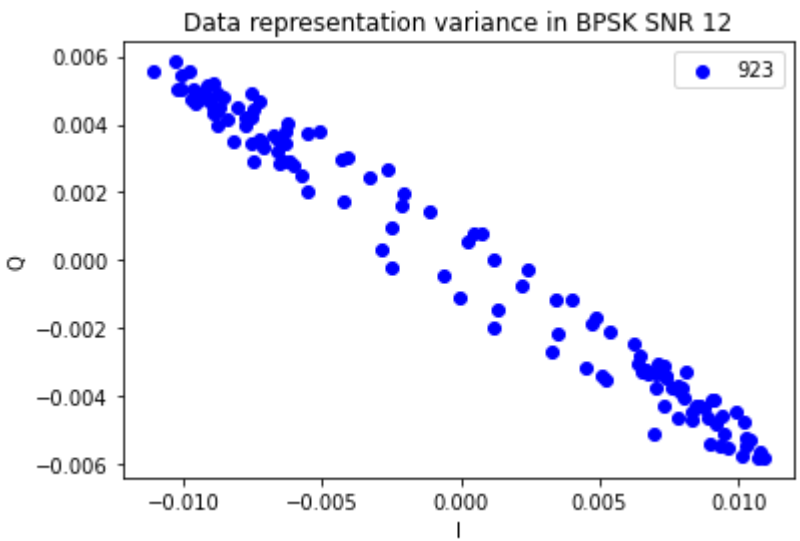

Data representation variance in BPSK SNR 12
918
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.0100 −0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075 0.0100
I

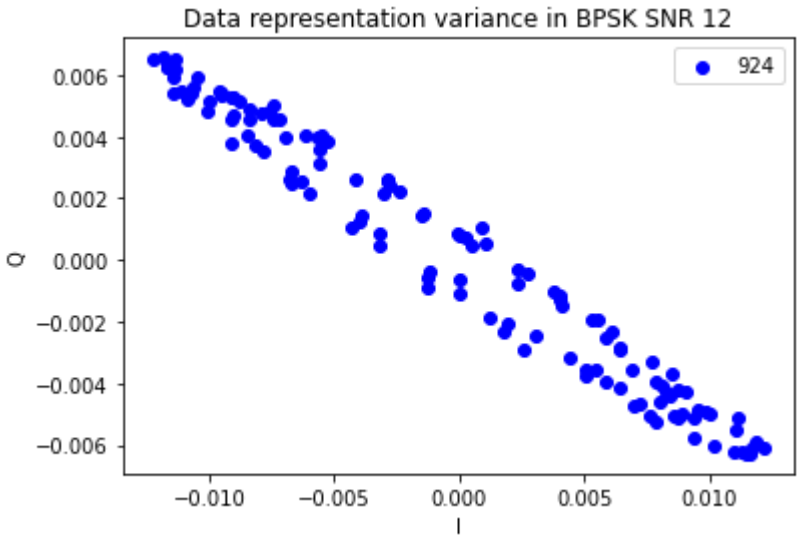

Data representation variance in BPSK SNR 12
919
0.008
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010 −0.005 0.000 0.005 0.010
I

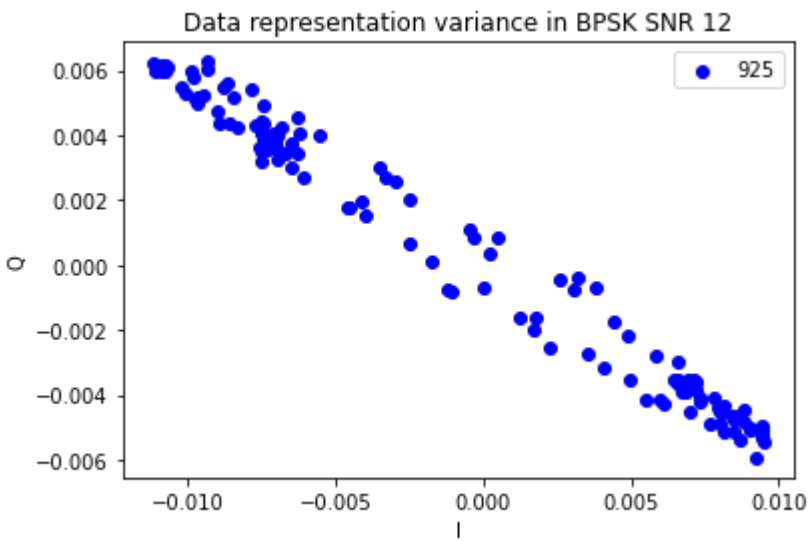

Data representation variance in BPSK SNR 12
920
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

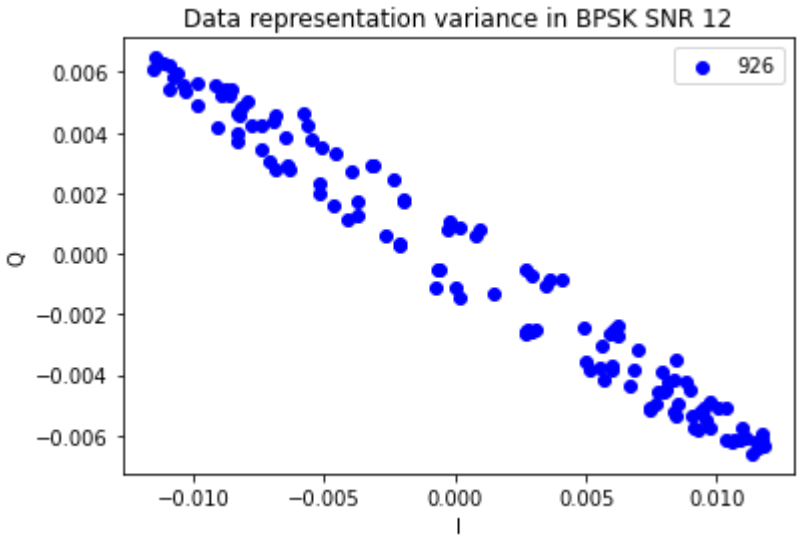

Data representation variance in BPSK SNR 12
921
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

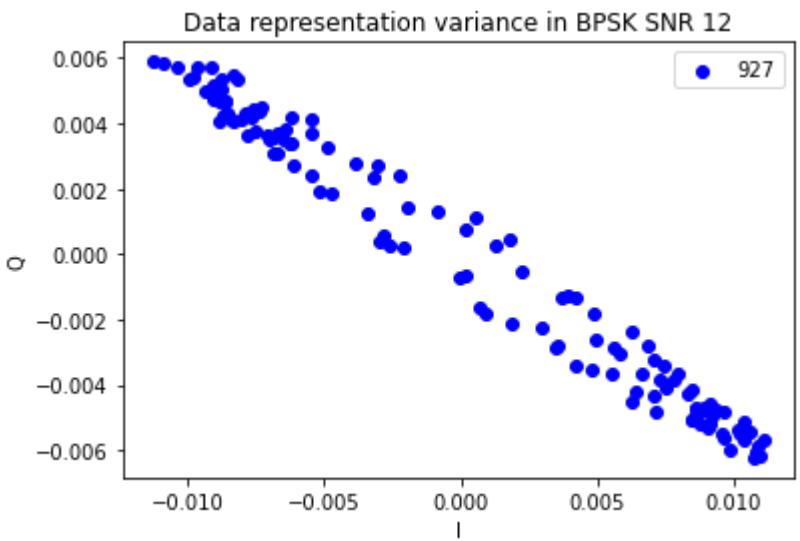

Data representation variance in BPSK SNR 12
922
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

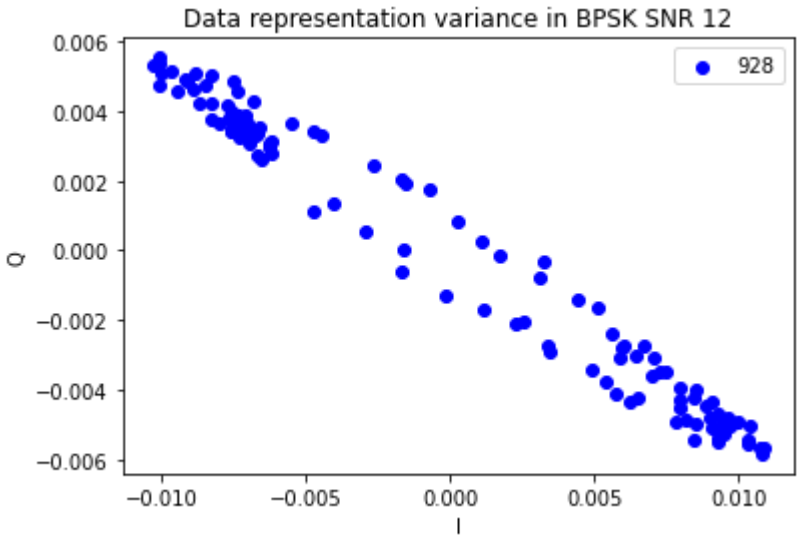

Data representation variance in BPSK SNR 12
923
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

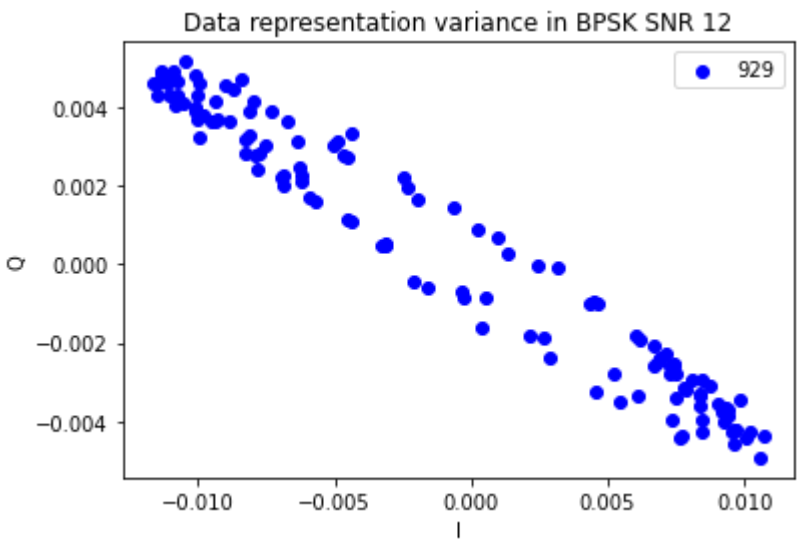

Data representation variance in BPSK SNR 12
924
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I

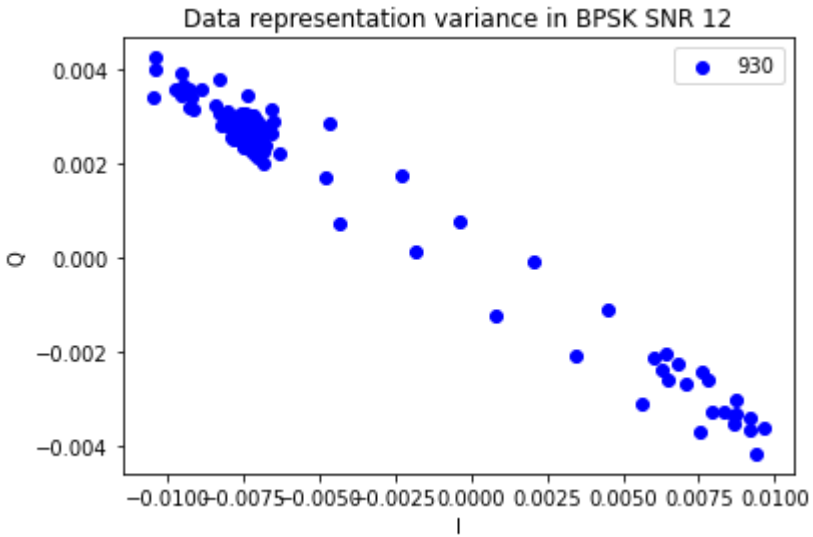

Data representation variance in BPSK SNR 12
925
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
926
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
927
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
928
0.006
0.004
0.002
0.000
−0.002
−0.004
−0.006
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
929
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I


Data representation variance in BPSK SNR 12
930
0.004
0.002
0.000
−0.002
−0.004
Q
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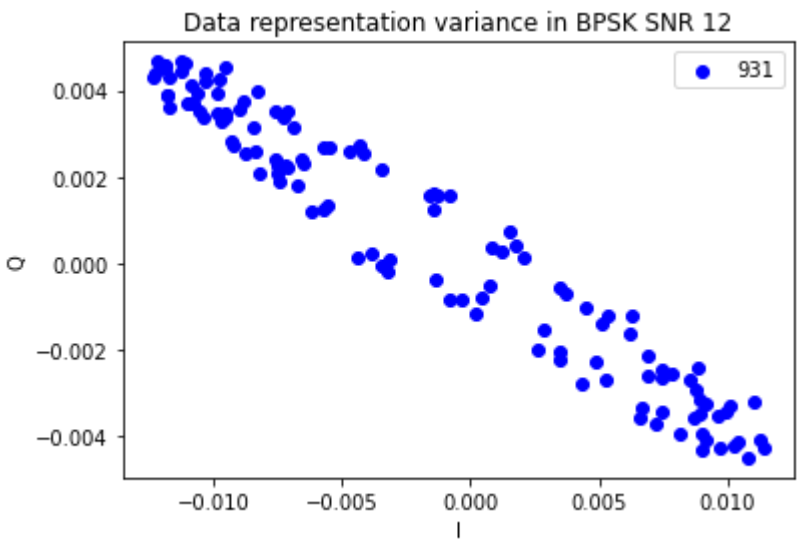
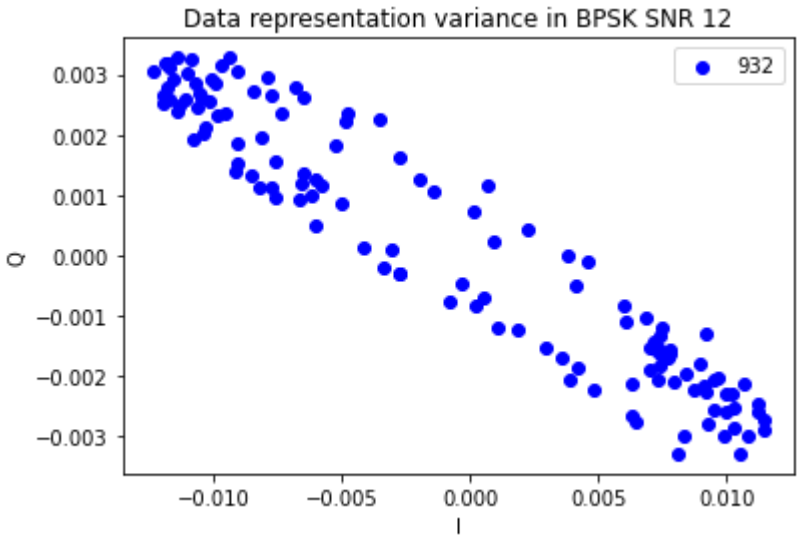
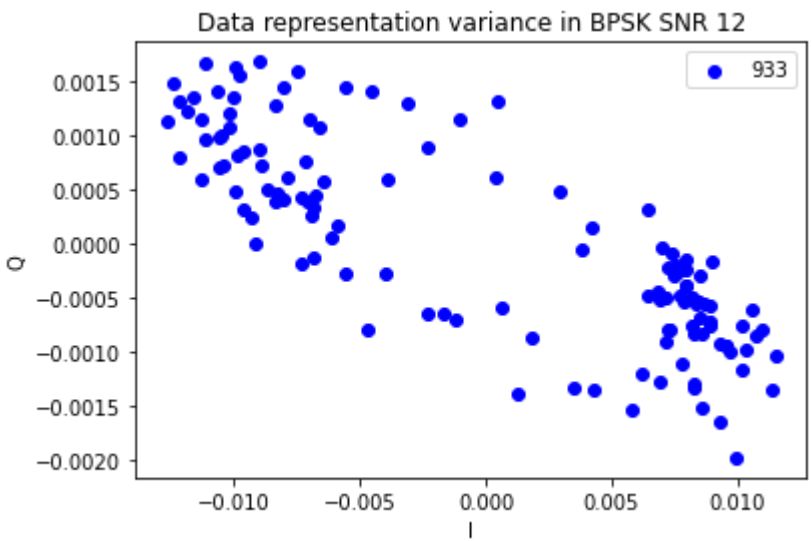
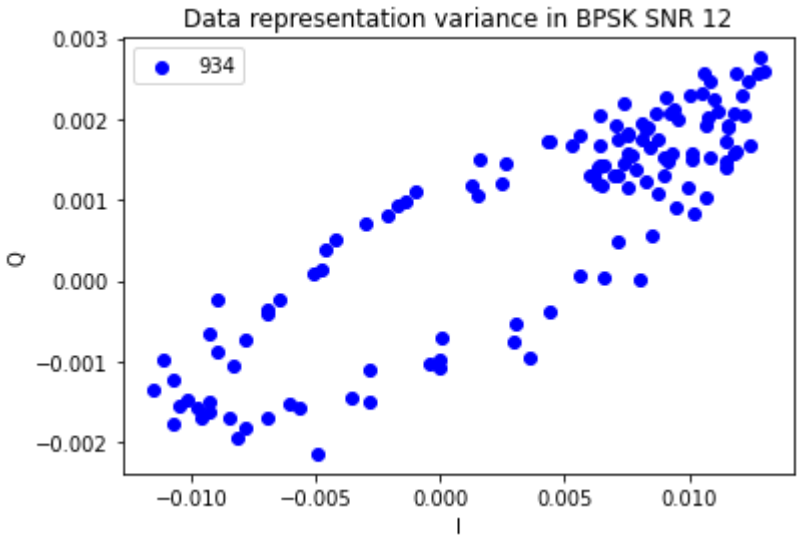
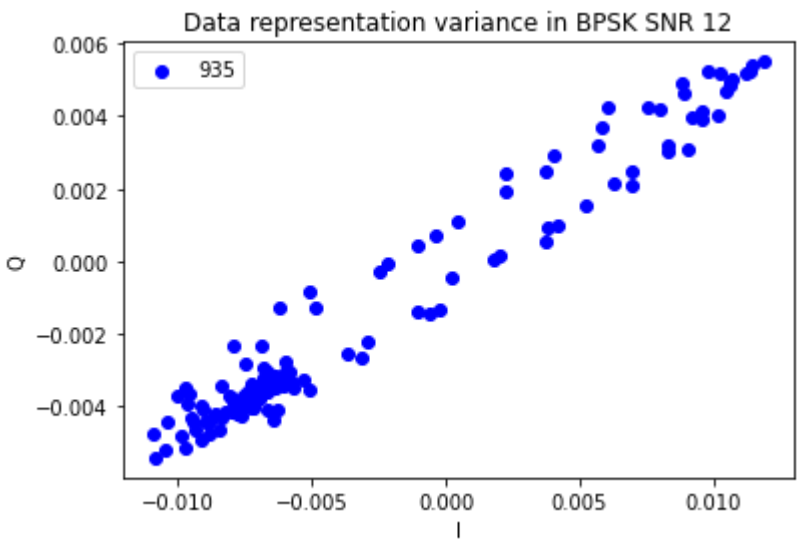
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
0.0100
I

