

cvcourseworkfinal-3

April 23, 2023

```
[88]: from google.colab import drive
drive.mount('/content/drive', force_remount=True)
```

Mounted at /content/drive

```
[89]: !pip install opencv-python==4.5.5.64
```

Looking in indexes: <https://pypi.org/simple>, <https://us-python.pkg.dev/colab-wheels/public/simple/>
Requirement already satisfied: opencv-python==4.5.5.64 in
/usr/local/lib/python3.9/dist-packages (4.5.5.64)
Requirement already satisfied: numpy>=1.19.3 in /usr/local/lib/python3.9/dist-packages (from opencv-python==4.5.5.64) (1.22.4)

```
[90]: !pip install skorch
```

Looking in indexes: <https://pypi.org/simple>, <https://us-python.pkg.dev/colab-wheels/public/simple/>
Requirement already satisfied: skorch in /usr/local/lib/python3.9/dist-packages (0.12.1)
Requirement already satisfied: tabulate>=0.7.7 in /usr/local/lib/python3.9/dist-packages (from skorch) (0.8.10)
Requirement already satisfied: scipy>=1.1.0 in /usr/local/lib/python3.9/dist-packages (from skorch) (1.10.1)
Requirement already satisfied: tqdm>=4.14.0 in /usr/local/lib/python3.9/dist-packages (from skorch) (4.65.0)
Requirement already satisfied: scikit-learn>=0.22.0 in /usr/local/lib/python3.9/dist-packages (from skorch) (1.2.2)
Requirement already satisfied: numpy>=1.13.3 in /usr/local/lib/python3.9/dist-packages (from skorch) (1.22.4)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.9/dist-packages (from scikit-learn>=0.22.0->skorch) (3.1.0)
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.9/dist-packages (from scikit-learn>=0.22.0->skorch) (1.2.0)

```
[93]: import os
```

```

# TODO: Fill in the Google Drive path where you uploaded the lab materials
# Example: GOOGLE_DRIVE_PATH_AFTER_MYDRIVE = 'Colab Notebooks/Lab materials_
↳01-20210104'

dirCVCourseWork = '/content/drive/MyDrive/ComputerVision/CVCourseWork_Mohsin/
↳CW_Folder_PG'
GOOGLE_DRIVE_PATH = os.path.join(dirCVCourseWork)
print(os.listdir(GOOGLE_DRIVE_PATH))

```

```

['CV2023_CW_Dataset', '.DS_Store', 'Video', 'Models', 'Code',
'test_functions.ipynb']

```

```

[350]: import copy
import pickle
import time
from collections import Counter
import cv2
import seaborn as sns
from sklearn.metrics import ConfusionMatrixDisplay
from sklearn.metrics import confusion_matrix
import imgaug.augmenters as iaa
import matplotlib.animation as animation
import matplotlib.pyplot as plot
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
import torch
import torch.nn as nn
import torch.nn.functional as F
import torchvision.transforms as transforms
from facenet_pytorch import MTCNN
from joblib import dump, load
from matplotlib import patches, rc
from PIL import Image
from skimage import color, exposure, filters, img_as_ubyte, io
from skimage.measure import label, regionprops
from skimage.morphology import disk, square
from sklearn import metrics
from sklearn.cluster import MiniBatchKMeans
from sklearn.metrics import (accuracy_score, f1_score, make_scorer,
                             precision_score, recall_score, roc_auc_score)
from sklearn.model_selection import (GridSearchCV, RandomizedSearchCV,
                                     cross_validate, train_test_split)
from sklearn.neural_network import MLPClassifier
from sklearn.pipeline import make_pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.svm import SVC

```

```

from skorch import NeuralNetClassifier
from skorch.callbacks import EarlyStopping
from torch.utils.data import Dataset
from torchvision import datasets

```

```

[81]: # Identify path to zipped dataset
zip_path = os.path.join(GOOGLE_DRIVE_PATH, 'CV2023_CW_Dataset/CV2023_CW_Dataset.
↳zip')

# Copy it to Colab
!cp '{zip_path}' .

# Unzip it
!yes|unzip -q CV2023_CW_Dataset.zip

# Delete zipped version from Colab (not from Drive)
!rm CV2023_CW_Dataset.zip