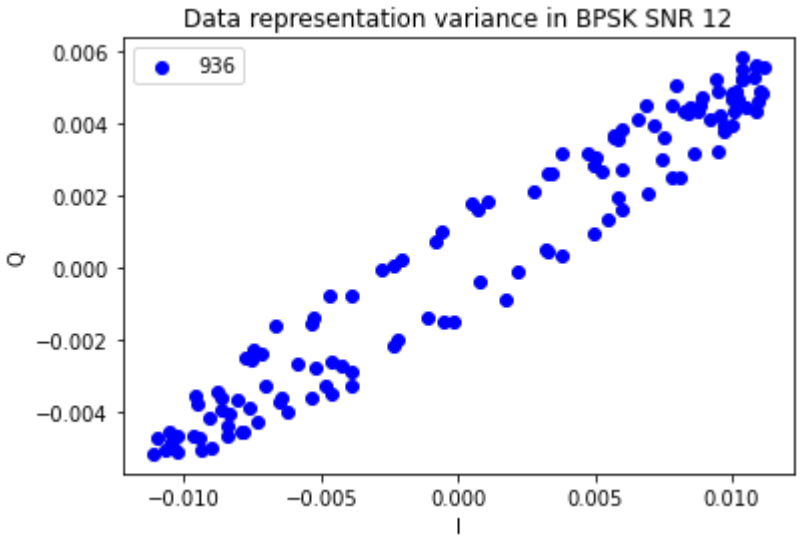

Data representation variance in BPSK SNR 12
931
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

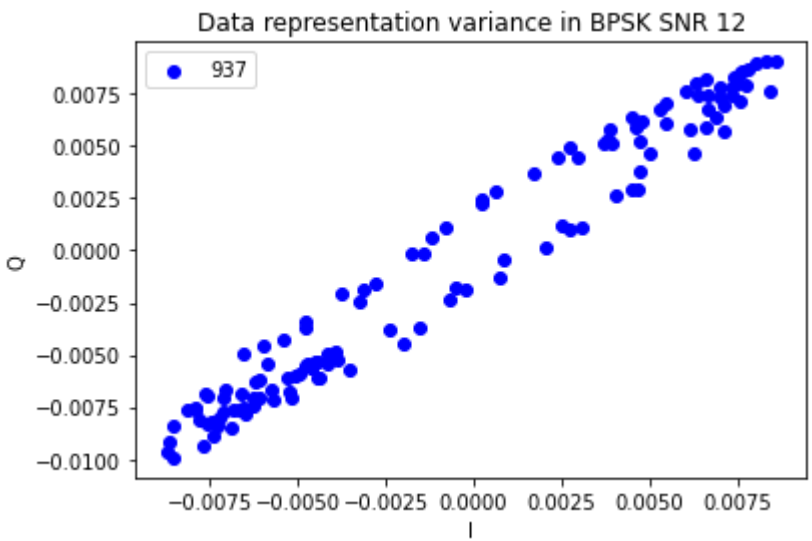

Data representation variance in BPSK SNR 12
932
0.003
0.002
0.001
0.000
−0.001
−0.002
−0.003
Q
−0.010
−0.005
0.000
0.005
0.010
I

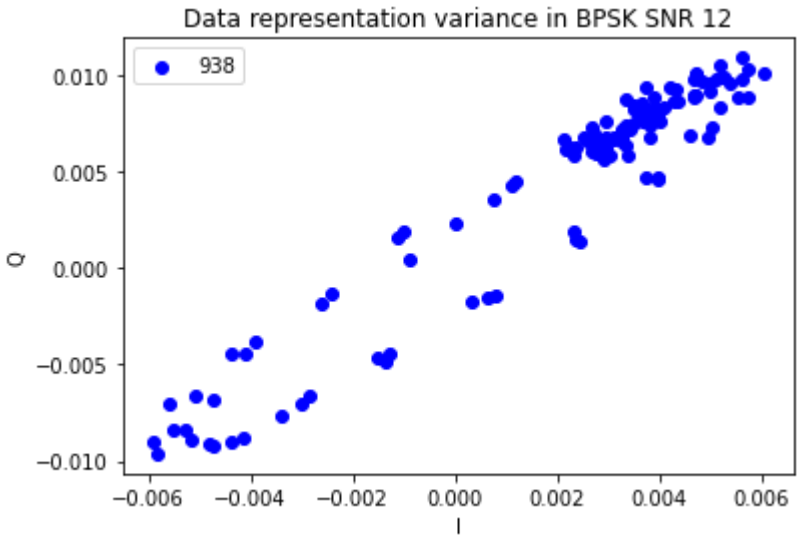

Data representation variance in BPSK SNR 12
933
0.0015
0.0010
0.0005
0.0000
−0.0005
−0.0010
−0.0015
−0.0020
Q
−0.010
−0.005
0.000
0.005
0.010
I

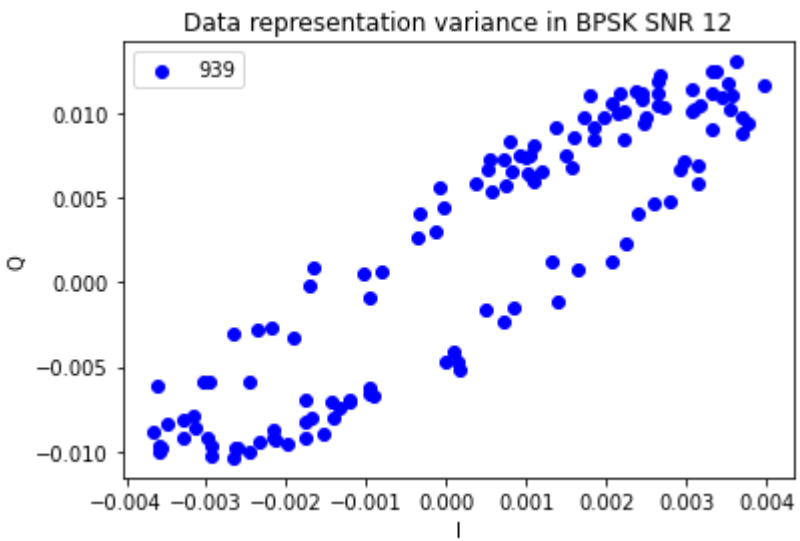

Data representation variance in BPSK SNR 12
934
0.003
0.002
0.001
0.000
−0.001
−0.002
Q
−0.010
−0.005
0.000
0.005
0.010
I

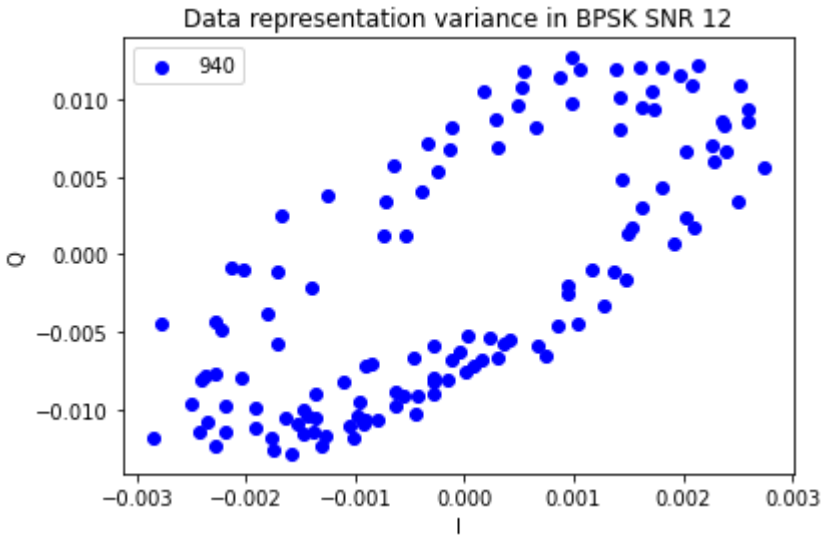

Data representation variance in BPSK SNR 12
935
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

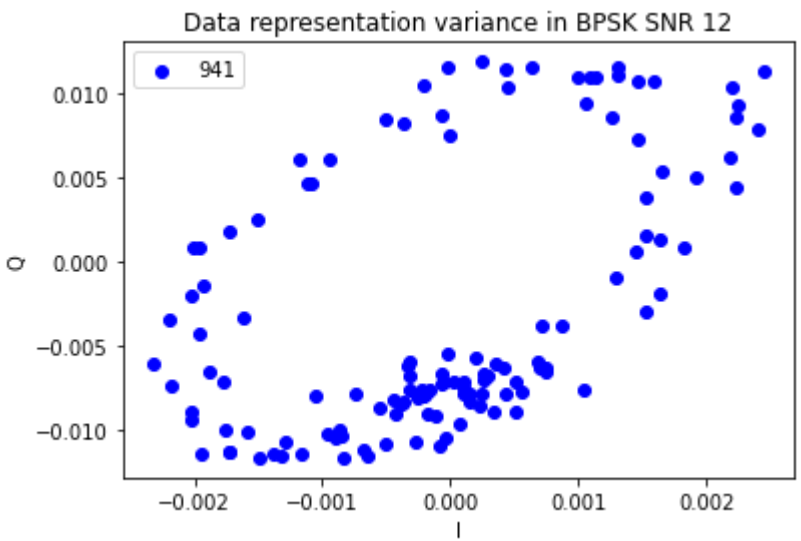

Data representation variance in BPSK SNR 12
936
0.006
0.004
0.002
0.000
−0.002
−0.004
Q
−0.010
−0.005
0.000
0.005
0.010
I

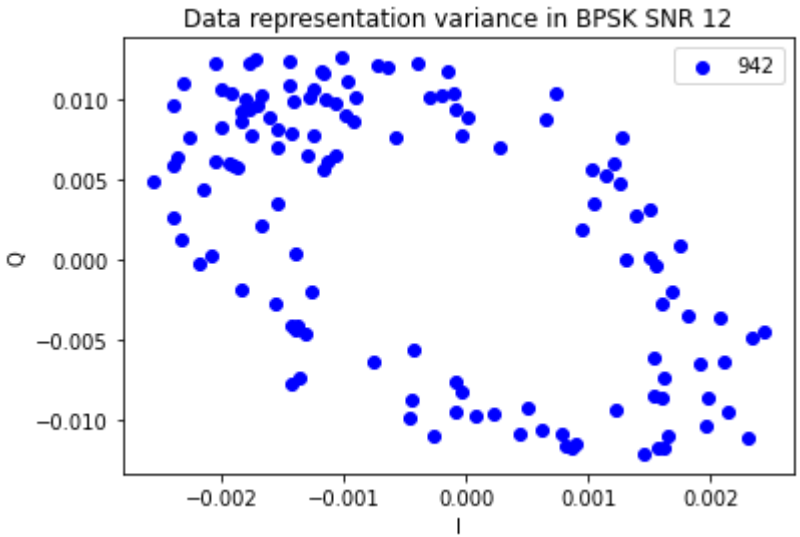

Data representation variance in BPSK SNR 12
937
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075
−0.0050
−0.0025
0.0000
0.0025
0.0050
0.0075
I

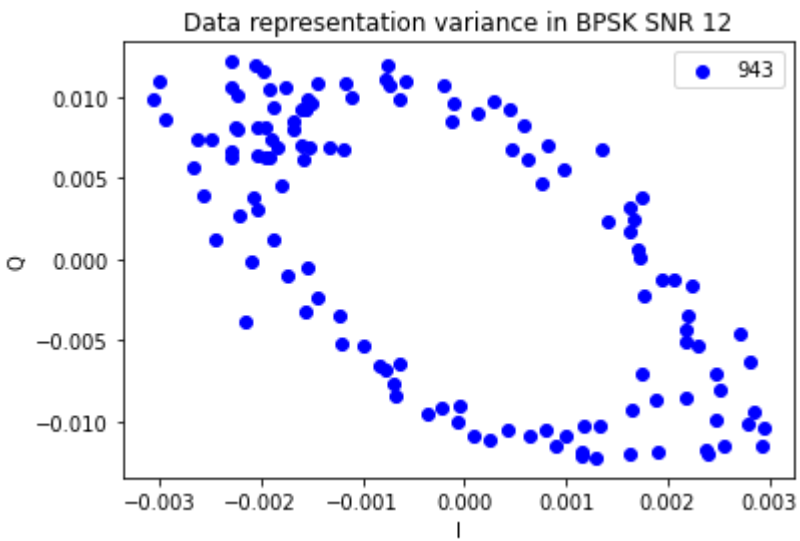

Data representation variance in BPSK SNR 12
938
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

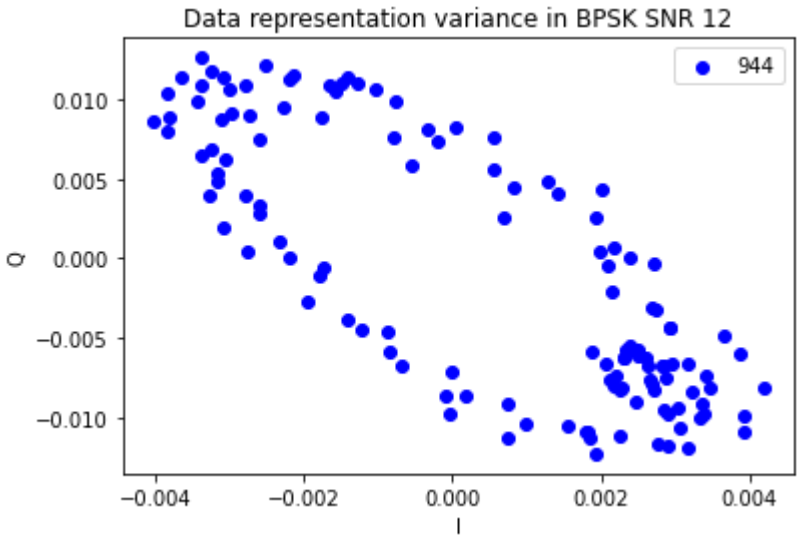

Data representation variance in BPSK SNR 12
939
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I

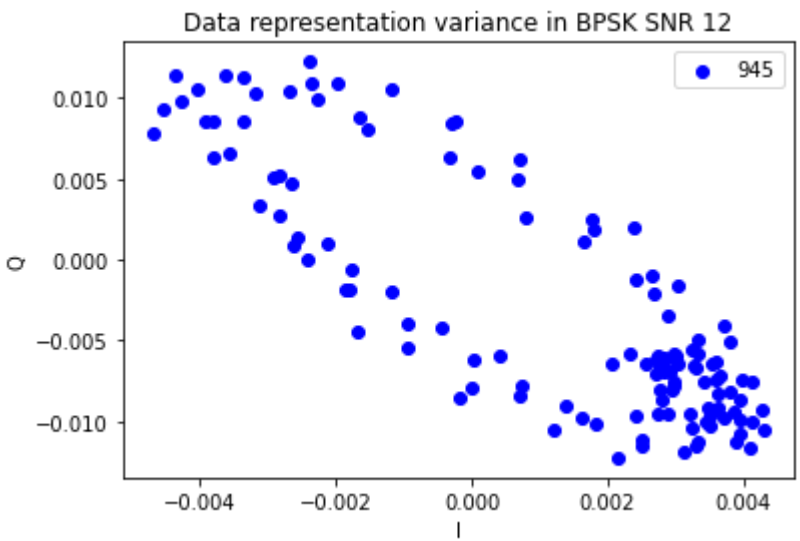

Data representation variance in BPSK SNR 12
940
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

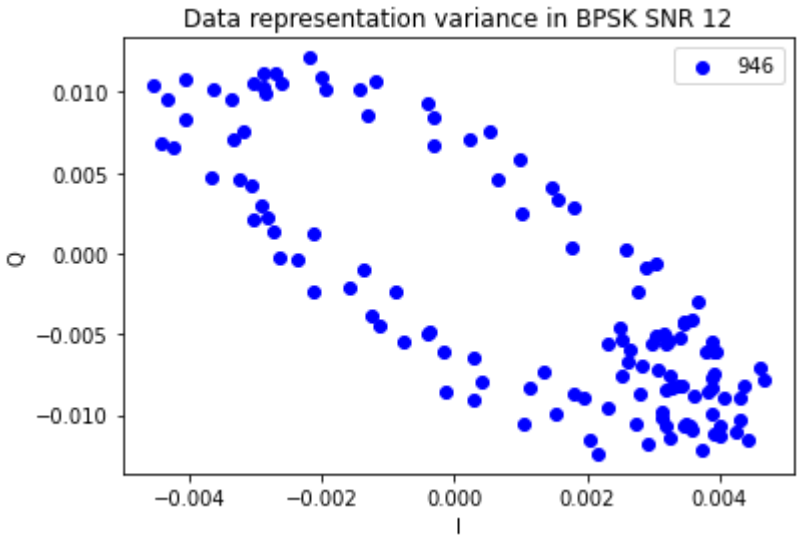

Data representation variance in BPSK SNR 12
941
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
942
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
943
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
944
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
945
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
946
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0.005
0.000
−0.005
−0.010
Q
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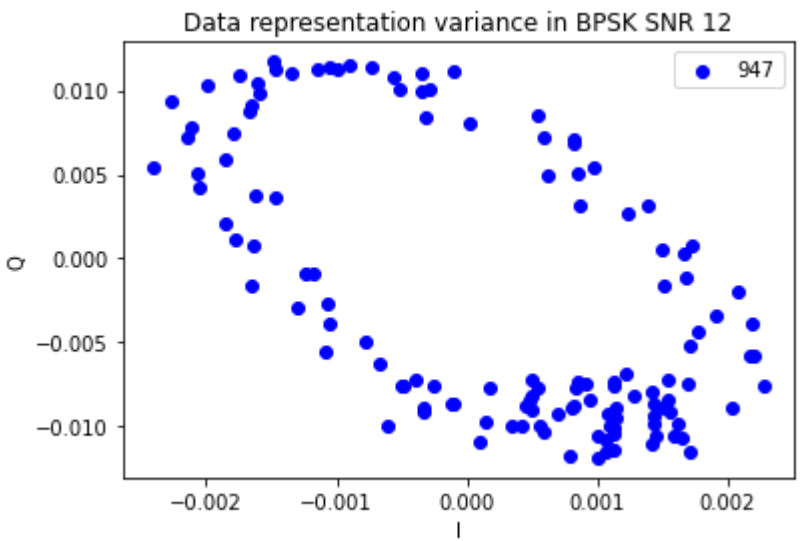
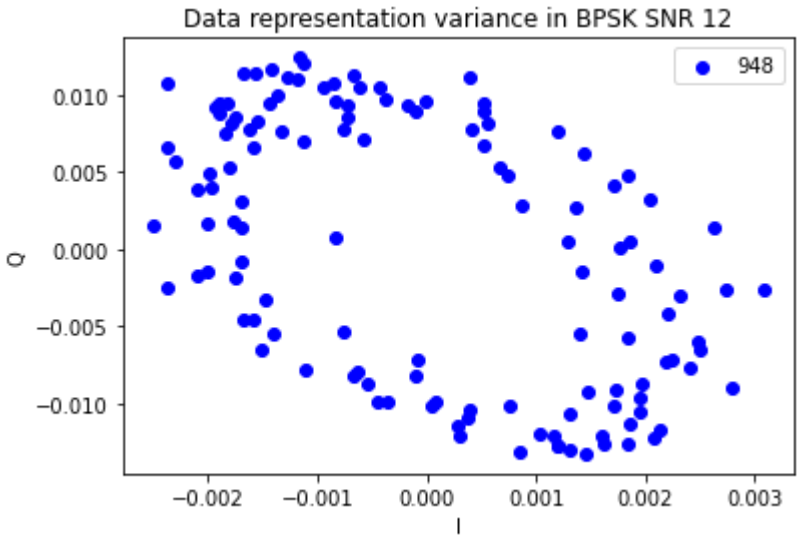
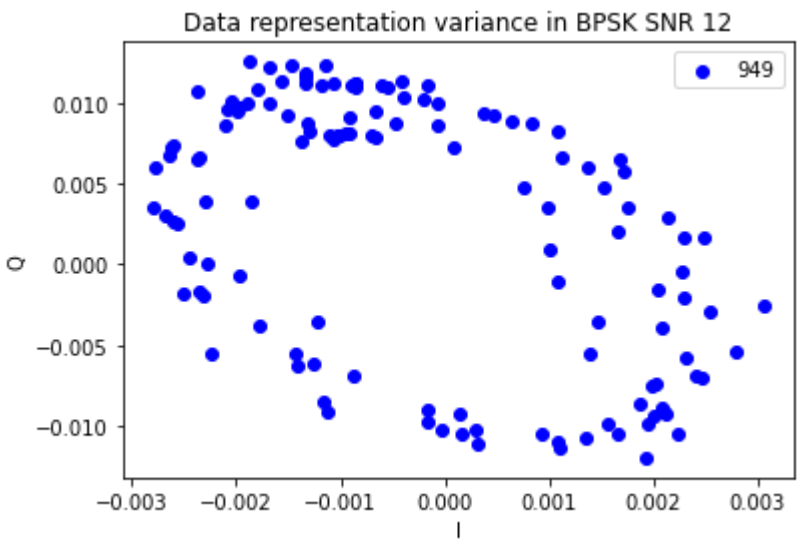
0.004
I


Data representation variance in BPSK SNR 12
947
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
I


Data representation variance in BPSK SNR 12
948
0.010
0.005
0.000
−0.005
−0.010
Q
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
949
0.010
0.005
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−0.005
−0.010
Q
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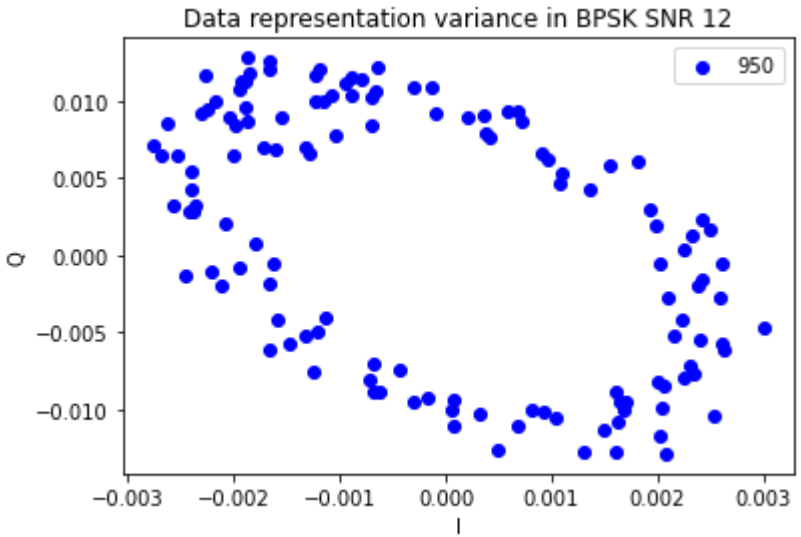
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
950
0.010
0.005
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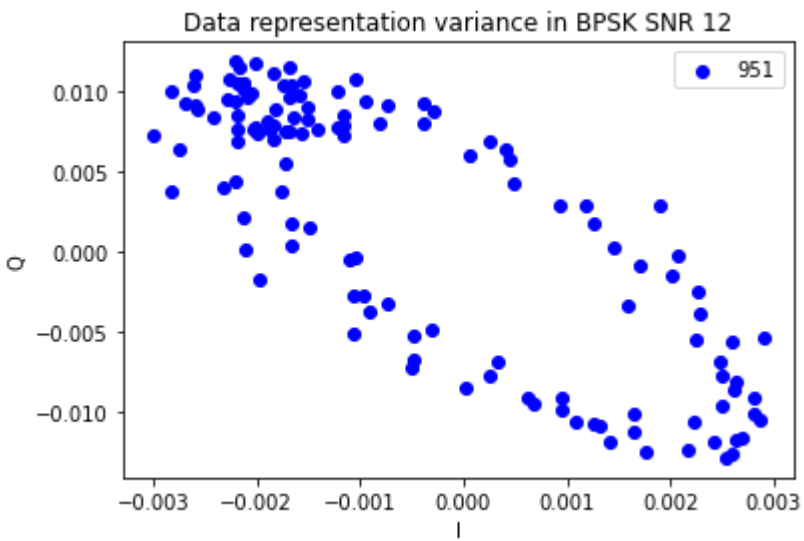
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
951
0.010
0.005
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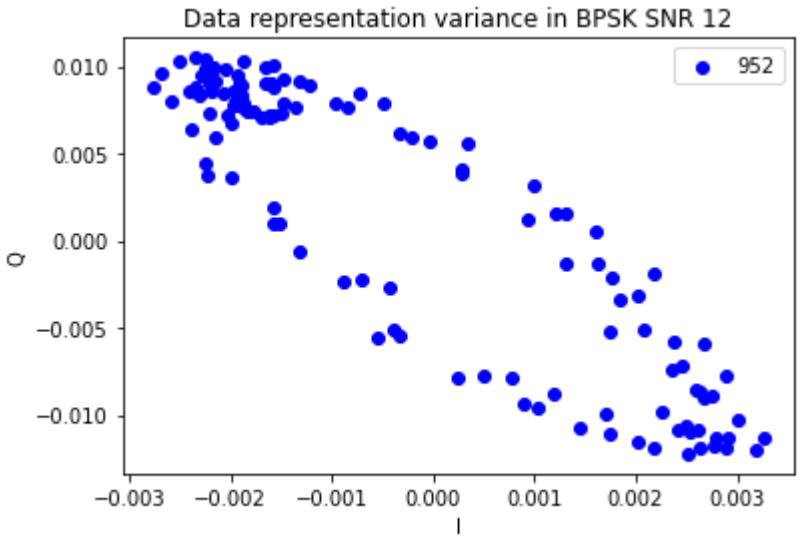
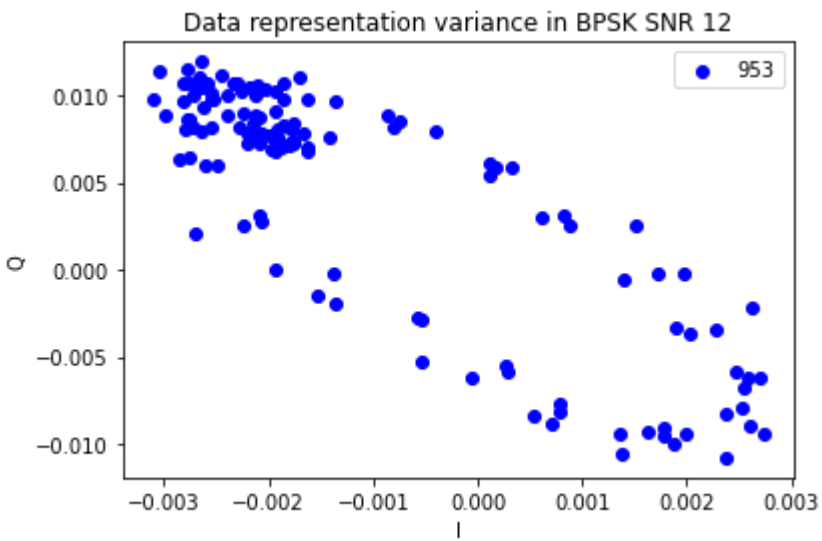
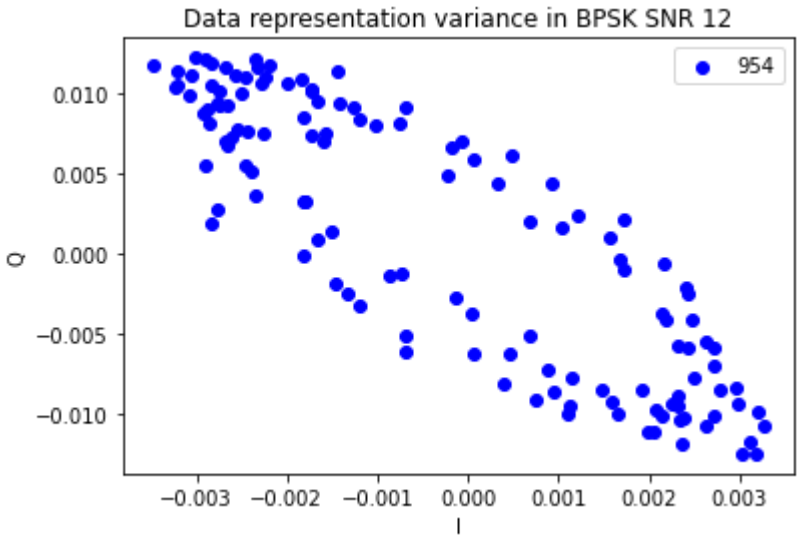
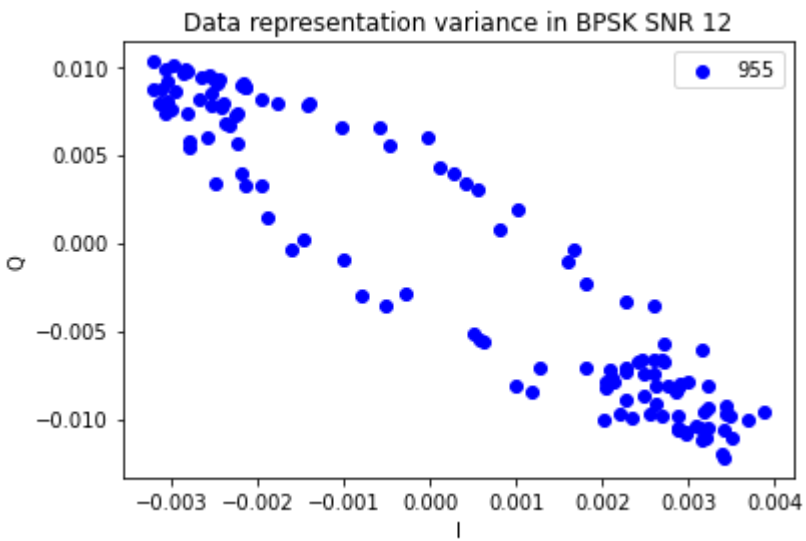
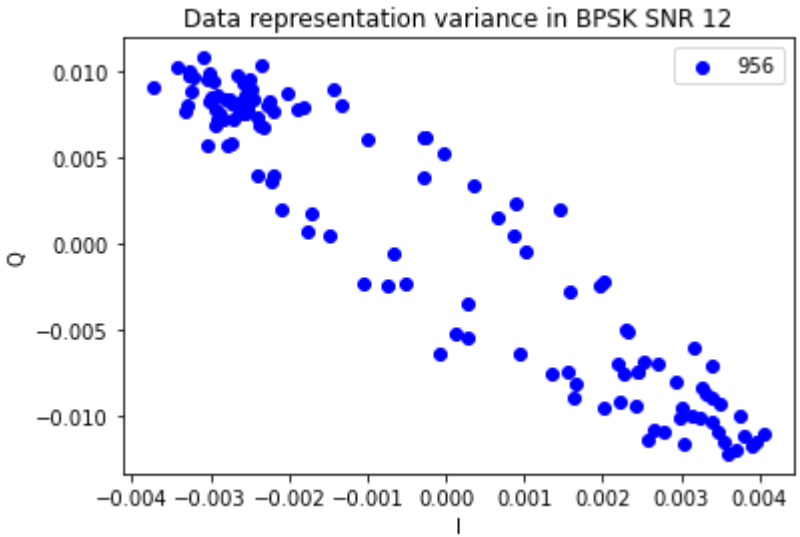
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