```

```

replace test/images/image_2711.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace test/images/image_2654.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace test/images/image_2438.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace test/images/image_2592.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace test/images/image_2746.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace test/images/image_2603.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace test/images/image_2480.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
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replace test/images/image_2615.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
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replace test/images/image_2707.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
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replace test/images/image_2551.jpeg? [y]es, [n]o, [A]ll, [N]one, [r]ename:

```


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replace train/labels/image_2306.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_0277.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_1169.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_0263.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_2312.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_0505.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_1633.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_1155.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_1141.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_1627.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:
replace train/labels/image_0539.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename:

```

```

[95]: !mkdir CV2023_CW_Dataset
      !mv * CV2023_CW_Dataset/

```

```

mkdir: cannot create directory 'CV2023_CW_Dataset': File exists
mv: cannot move 'CV2023_CW_Dataset' to a subdirectory of itself,
'CV2023_CW_Dataset/CV2023_CW_Dataset'
mv: cannot move 'drive' to 'CV2023_CW_Dataset/drive': Device or resource busy
mv: cannot move 'test' to 'CV2023_CW_Dataset/test': Directory not empty
mv: cannot move 'train' to 'CV2023_CW_Dataset/train': Directory not empty

```

```

[96]: imgTemp= 0
def import_selected_data(path, label_list=None):
    """Load images and labels from selected directories"""
    images = []
    labels = []
    imageSize=[]

    if label_list is None:
        folder_names = [folder for folder in sorted(os.listdir(path)) if not
↪folder.startswith('.')]
    else:
        folder_names = [folder for folder in sorted(os.listdir(path)) if folder
↪in label_list]

    for folder in folder_names:
        if folder=='images':
            file_names = [file for file in sorted(os.listdir(os.path.join(path,
↪folder))) if file.endswith('.jpeg')]
            for file in file_names:
                images.append(io.imread(os.path.join(path, folder, file)))
        if folder=='labels':
            label_file_names = [file for file in sorted(os.listdir(os.path.
↪join(path, folder))) if file.endswith('.txt')]
            for file in label_file_names:
                with open(os.path.join(path, folder, file), 'r') as f:

```

```

        label = f.readline().strip()
        label= int(label)
        labels.append(label)

    return images,labels

```

Importing the train and test files, accessing images with corresponding labels in X,y and XTest and yTest

```

[467]: X,y= import_selected_data('CV2023_CW_Dataset/train')
       XTest,yTest= import_selected_data('CV2023_CW_Dataset/test')

```

80, 20 percent split on training and test set

```

[99]: XTrain, XTest, yTrain, yTest = train_test_split(
      X, y, test_size=0.2, shuffle=True, stratify=y)

```

```

[100]: def imageResizing60(imageToResize):
       imageToResize = img_as_ubyte(resize(imageToResize, (60,60)))
       return imageToResize

```

```

[471]: Counter(y)

```

```

[471]: Counter({0: 376, 1: 1940, 2: 78})

```

0.1 SIFT

The process follows by giving random number of clusters and batch size, after the feature descriptors are extracted from the images

```

[407]: from skimage.transform import resize

       # Initiate SIFT detector
       sift = cv2.SIFT_create()
       def localizationFeatureExtractionSIFT(XTrain):

           # Create empty lists for feature descriptors and labels
           des_list = []
           y_train_list = []

           fig, ax = plot.subplots(1, 4, figsize=(9, 5), sharey=True)

           for i in range(len(XTrain)):

               # Identify keypoints and extract descriptors with SIFT

               imageProcessGray = img_as_ubyte(color.rgb2gray(XTrain[i]))

```

```

img_sharpened = img_as_ubyte(exposure.equalize_hist(imageProcessGray))
image_resized = imageResizing60(img_sharpened)

# Resize the image

kp, des = sift.detectAndCompute(image_resized, None)
# Show results for first 4 images
if i<4:
    img_with_SIFT = cv2.drawKeypoints(image_resized, kp, image_resized)
    ax[i].imshow(img_with_SIFT)
    ax[i].set_axis_off()

# Append list of descriptors and label to respective lists
if des is not None:
    des_list.append(des)
    y_train_list.append(yTrain[i])

plt.title('SIFT Feature localization Feature Extraction',loc='left',x=-2.
↪5,fontweight='bold', pad=20)

plot.show()

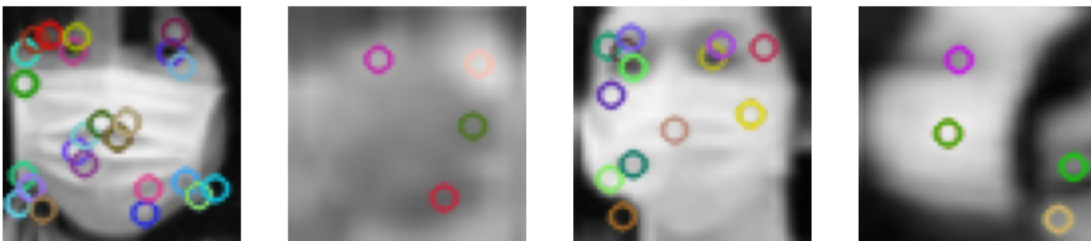
# Convert to array for easier handling
des_array = np.vstack(des_list)

return des_array, des_list, y_train_list

localFeatureExtractionSIFTArray, localFeatureExtractionSIFTList, yTrainList=↪
↪localizationFeatureExtractionSIFT(XTrain)

```

SIFT Feature localization Feature Extraction



HOCW (Histogram of Code Words) is applied to perform clustering by assigning each SIFT feature descriptor to the closest cluster centroid determined by K-means followed by counting the total number of feature descriptors as well

```
[472]: def findingOptimalKsAndBatchSize(k, bS):
    noOfks = len(np.unique(yTrain)) * k
    batchSize = localFeatureExtractionSIFTArray.shape[0] // bS
    kMeanAlg = MiniBatchKMeans(n_clusters=noOfks, batch_size=batchSize).
    fit(localFeatureExtractionSIFTArray)
    return noOfks, kMeanAlg

def histogramOfCodeWords(k, bS):
    # Convert descriptors into histograms of codewords for each image
    histList = []
    idx_list = []
    noOfKs, kMeanAlg = findingOptimalKsAndBatchSize(k, bS)
    for featureDescriptor in localFeatureExtractionSIFTList:
        hist = np.zeros(noOfKs)
        idx = kMeanAlg.predict(featureDescriptor)
        idx_list.append(idx)
        for j in idx:
            hist[j] = hist[j] + (1 / len(featureDescriptor))
        histList.append(hist)

    histArray = np.vstack(histList)
    return histArray

def testingSIFT(k, bS):
    histList = []
    noOfKs, kMeanAlg = findingOptimalKsAndBatchSize(k, bS)
    for i in range(len(XTest)):
        img = img_as_ubyte(color.rgb2gray(XTest[i]))
        kp, des = sift.detectAndCompute(img, None)

        if des is not None:
            hist = np.zeros(noOfKs)

            idx = kMeanAlg.predict(des)

            for j in idx:
                hist[j] = hist[j] + (1 / len(des))

            histList.append(hist)

        else:
            histList.append(None)
```

```
# Remove if there are no feature descriptors of an image
idx_not_empty = [i for i, x in enumerate(histList) if x is not None]
histList = [histList[i] for i in idx_not_empty]
ytestAll = [yTest[i] for i in idx_not_empty]
histArray = np.vstack(histList)

return histArray, ytestAll
```

Testing on 3 different no of K's and Batch size for Evaluation

```
[409]: hocWordsArray1=histogramOfCodeWords(10,6)
hocWordsArray2=histogramOfCodeWords(13,8)
hocWordsArray3=histogramOfCodeWords(17,10)
```

```
/usr/local/lib/python3.9/dist-packages/sklearn/cluster/_kmeans.py:870:
FutureWarning: The default value of `n_init` will change from 3 to 'auto' in
1.4. Set the value of `n_init` explicitly to suppress the warning
    warnings.warn(
/usr/local/lib/python3.9/dist-packages/sklearn/cluster/_kmeans.py:870:
FutureWarning: The default value of `n_init` will change from 3 to 'auto' in
1.4. Set the value of `n_init` explicitly to suppress the warning
    warnings.warn(
/usr/local/lib/python3.9/dist-packages/sklearn/cluster/_kmeans.py:870:
FutureWarning: The default value of `n_init` will change from 3 to 'auto' in
1.4. Set the value of `n_init` explicitly to suppress the warning
    warnings.warn(
```

In the pursuit of finding the optimal architecture, I started with training SVM, used 3 different model based on number of 3 different number of clusters and batch size to compare to an extent that the model can be selected.

SVM Model 1 Architecture