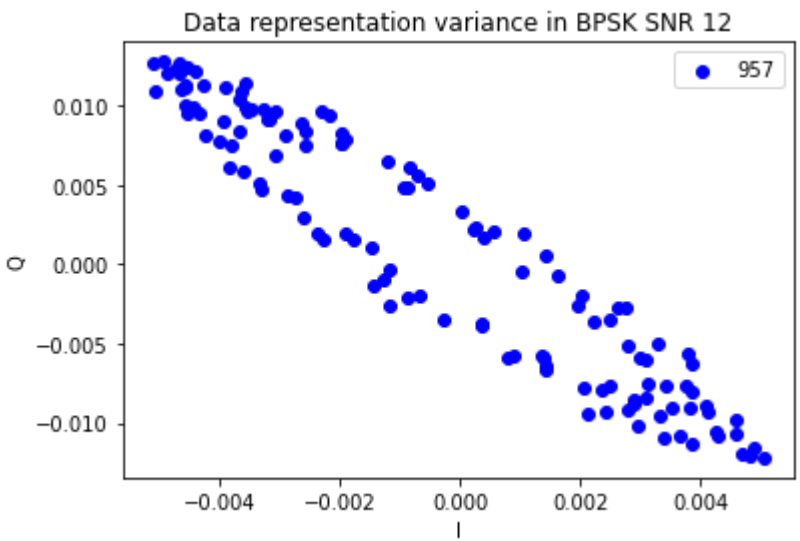

Data representation variance in BPSK SNR 12
952
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
953
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
954
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I


Data representation variance in BPSK SNR 12
955
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
0.004
I


Data representation variance in BPSK SNR 12
956
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.003 −0.002 −0.001 0.000 0.001 0.002 0.003 0.004
I


Data representation variance in BPSK SNR 12
957
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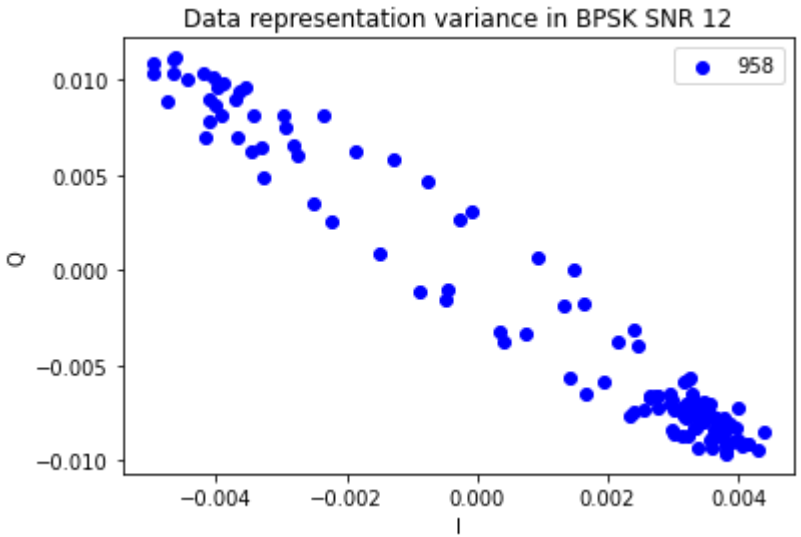
0.005
0.000
−0.005
−0.010
Q
−0.004 −0.002 0.000 0.002 0.004
I


Data representation variance in BPSK SNR 12
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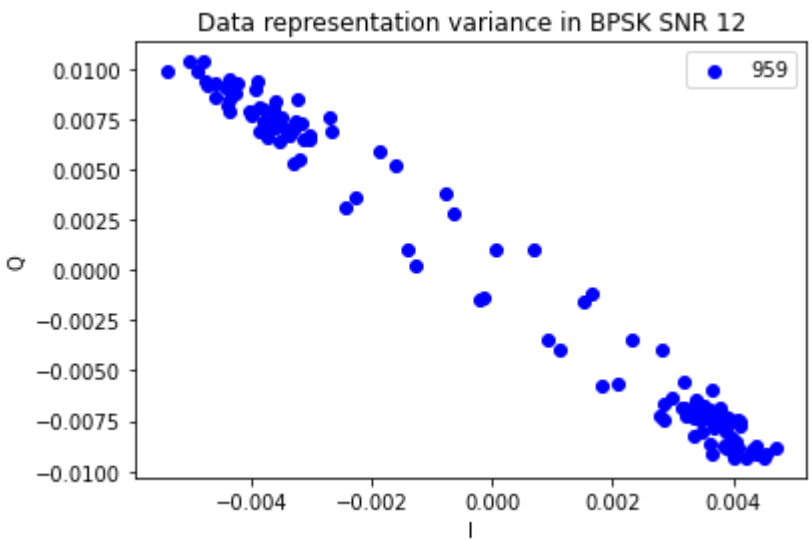
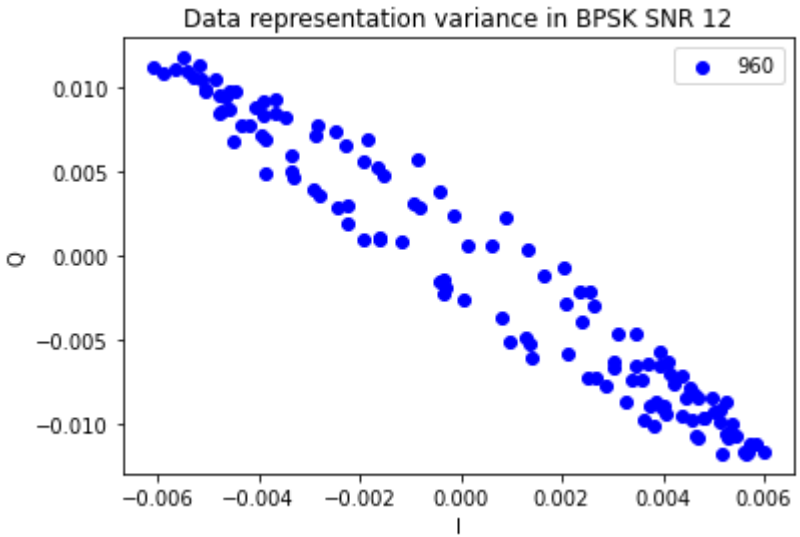
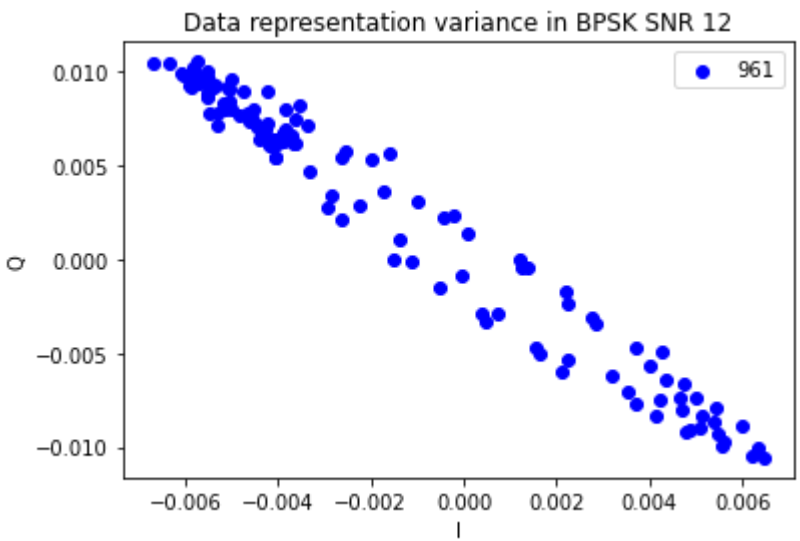
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
959
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
960
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
961
0.010
0.005
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−0.010
Q
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−0.004
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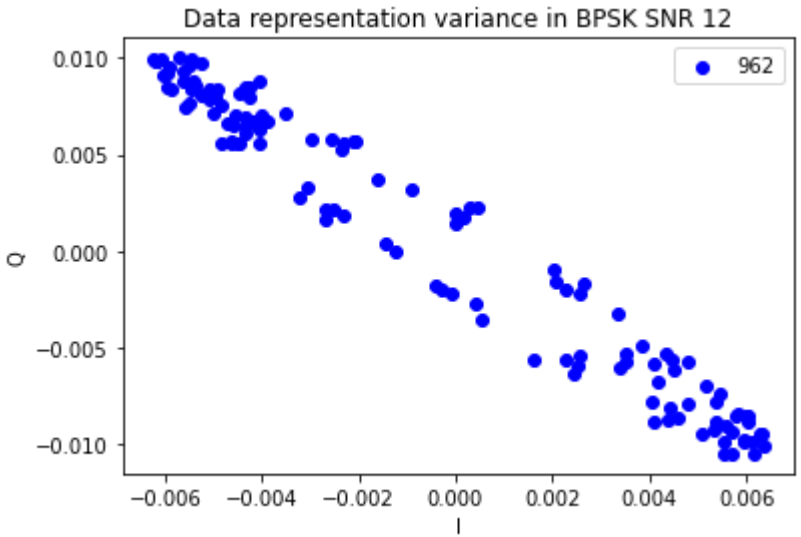
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
962
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0.005
0.000
−0.005
−0.010
Q
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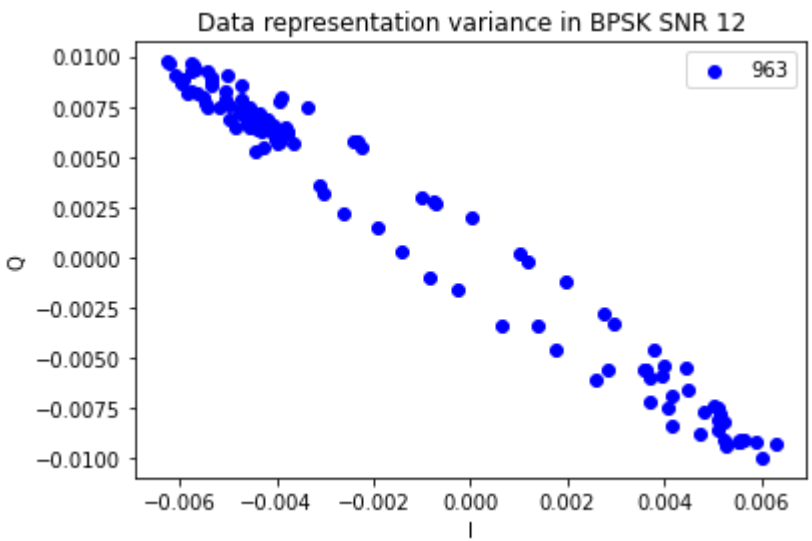
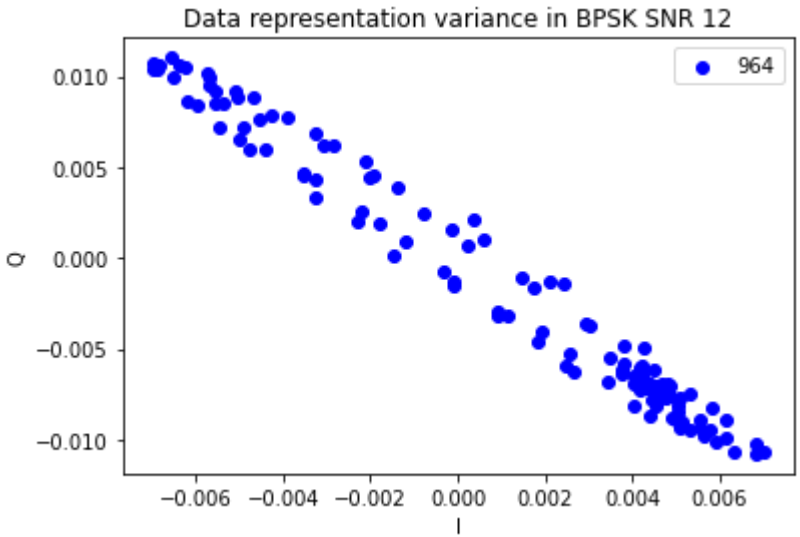
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
963
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
964
0.010
0.005
0.000
−0.005
−0.010
Q
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−0.004
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0.000
0.002
0.004
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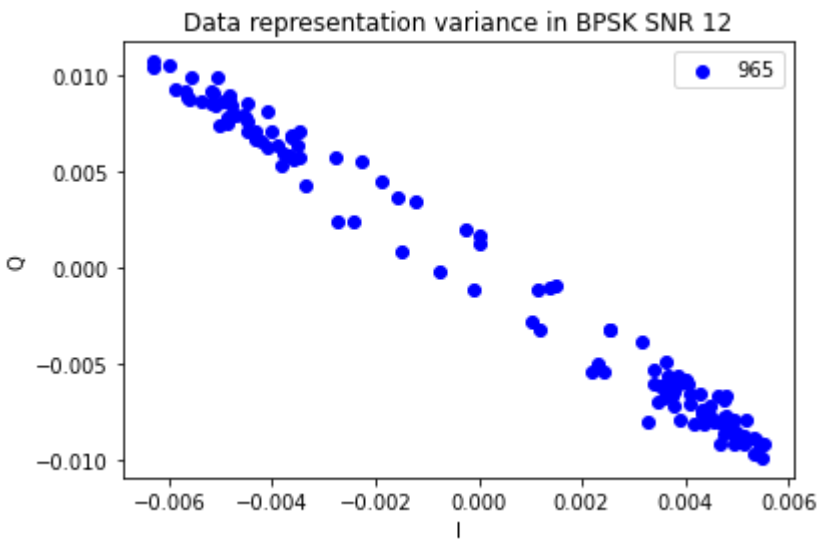
Data representation variance in BPSK SNR 12
965
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0.005
0.000
−0.005
−0.010
Q
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−0.004
−0.002
0.000
0.002
0.004
0.006
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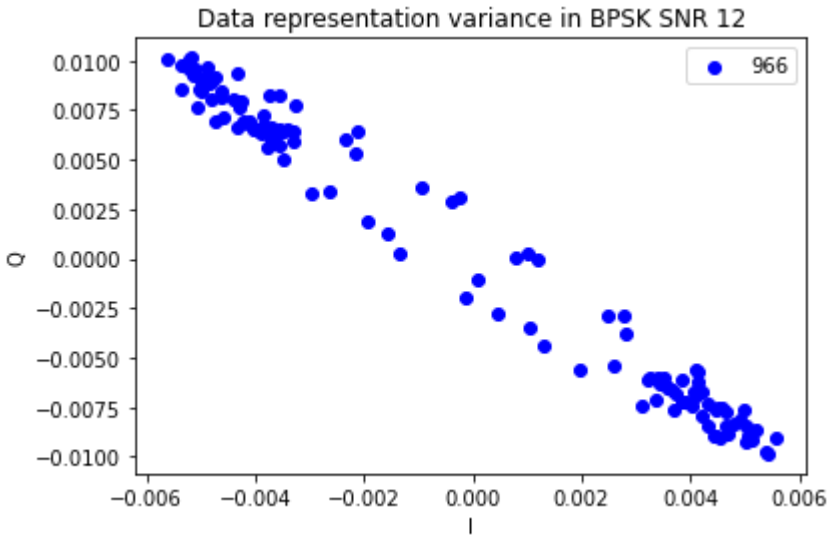
Data representation variance in BPSK SNR 12
966
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
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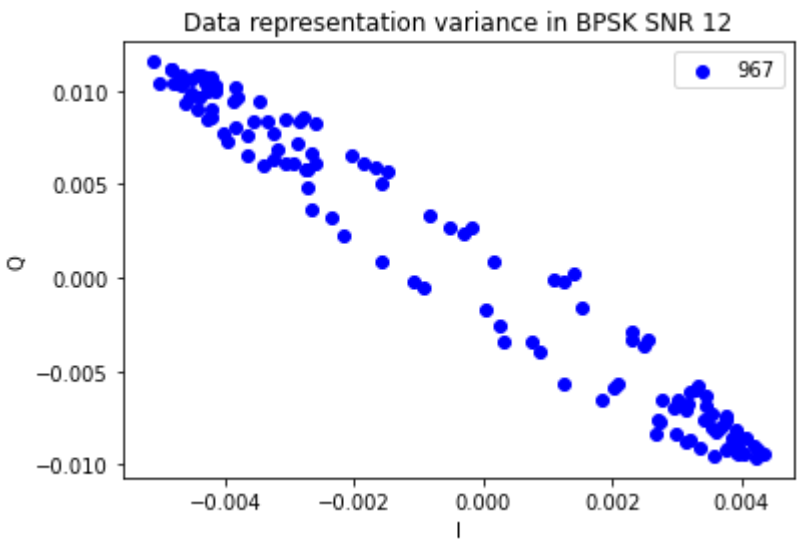
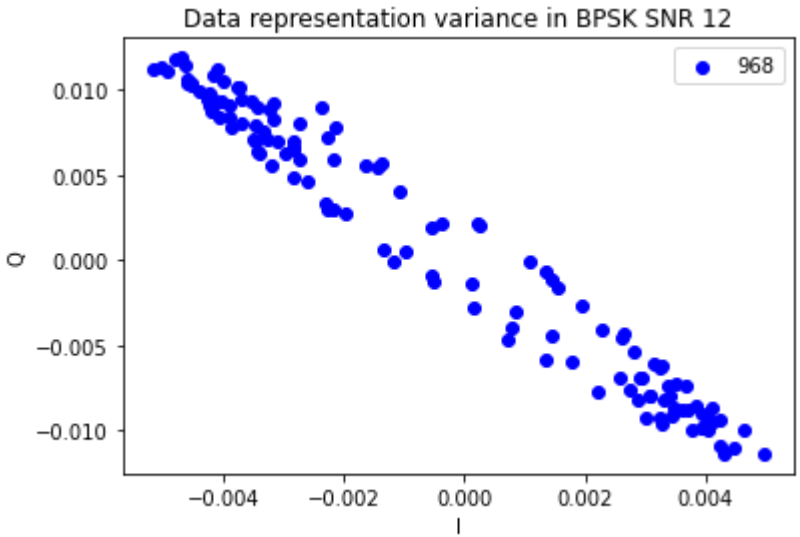
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
967
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
968
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−0.010
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0.004
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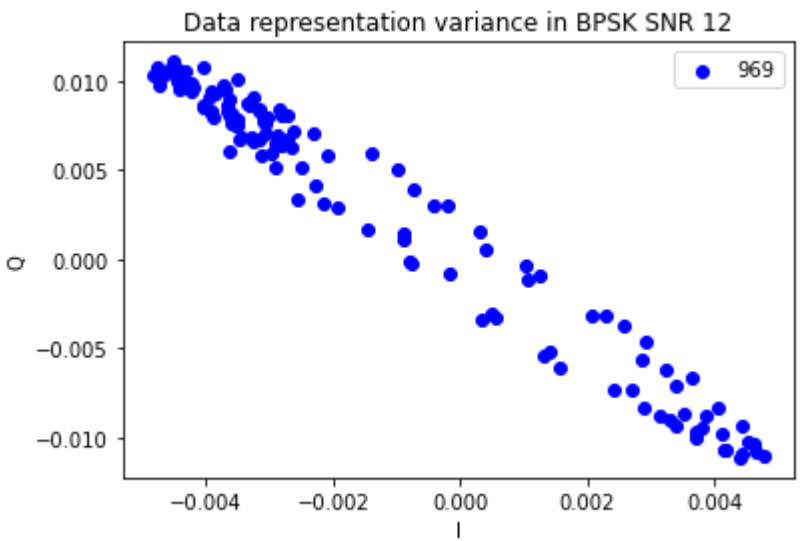
Data representation variance in BPSK SNR 12
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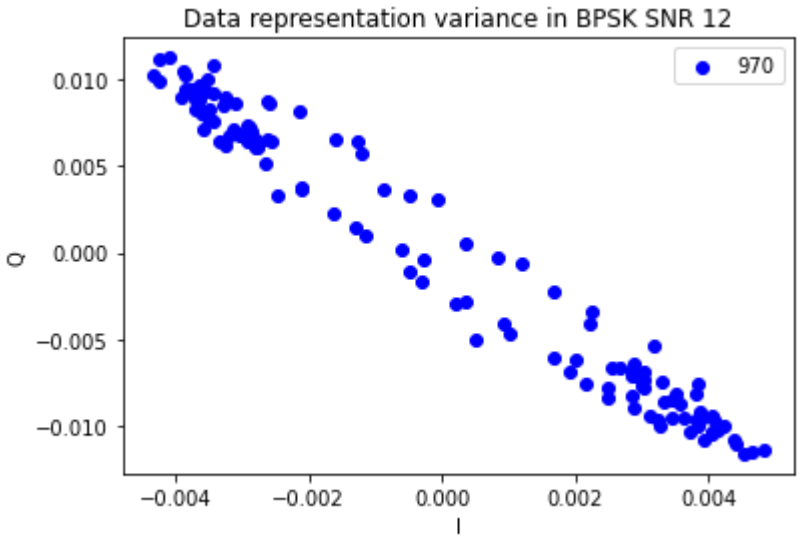
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
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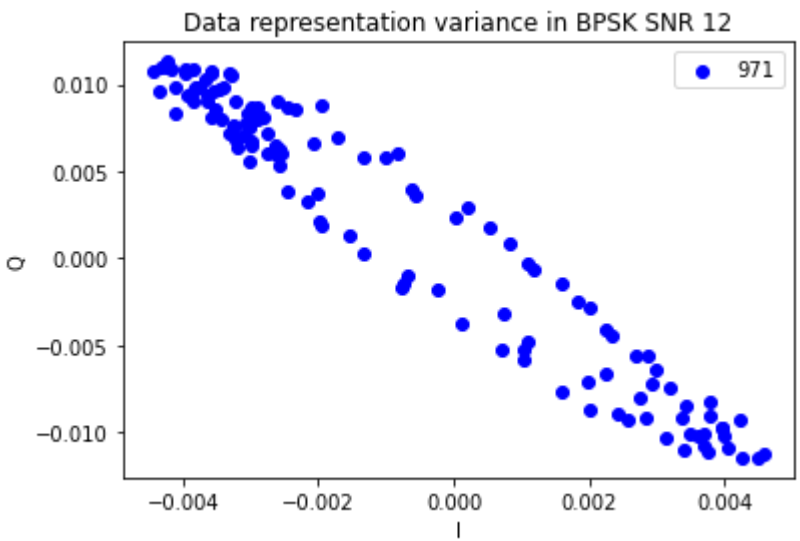
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
971
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0.000
−0.005
−0.010
Q
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−0.002
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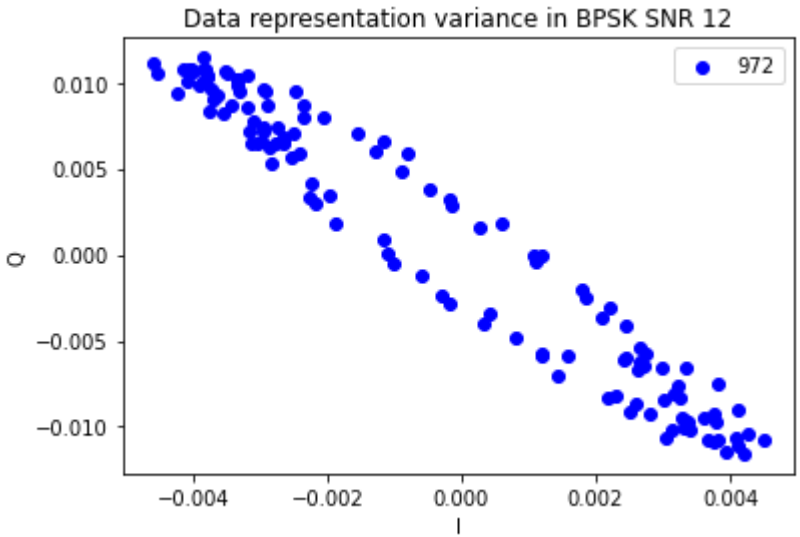
0.002
0.004
I