```
[211]: classifierSVM1 = SVC(kernel='poly', C=12, degree=3)

classifierSVM1.fit(hocWordsArray1, yTrainList)
```

```
[211]: SVC(C=12, kernel='poly')
```

SVM Model 2 Architecture

```
[212]: classifierSVM2 = SVC(kernel='poly', C=12, degree=3)
classifierSVM2.fit(hocWordsArray2, yTrainList)
```

```
[212]: SVC(C=12, kernel='poly')
```

SVM Model 3 Architecture

```
[266]: classifierSVM3 = SVC(kernel='poly', C=12, degree=3)
classifierSVM3.fit(hocWordsArray3, yTrainList)
```

```
[266]: SVC(C=12, kernel='poly')
```

```
[298]: hocWordsArrayTest1,ytestAll1=testingSIFT(10,6)

PredSIFTSVMMaskModel1 = classifierSVM1.predict(hocWordsArrayTest1).tolist()

print(f""""Classification report for classifier {classifierSVM1}:
      {metrics.classification_report(ytestAll1, PredSIFTSVMMaskModel1)}\n""")

accuracySVMModel1 = accuracy_score(ytestAll1, PredSIFTSVMMaskModel1)
print("Accuracy on test set:", accuracySVMModel1)
```

```
/usr/local/lib/python3.9/dist-packages/sklearn/cluster/_kmeans.py:870:
FutureWarning: The default value of `n_init` will change from 3 to 'auto' in
1.4. Set the value of `n_init` explicitly to suppress the warning
  warnings.warn(
```

```
Classification report for classifier SVC(C=12, kernel='poly'):
      precision    recall  f1-score   support
```

0	0.14	0.28	0.19	74
1	0.80	0.61	0.70	387
2	0.07	0.13	0.09	15
accuracy			0.55	476
macro avg	0.34	0.34	0.33	476
weighted avg	0.68	0.55	0.60	476

```
Accuracy on test set: 0.5483193277310925
```

```
[218]: hocWordsArrayTest2,ytestAll2=testingSIFT(13,8)

PredSIFTSVMMaskModel2 = classifierSVM2.predict(hocWordsArrayTest2).tolist()

print(f""""Classification report for classifier {classifierSVM2}:
      {metrics.classification_report(ytestAll2, PredSIFTSVMMaskModel2)}\n""")

accuracySVMModel2 = accuracy_score(ytestAll2, PredSIFTSVMMaskModel2)
print("Accuracy on test set:", accuracySVMModel2)
```

```
/usr/local/lib/python3.9/dist-packages/sklearn/cluster/_kmeans.py:870:
FutureWarning: The default value of `n_init` will change from 3 to 'auto' in
1.4. Set the value of `n_init` explicitly to suppress the warning
```

```
warnings.warn(
Classification report for classifier SVC(C=12, kernel='poly'):
      precision    recall  f1-score   support

     0       0.16      0.32      0.22        74
     1       0.82      0.63      0.72       387
     2       0.06      0.13      0.09        15

 accuracy          0.57        476
 macro avg       0.35      0.36      0.34        476
weighted avg       0.70      0.57      0.62        476
```

Accuracy on test set: 0.569327731092437

```
[272]: hocWordsArrayTest3,ytestAll3=testingSIFT(17,10)
PredSIFTSVMModel3 = classifierSVM3.predict(hocWordsArrayTest3).tolist()

print(f"""Classification report for classifier {classifierSVM3}:
      {metrics.classification_report(ytestAll3, PredSIFTSVMModel3)}\n""")

accuracySVMModel3 = accuracy_score(ytestAll3, PredSIFTSVMModel3)
print("Accuracy on test set:", accuracySVMModel3)
```

```
/usr/local/lib/python3.9/dist-packages/sklearn/cluster/_kmeans.py:870:
FutureWarning: The default value of `n_init` will change from 3 to 'auto' in
1.4. Set the value of `n_init` explicitly to suppress the warning
warnings.warn(
```

```
Classification report for classifier SVC(C=12, kernel='poly'):
      precision    recall  f1-score   support

     0       0.19      0.38      0.26        74
     1       0.83      0.67      0.74       387
     2       0.11      0.13      0.12        15

 accuracy          0.61        476
 macro avg       0.38      0.39      0.37        476
weighted avg       0.71      0.61      0.65        476
```

Accuracy on test set: 0.6092436974789915

Now it is quite evident that ClassifierSVM1 has outperformed other 2 classifier models such as by changing number of K's and Batch size, therefore we'll continue with ClassifierSVM1 to apply GridSearchCV to get optimal parameters

This code was inspired and developed based on the documentation on towardsdatascience website <https://towardsdatascience.com/multiclass-classification-with-support-vector-machines-svm-kernel-trick-kernel-functions-f9d5377d6f02>

Parameter Grid for hyper parameter Initialization is defined and will be an input to grid search cv to find the optimal hyper parameter in the process using 5 fold cross validation

```
[154]: paramGridSVM= {'C': [0.1, 1, 10,13,15], 'gamma': [0.1,0.3,0.5, 1, 10], 'kernel':  
    ↪ ['linear', 'rbf','poly']}  
  
classifierSVMFinalModel = SVC()  
  
gridSearchCVSVM = GridSearchCV(estimator=classifierSVMFinalModel, ↪  
    ↪ param_grid=paramGridSVM, cv=5)  
gridSearchCVSVM.fit(hocWordsArray1, yTrainList)
```

```
[154]: GridSearchCV(cv=5, estimator=SVC(),  
    param_grid={'C': [0.1, 1, 10, 13, 15],  
        'gamma': [0.1, 0.3, 0.5, 1, 10],  
        'kernel': ['linear', 'rbf', 'poly']})
```

Best Hyper Parameters found by the grid search cv

```
[159]: print("Best parameters:", gridSearchCVSVM.best_params_)  
  
predgridSearchCVSVM = gridSearchCVSVM.predict(hocWordsArrayTest1)  
accuracyGridSVM = accuracy_score(ytestAll1, predgridSearchCVSVM)  
print("Accuracy on test set:", accuracyGridSVM)
```

Best parameters: {'C': 1, 'gamma': 10, 'kernel': 'rbf'}
Accuracy on test set: 0.8067226890756303

Training our best SVM Model

```
[466]: t0 = time.time()  
  
classifierSVMFinalModel = SVC(kernel='rbf', C=1, gamma=10)  
  
classifierSVMFinalModel.fit(hocWordsArray1, yTrainList)  
  
print('Finished Training: total time in seconds =', time.time() - t0)
```

Finished Training: total time in seconds = 0.16905808448791504

The model trained on the best hyper parameter seems to be reduced in the evaluation metrics such as f1 score and macro average as well so well consider the SVM model 3

```
[242]: PredSIFTSVMModelFinal = classifierSVMFinalModel.predict(hocWordsArrayTest1).
        ↳tolist()

print(f"""\nClassification report for classifier {classifierSVMFinalModel}:
      {metrics.classification_report(ytestAll1,
        ↳PredSIFTSVMModelFinal)}\n""")
accuracyFinalSVMModel = accuracy_score(ytestAll1, PredSIFTSVMModelFinal)
print("\nAccuracy on test set:", accuracyFinalSVMModel)
```

Classification report for classifier SVC(C=1, gamma=10):

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.14	0.03	0.05	74
1	0.82	0.97	0.89	387
2	0.00	0.00	0.00	15
accuracy			0.80	476
macro avg	0.32	0.33	0.31	476
weighted avg	0.69	0.80	0.73	476

Accuracy on test set: 0.7962184873949579

/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.

_warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.

_warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.

_warn_prf(average, modifier, msg_start, len(result))

Saving Best SVM Model in the directory path

```
[306]: dump(classifierSVM3, os.path.join(GOOGLE_DRIVE_PATH, 'Models/'
        ↳bestSVMModelFinal.joblib'))
```