Data representation variance in BPSK SNR 12
972
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−0.010
Q
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−0.002
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0.004
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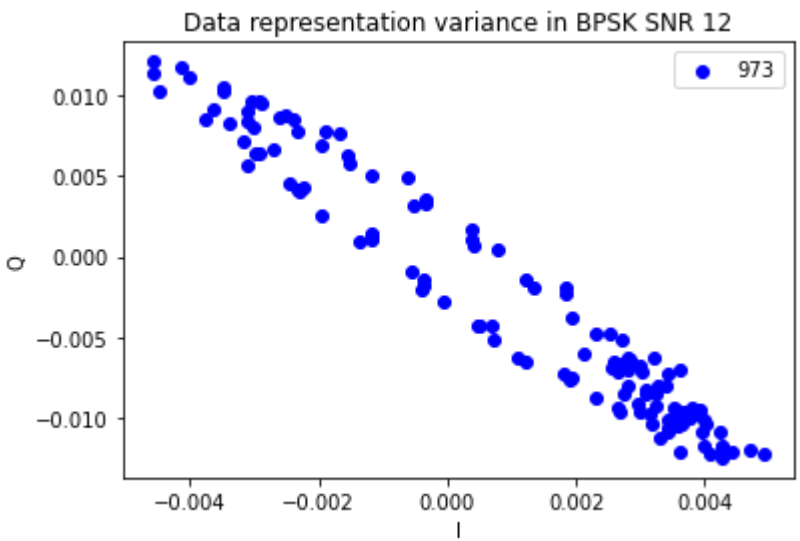
Data representation variance in BPSK SNR 12
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0.000
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−0.010
Q
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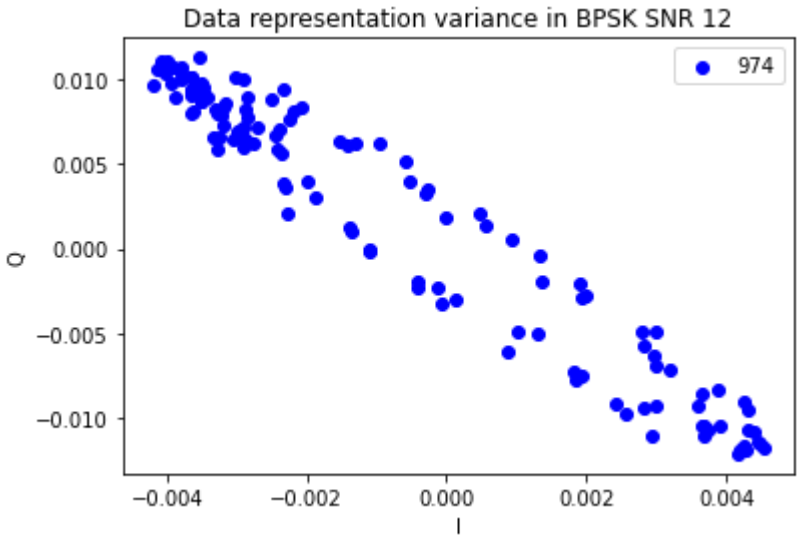
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
974
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0.000
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−0.010
Q
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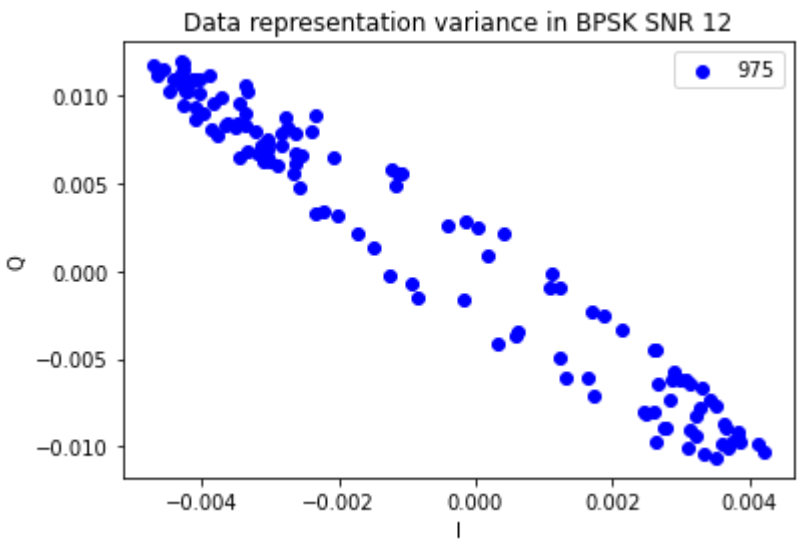
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
975
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0.005
0.000
−0.005
−0.010
Q
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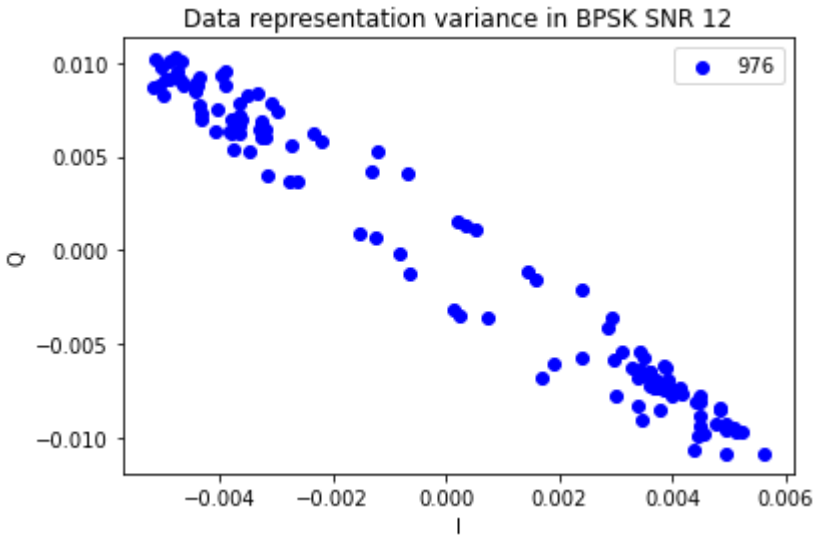
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
976
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
0.006
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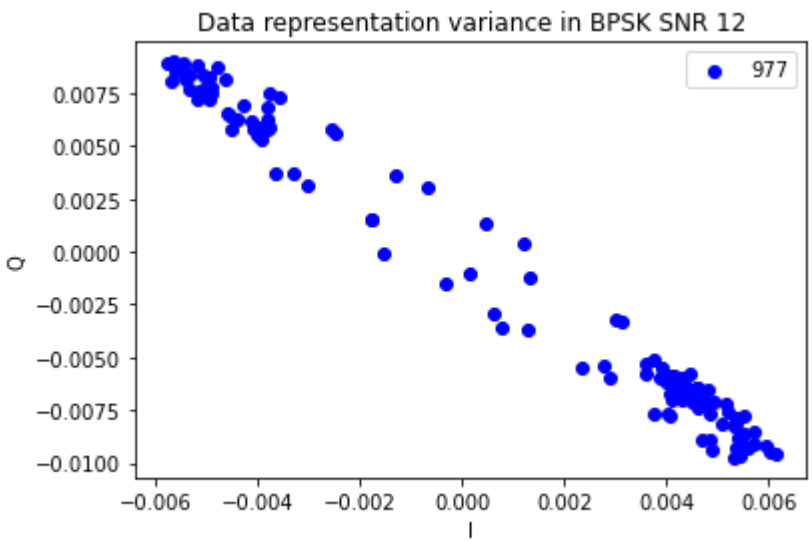
Data representation variance in BPSK SNR 12
977
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0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
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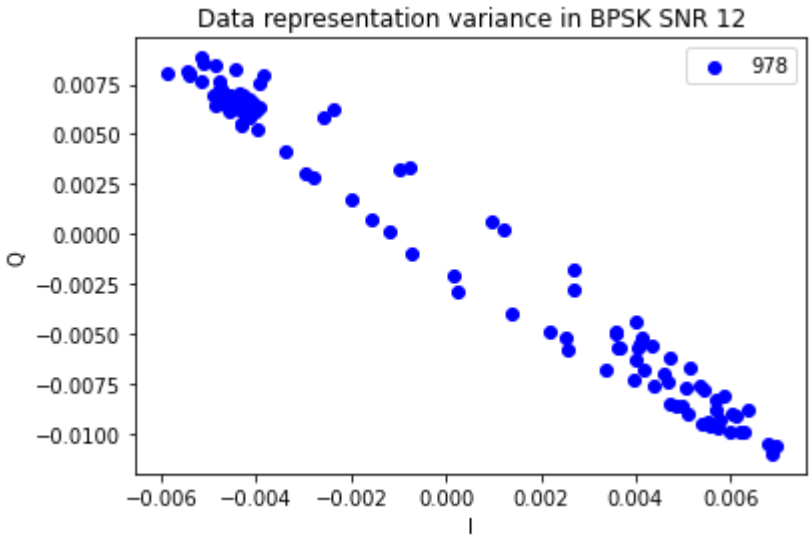
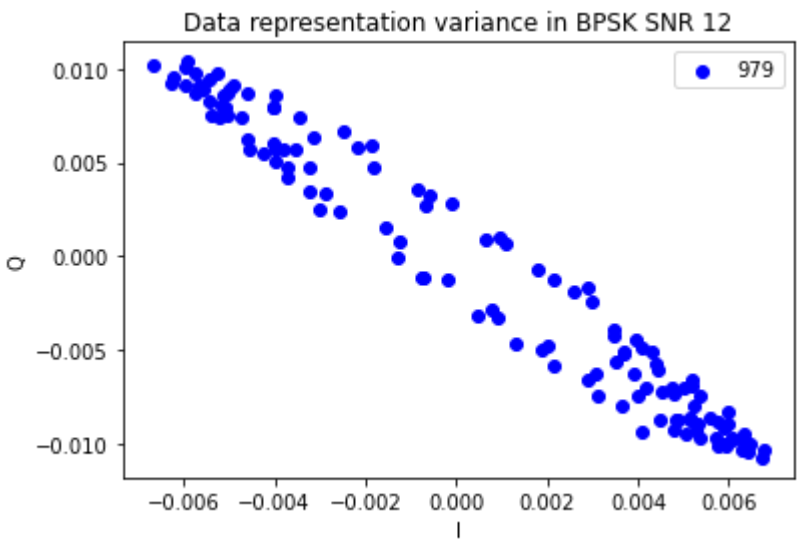
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
978
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
979
0.010
0.005
0.000
−0.005
−0.010
Q
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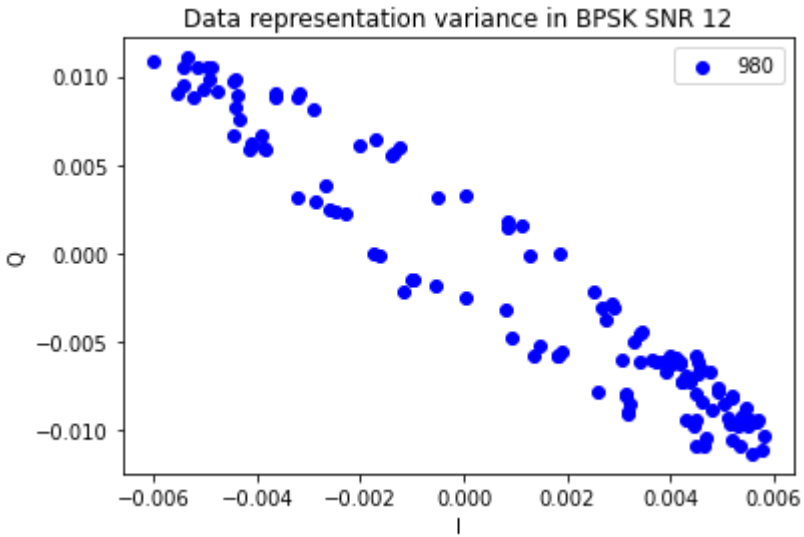
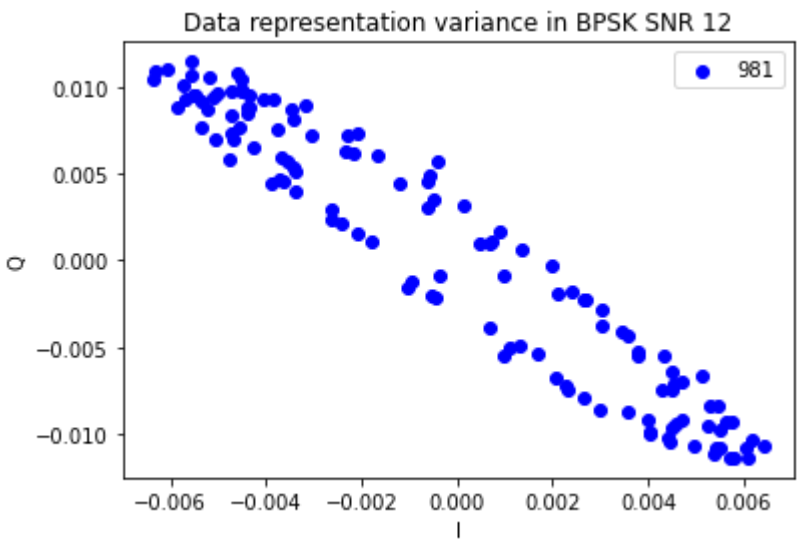
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
980
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I