```
[306]: ['content/drive/MyDrive/ComputerVision/CVCourseWork_Mohsin/CW_Folder_PG/Models/
bestSVMMaskModelFinal.joblib']
```

0.2 Multilayer Perceptron(MLP)

This code was inspired and developed based on the documentation on scikit-learn website https://scikit-learn.org/stable/modules/generated/sklearn.neural_network.MLPClassifier.html

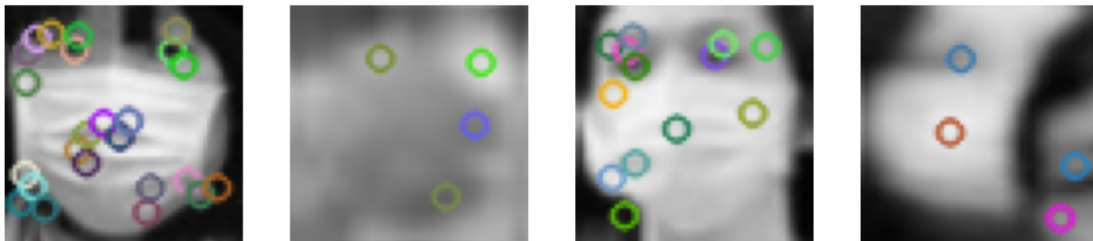
2 Architecture for MLP Classifier to experiment which model is better

```
[453]: localFeatureExtractionSIFTArray, localFeatureExtractionSIFTList, yTrainList=
↳ localizationFeatureExtractionSIFT(XTrain)

def NNMLPModelMaskWide(neuronNumber):
    NNMLPModel = MLPClassifier(hidden_layer_sizes=(neuronNumber[0]),
↳max_iter=100, alpha=0.01,
                                solver='adam', verbose=True, random_state=1, batch_size=
↳32,
                                learning_rate_init=0.01, early_stopping=True)
    return NNMLPModel

def NNMLPModelMaskInter(neuronNumber):
    NNMLPModel =
↳MLPClassifier(hidden_layer_sizes=(neuronNumber[0], neuronNumber[1]),
↳max_iter=100, alpha=0.01,
                                solver='adam', verbose=True, random_state=1, batch_size=
↳32,
                                learning_rate_init=0.01, early_stopping=True)
    return NNMLPModel
```

SIFT Feature localization Feature Extraction



```
[454]: NNMLPModel1=NNMLPModelMaskWide([48])
NNMLPModel2=NNMLPModelMaskInter([42,28])
```

```
[455]: NNMLPMaskModel1.fit(hocWordsArray3, yTrainList)
PredNNMLPMaskModelSift1 = NNMLPMaskModel1.predict(hocWordsArrayTest3).tolist()

print(f"""Classification report for classifier {NNMLPMaskModel1}:
      {metrics.classification_report(ytestAll1, PredNNMLPMaskModelSift1)}\n""")
```

```
Iteration 1, loss = 0.63348423
Validation score: 0.781250
Iteration 2, loss = 0.50775185
Validation score: 0.791667
Iteration 3, loss = 0.47806954
Validation score: 0.843750
Iteration 4, loss = 0.46683644
Validation score: 0.848958
Iteration 5, loss = 0.46850736
Validation score: 0.838542
Iteration 6, loss = 0.46172364
Validation score: 0.854167
Iteration 7, loss = 0.46435493
Validation score: 0.833333
Iteration 8, loss = 0.45838345
Validation score: 0.854167
Iteration 9, loss = 0.45582460
Validation score: 0.854167
Iteration 10, loss = 0.45578838
Validation score: 0.843750
Iteration 11, loss = 0.45551574
Validation score: 0.848958
Iteration 12, loss = 0.44581346
Validation score: 0.848958
Iteration 13, loss = 0.44660846
Validation score: 0.848958
Iteration 14, loss = 0.44777689
Validation score: 0.848958
Iteration 15, loss = 0.44529897
Validation score: 0.843750
Iteration 16, loss = 0.44710491
Validation score: 0.848958
Iteration 17, loss = 0.44171848
Validation score: 0.848958
Validation score did not improve more than tol=0.000100 for 10 consecutive
epochs. Stopping.
Classification report for classifier MLPClassifier(alpha=0.01, batch_size=32,
early_stopping=True,
            hidden_layer_sizes=(48,), learning_rate_init=0.01, max_iter=100,
            random_state=1, verbose=True):
```

	precision	recall	f1-score	support
0	0.14	0.14	0.14	74
1	0.81	0.84	0.83	387
2	0.00	0.00	0.00	15
accuracy			0.71	476
macro avg	0.32	0.33	0.32	476
weighted avg	0.68	0.71	0.69	476