Data representation variance in BPSK SNR 12
981
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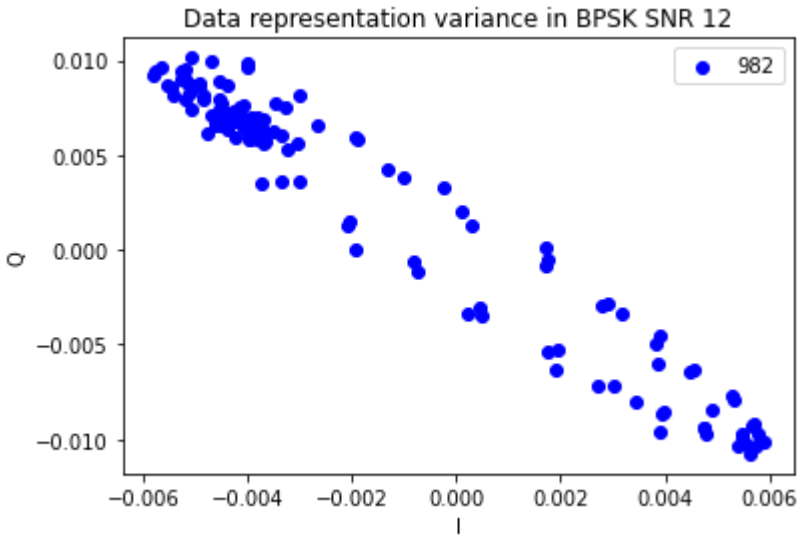
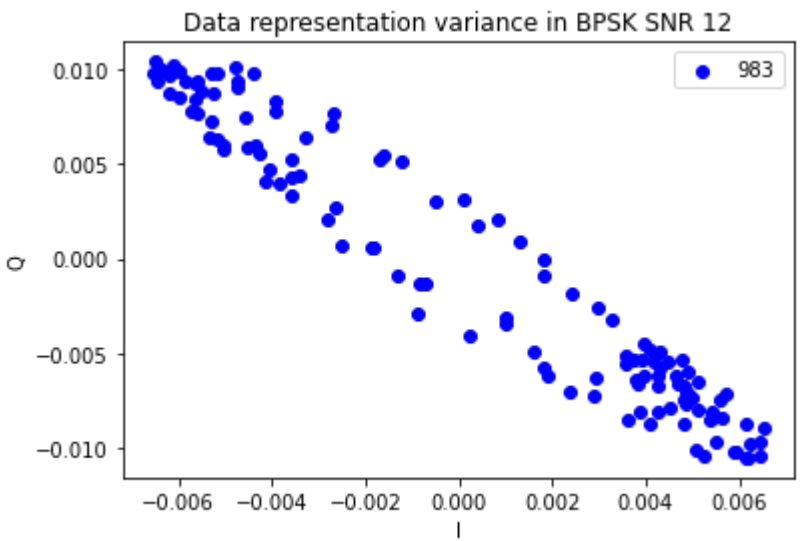
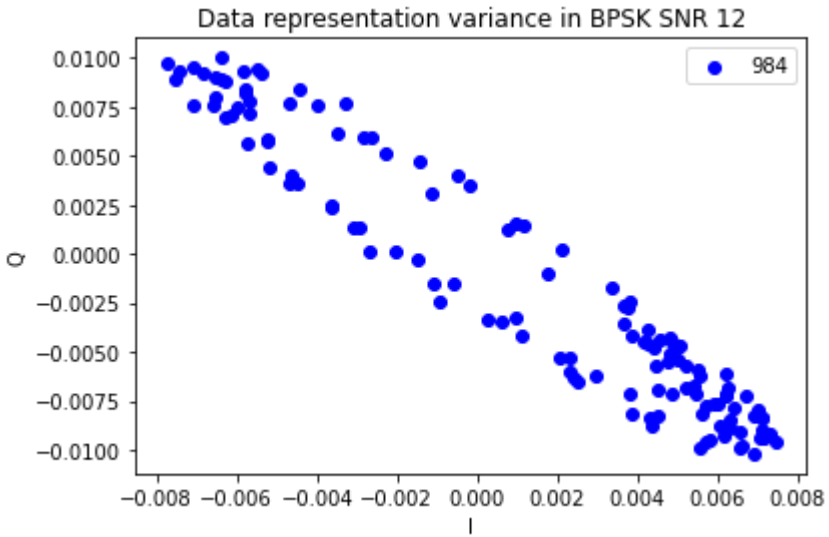
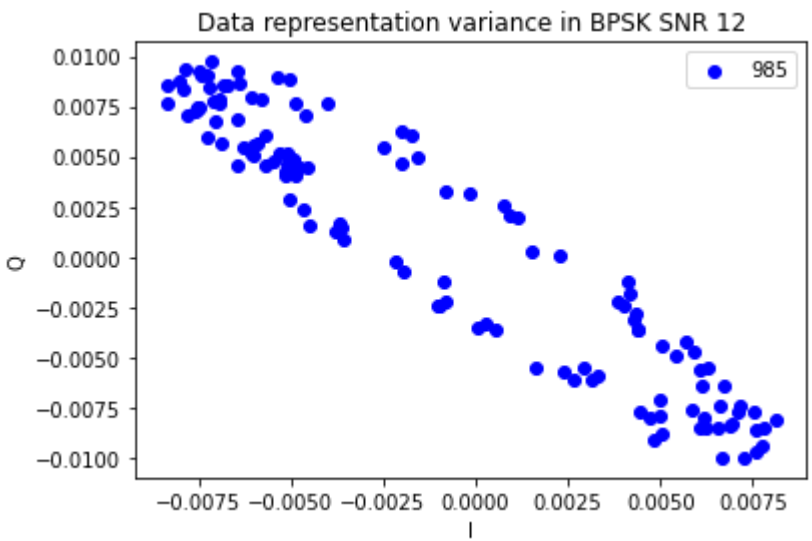
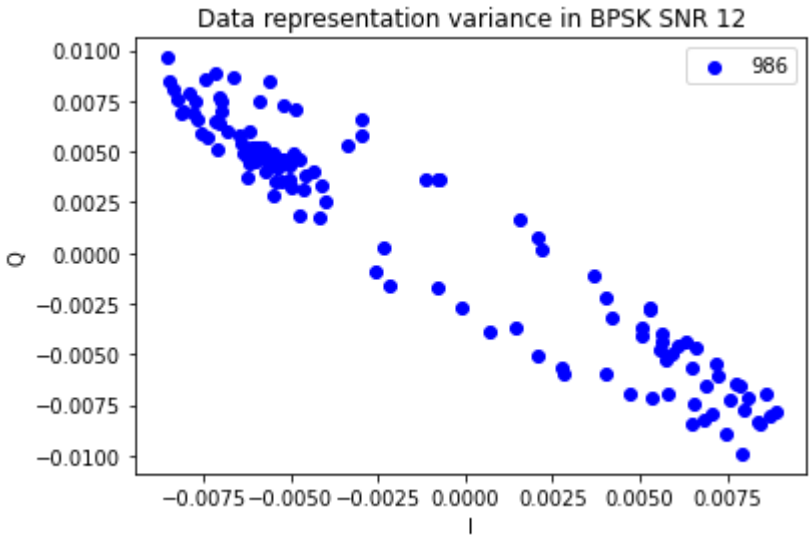
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

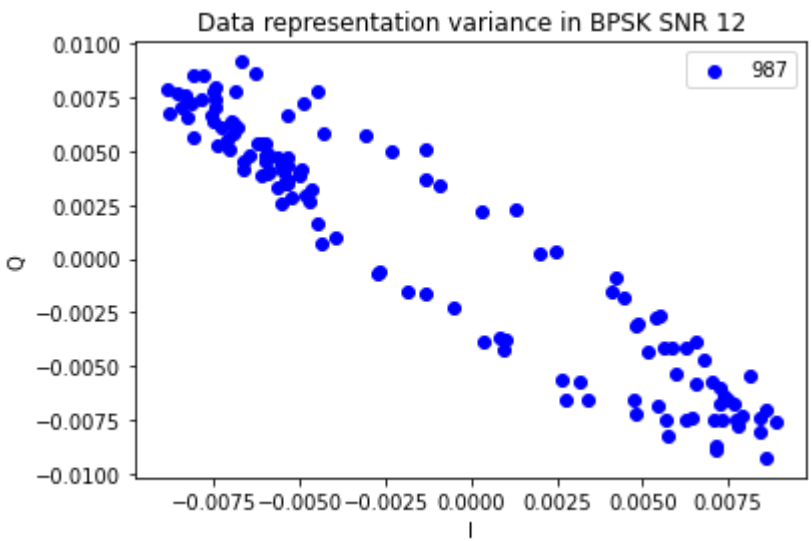

Data representation variance in BPSK SNR 12
982
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

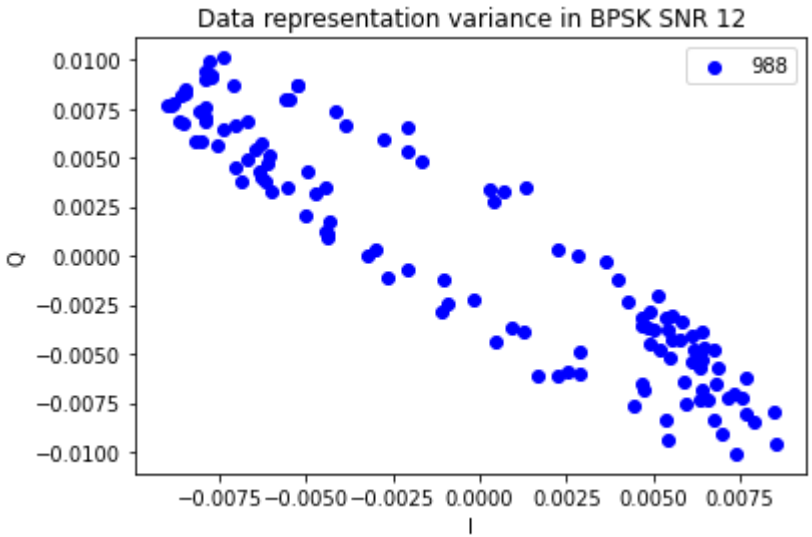

Data representation variance in BPSK SNR 12
983
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I

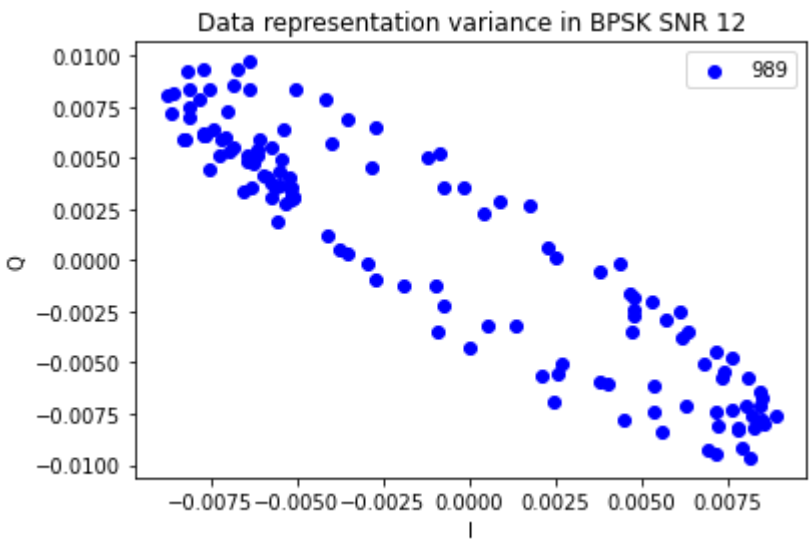

Data representation variance in BPSK SNR 12
984
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.008 −0.006 −0.004 −0.002 0.000 0.002 0.004 0.006 0.008
I

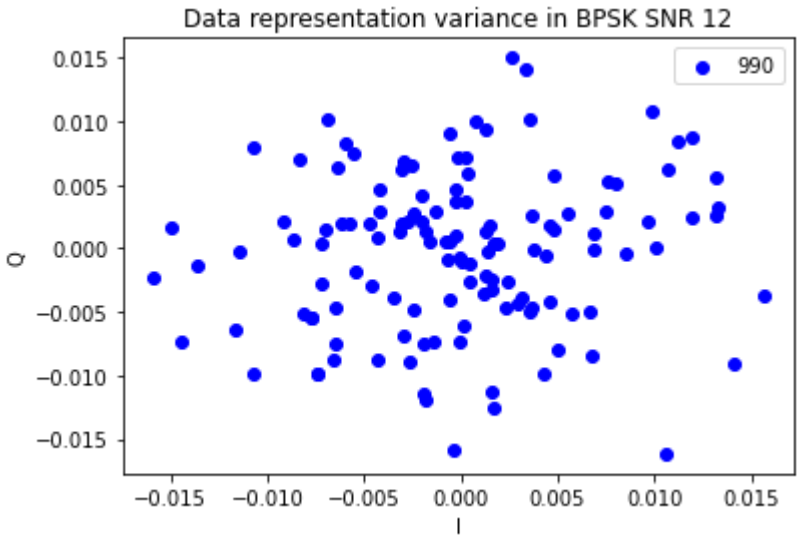

Data representation variance in BPSK SNR 12
985
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

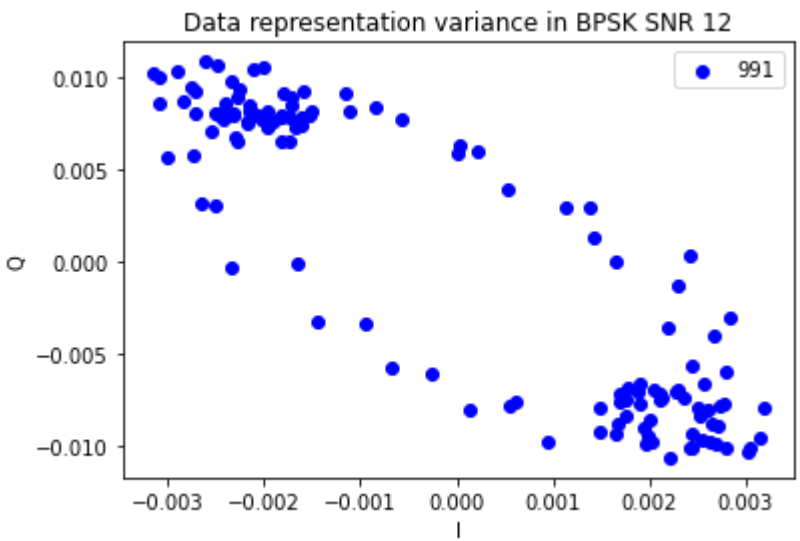

Data representation variance in BPSK SNR 12
986
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

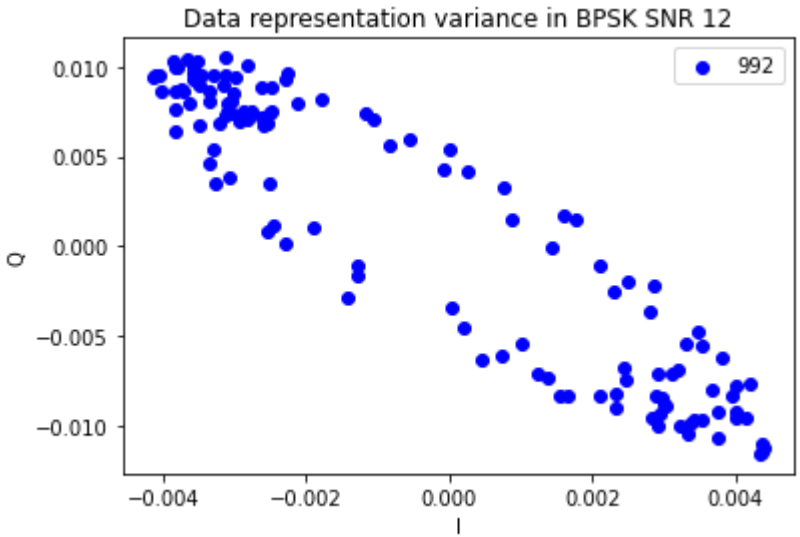

Data representation variance in BPSK SNR 12
987
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

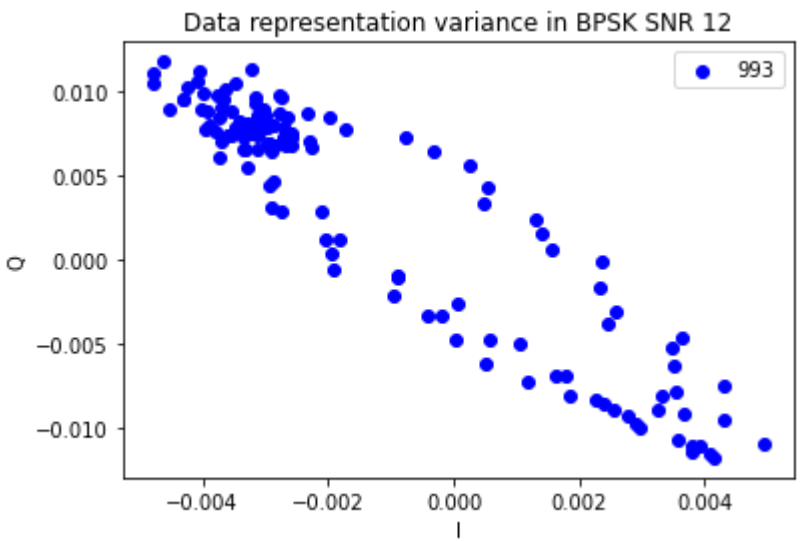

Data representation variance in BPSK SNR 12
988
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

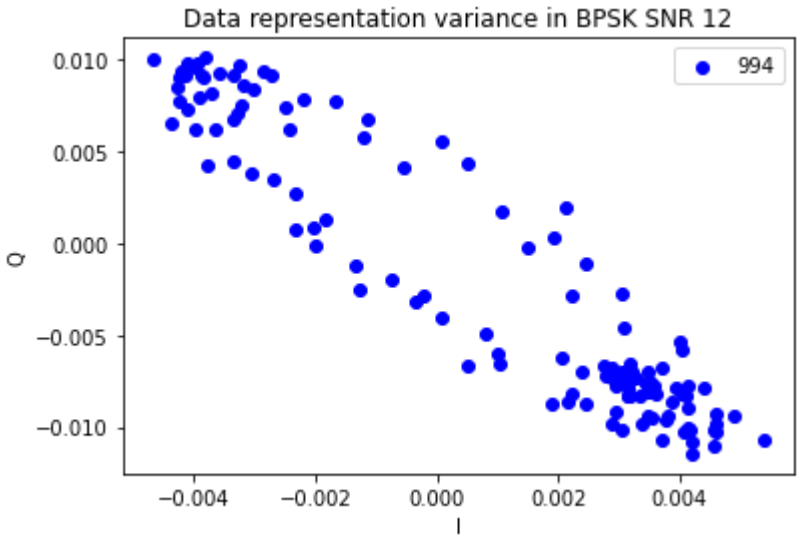

Data representation variance in BPSK SNR 12
989
0.0100
0.0075
0.0050
0.0025
0.0000
−0.0025
−0.0050
−0.0075
−0.0100
Q
−0.0075 −0.0050 −0.0025 0.0000 0.0025 0.0050 0.0075
I

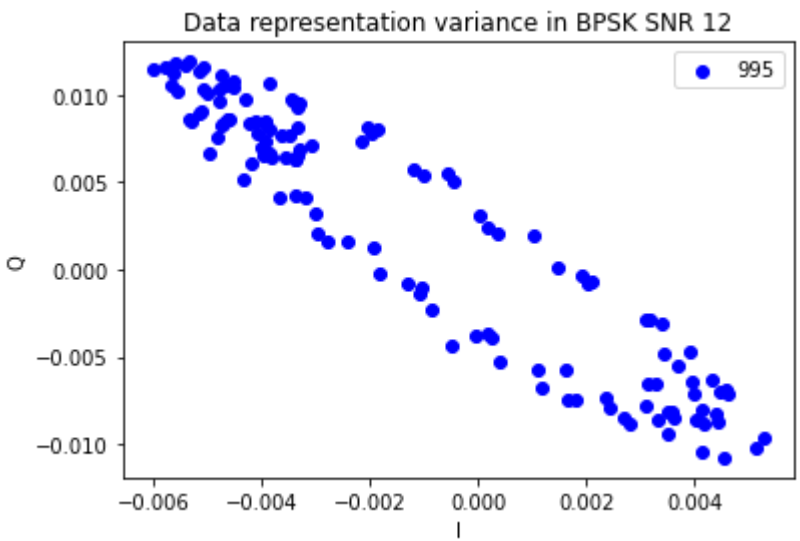

Data representation variance in BPSK SNR 12
990
0.015
0.010
0.005
0.000
−0.005
−0.010
−0.015
Q
−0.015
−0.010
−0.005
0.000
0.005
0.010
0.015
I

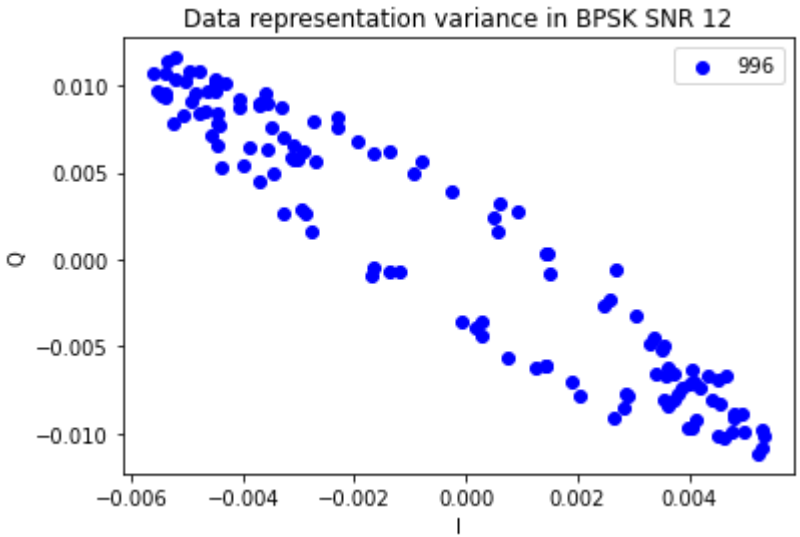

Data representation variance in BPSK SNR 12
991
0.010
0.005
0.000
−0.005
−0.010
Q
−0.003
−0.002
−0.001
0.000
0.001
0.002
0.003
I

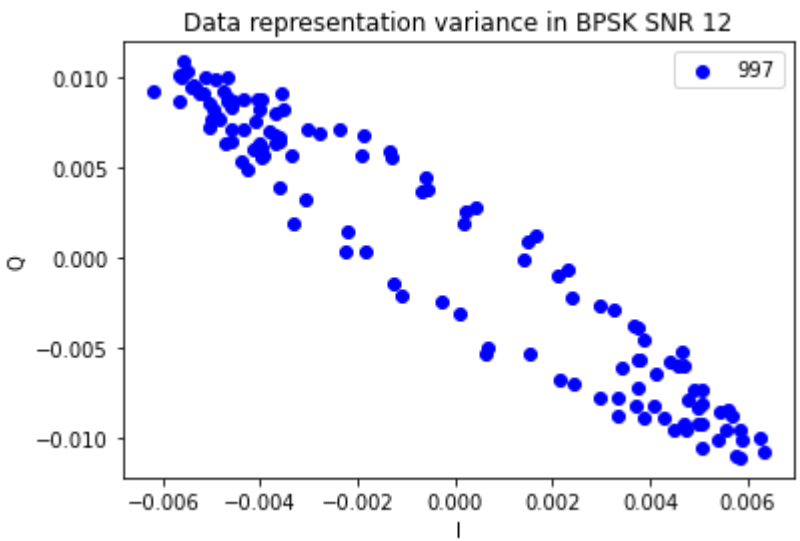

Data representation variance in BPSK SNR 12
992
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

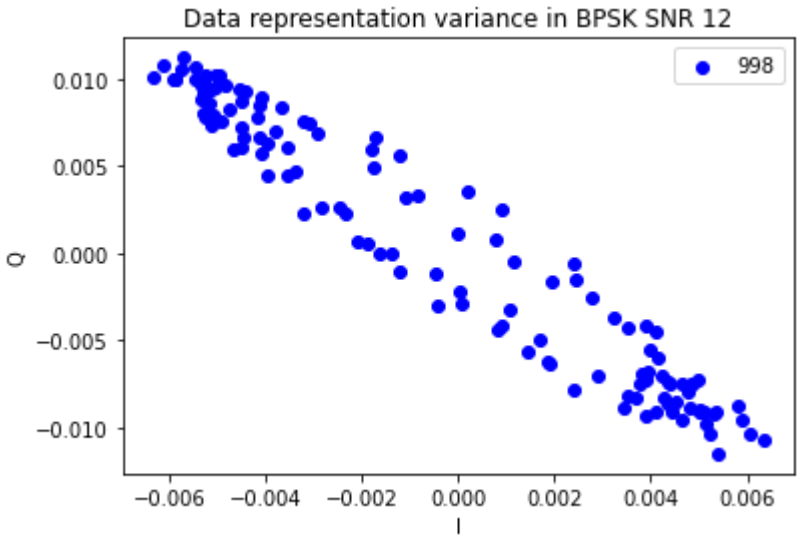

Data representation variance in BPSK SNR 12
993
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I

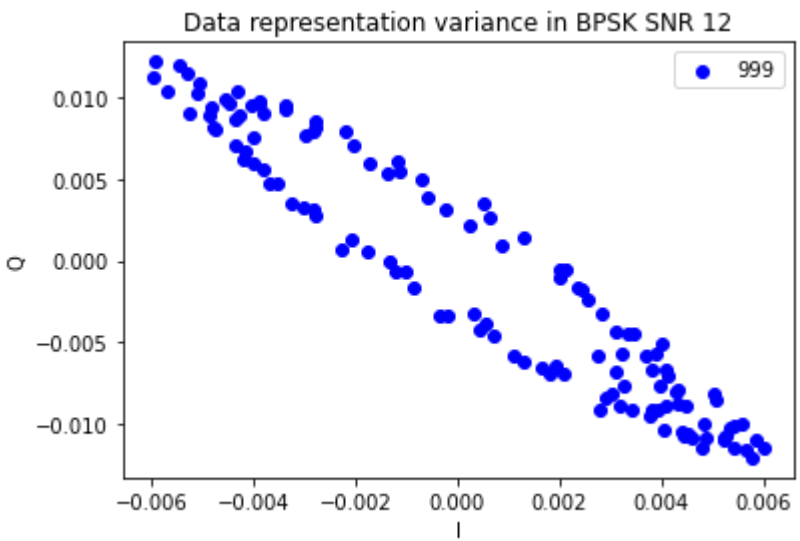

Data representation variance in BPSK SNR 12
994
0.010
0.005
0.000
−0.005
−0.010
Q
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
995
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
996
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
I


Data representation variance in BPSK SNR 12
997
0.010
0.005
0.000
−0.005
−0.010
Q
−0.006
−0.004
−0.002
0.000
0.002
0.004
0.006
I





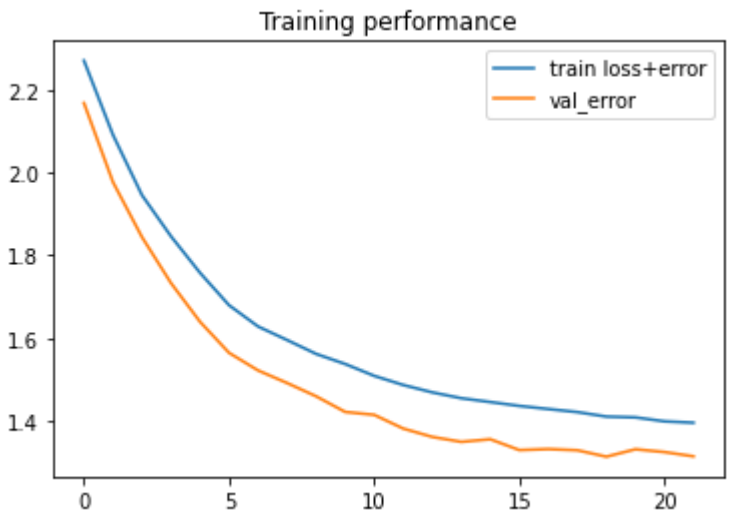
In [ ]:
```
predict=model.predict([x_valid])
predict=np.argmax(predict,axis=1)
```

In [ ]:
```
y_test=np.argmax(y_valid,axis=1)
```

In [ ]:
```
x_test=x_valid
```

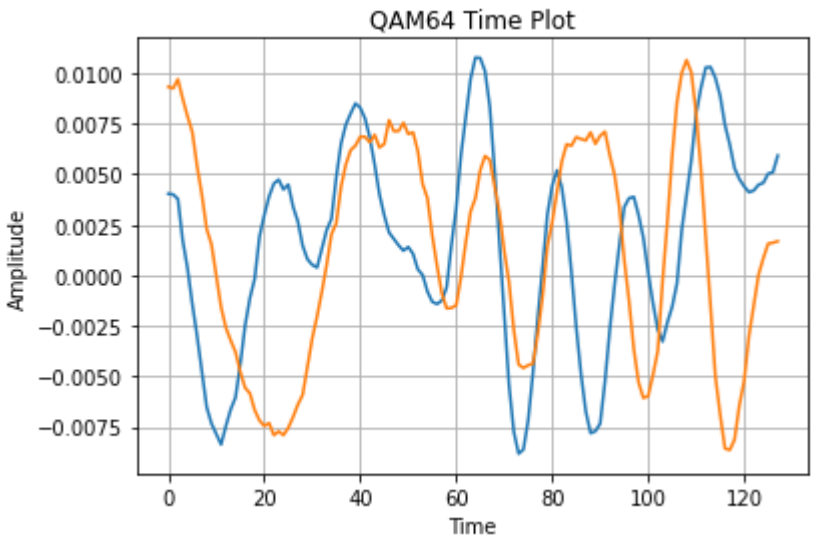
In [14]:
```
# Show loss curves
plt.figure()
plt.title('Training performance')
plt.plot(history.epoch, history.history['loss'], label='train loss+error')
plt.plot(history.epoch, history.history['val_loss'], label='val_error')
plt.legend()
```

Out[14]: <matplotlib.legend.Legend at 0x7f77a61fa358>



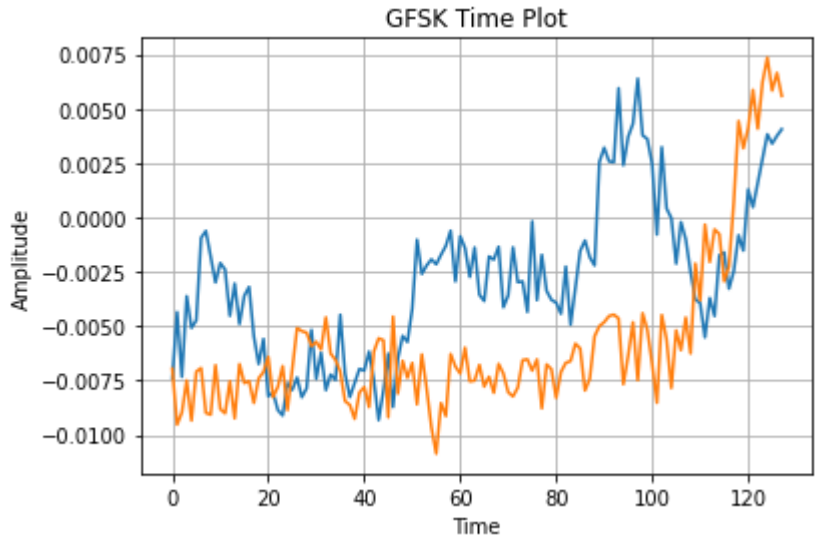
In [36]:
```
plt.plot(Xd[b'QAM64',4][2,0])
plt.plot(Xd[b'QAM64',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("QAM64 Time Plot")
```

Out[36]: Text(0.5, 1.0, 'QAM64 Time Plot')



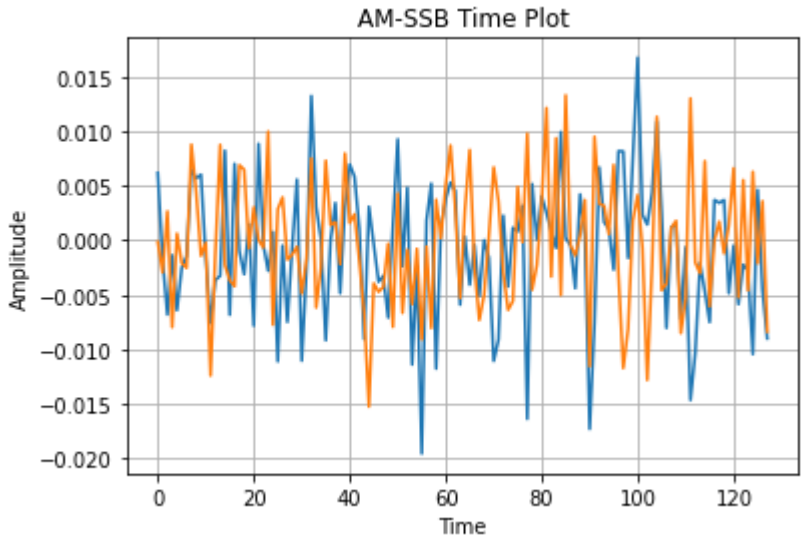
In [37]:
```
plt.plot(Xd[b'GFSK',4][2,0])
plt.plot(Xd[b'GFSK',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("GFSK Time Plot")
```

Out[37]: Text(0.5, 1.0, 'GFSK Time Plot')



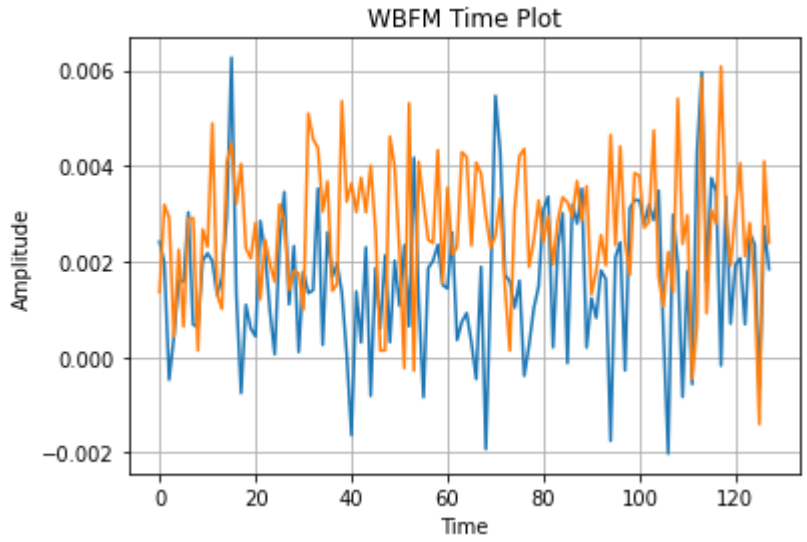
In [38]:
```
plt.plot(Xd[b'AM-SSB',4][2,0])
plt.plot(Xd[b'AM-SSB',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("AM-SSB Time Plot")
```

Out[38]: Text(0.5, 1.0, 'AM-SSB Time Plot')



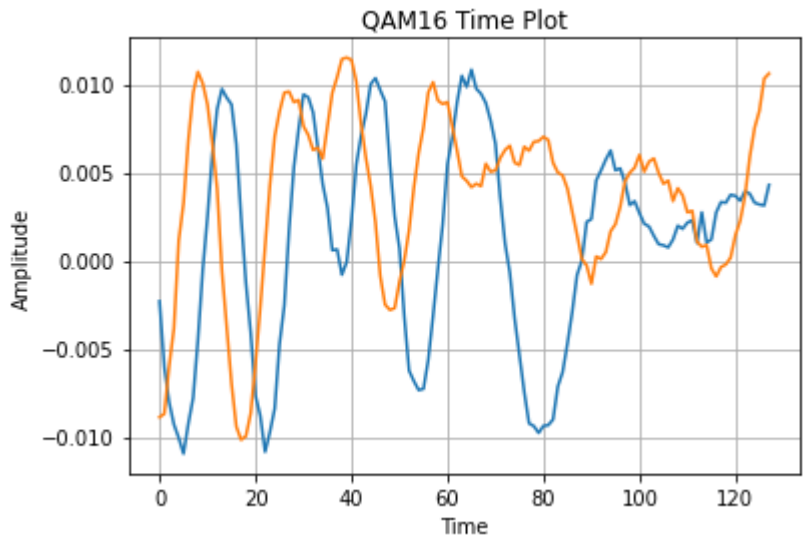
In [39]:
```
plt.plot(Xd[b'WBFM',4][2,0])
plt.plot(Xd[b'WBFM',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("WBFM Time Plot")
```

Out[39]: Text(0.5, 1.0, 'WBFM Time Plot')



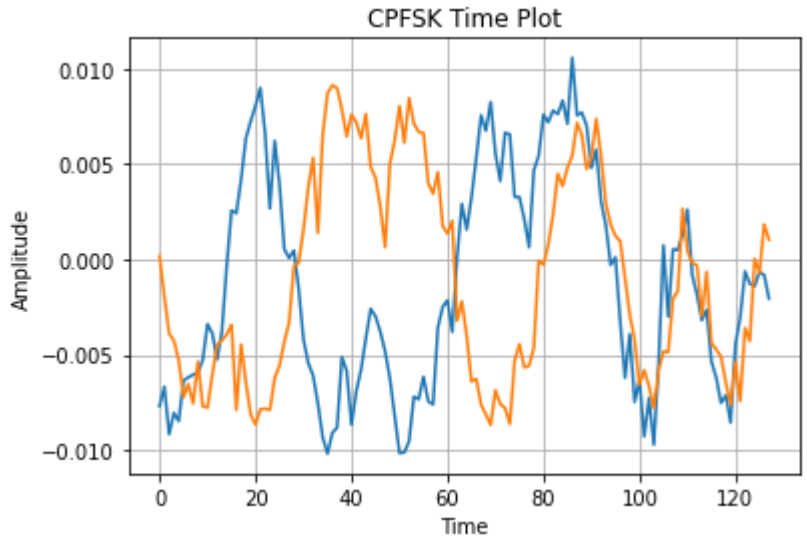
In [40]:
```
plt.plot(Xd[b'QAM16',4][2,0])
plt.plot(Xd[b'QAM16',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("QAM16 Time Plot")
```

Out[40]: Text(0.5, 1.0, 'QAM16 Time Plot')



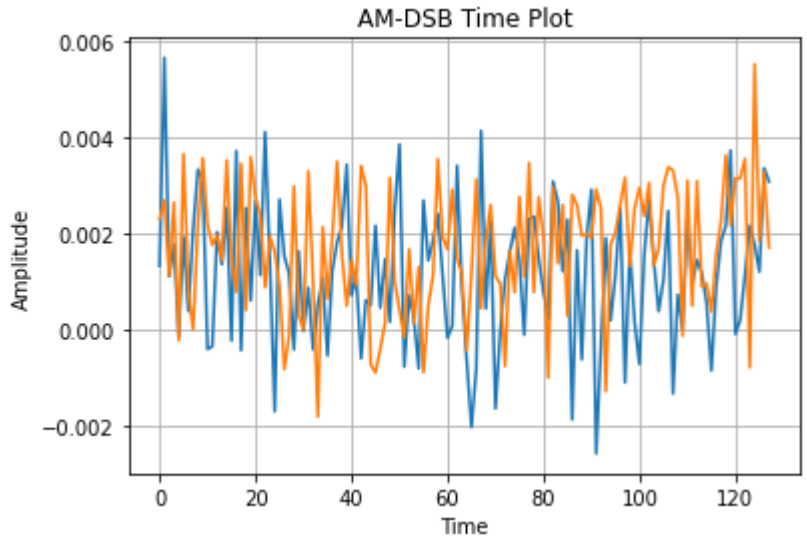
In [41]:
```
plt.plot(Xd[b'CPFSK',4][2,0])
plt.plot(Xd[b'CPFSK',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("CPFSK Time Plot")
```

Out[41]: Text(0.5, 1.0, 'CPFSK Time Plot')



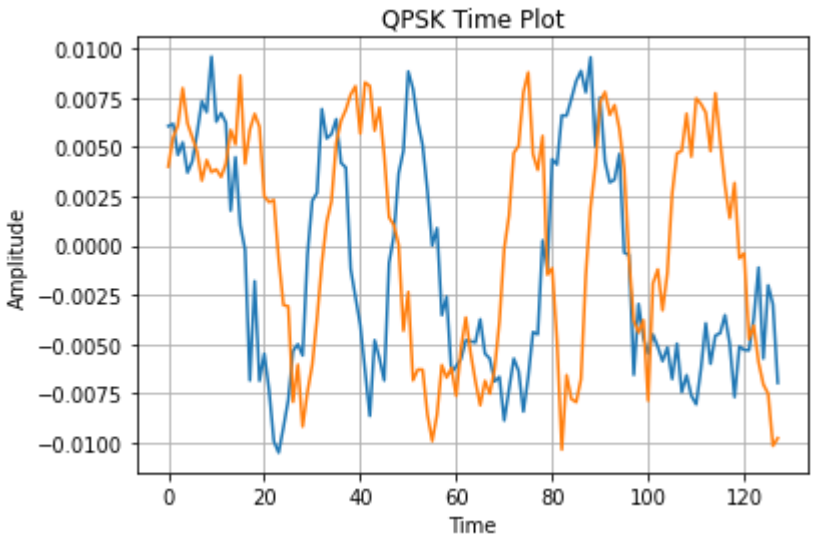
In [42]:
```
plt.plot(Xd[b'AM-DSB',4][2,0])
plt.plot(Xd[b'AM-DSB',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("AM-DSB Time Plot")
```

Out[42]: Text(0.5, 1.0, 'AM-DSB Time Plot')



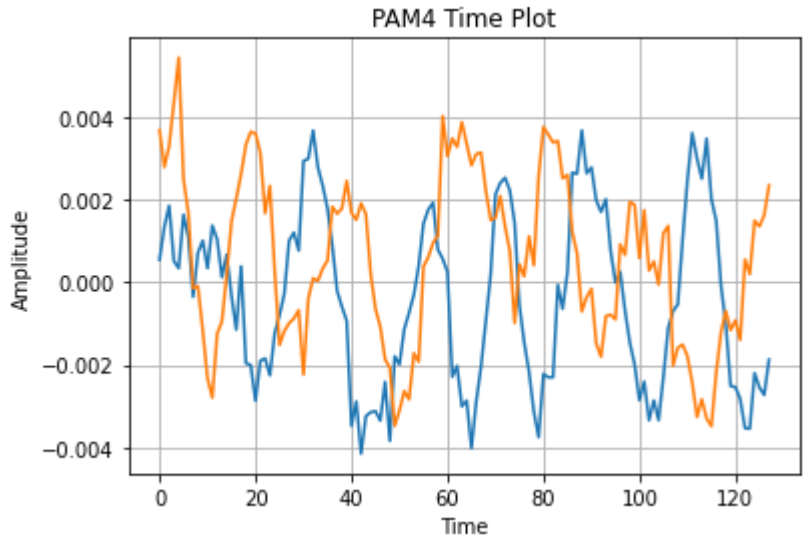
In [43]:
```
plt.plot(Xd[b'QPSK',4][2,0])
plt.plot(Xd[b'QPSK',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("QPSK Time Plot")
```

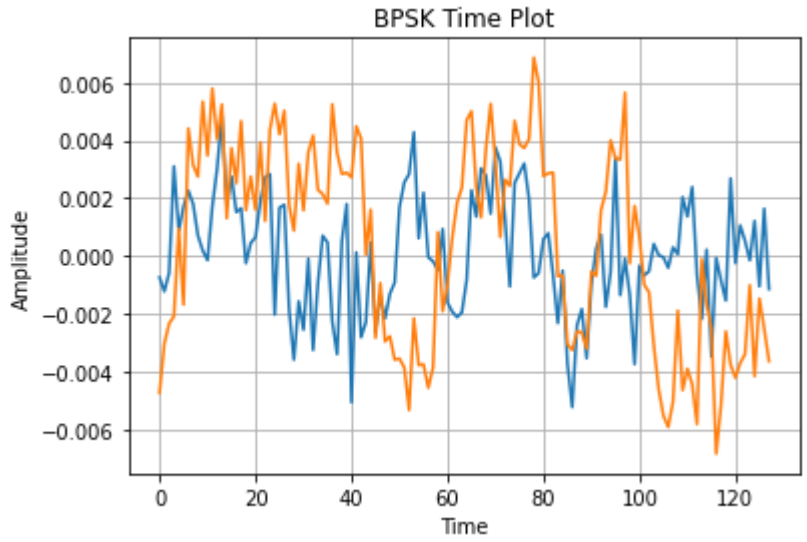
Out[43]: Text(0.5, 1.0, 'QPSK Time Plot')



In [44]:
```
plt.plot(Xd[b'PAM4',4][2,0])
plt.plot(Xd[b'PAM4',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("PAM4 Time Plot")
```

Out[44]: Text(0.5, 1.0, 'PAM4 Time Plot')



In [45]:
```
plt.plot(Xd[b'BPSK',4][2,0])
plt.plot(Xd[b'BPSK',4][5,0])
plt.xlabel("Time")
plt.ylabel("Amplitude")
plt.grid(b=True, axis='both')
plt.title("BPSK Time Plot")
```

Out[45]: Text(0.5, 1.0, 'BPSK Time Plot')