```
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
```

```
_warn_prf(average, modifier, msg_start, len(result))
```

```
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
```

```
_warn_prf(average, modifier, msg_start, len(result))
```

```
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
```

```
_warn_prf(average, modifier, msg_start, len(result))
```

```
[456]: NNMLPMaskModel2.fit(hocWordsArray3, yTrainList)
PredNNMLPMaskModelSift2 = NNMLPMaskModel2.predict(hocWordsArrayTest3).tolist()

print(f"""Classification report for classifier {NNMLPMaskModel2}:
      {metrics.classification_report(ytestAll1, PredNNMLPMaskModelSift2)}\n""")
```

```
Iteration 1, loss = 0.60354685
Validation score: 0.807292
Iteration 2, loss = 0.51821792
Validation score: 0.807292
Iteration 3, loss = 0.47033723
Validation score: 0.807292
Iteration 4, loss = 0.45994600
Validation score: 0.781250
Iteration 5, loss = 0.45877227
Validation score: 0.812500
Iteration 6, loss = 0.44867124
Validation score: 0.828125
Iteration 7, loss = 0.44628549
```

```

Validation score: 0.817708
Iteration 8, loss = 0.44231880
Validation score: 0.817708
Iteration 9, loss = 0.44026864
Validation score: 0.807292
Iteration 10, loss = 0.43633113
Validation score: 0.817708
Iteration 11, loss = 0.43629255
Validation score: 0.828125
Iteration 12, loss = 0.43330771
Validation score: 0.822917
Iteration 13, loss = 0.43080839
Validation score: 0.828125
Iteration 14, loss = 0.43822384
Validation score: 0.817708
Iteration 15, loss = 0.43214565
Validation score: 0.828125
Iteration 16, loss = 0.42517846
Validation score: 0.802083
Iteration 17, loss = 0.43249567
Validation score: 0.791667
Validation score did not improve more than tol=0.000100 for 10 consecutive
epochs. Stopping.
Classification report for classifier MLPClassifier(alpha=0.01, batch_size=32,
early_stopping=True,
                hidden_layer_sizes=(42, 28), learning_rate_init=0.01,
                max_iter=100, random_state=1, verbose=True):

```

	precision	recall	f1-score	support
0	0.18	0.28	0.22	74
1	0.82	0.76	0.79	387
2	0.00	0.00	0.00	15
accuracy			0.66	476
macro avg	0.33	0.35	0.34	476
weighted avg	0.70	0.66	0.68	476

```

/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.

```

```

_warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.

```

```

_warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
_warn_prf(average, modifier, msg_start, len(result))

```

Parameter Grid given to grid search cv using 3 fold cross validation to search for the best hyper parameters

```

[460]: NNMLPModelFinal = MLPClassifier(hidden_layer_sizes=(52,), max_iter=100, alpha=0.
↪01,
                                solver='adam', verbose=True, random_state=1, batch_size=
↪32,
                                learning_rate_init=0.01, early_stopping=True)

param_grid = {
    'hidden_layer_sizes': [(40,30), (45,25), (50,20), (55,10)],
    'solver': ['adam', 'sgd'],
    'learning_rate_init': [0.1, 0.01, 0.001],
    'alpha': [0.01, 0.001, 0.001],
}

gridSearchCvMLP = GridSearchCV(NNMLPModelFinal, param_grid,
↪scoring='f1_weighted', cv=5, error_score='raise')
gridSearchCvMLP.fit(hocWordsArray3, yTrainList)

```

Streaming output truncated to the last 5000 lines.

```

Validation score: 0.856209
Iteration 18, loss = 0.40925484
Validation score: 0.849673
Iteration 19, loss = 0.41706560
Validation score: 0.869281
Validation score did not improve more than tol=0.000100 for 10 consecutive
epochs. Stopping.
Iteration 1, loss = 0.56684550
Validation score: 0.803922
Iteration 2, loss = 0.50179408
Validation score: 0.810458
Iteration 3, loss = 0.50448619
Validation score: 0.803922
Iteration 4, loss = 0.47758065
Validation score: 0.836601
Iteration 5, loss = 0.47568571
Validation score: 0.823529
Iteration 6, loss = 0.45461228
Validation score: 0.823529

```

Iteration 7, loss = 0.44870524
Validation score: 0.816993
Iteration 8, loss = 0.43691406
Validation score: 0.816993
Iteration 9, loss = 0.43984341
Validation score: 0.823529
Iteration 10, loss = 0.44803601
Validation score: 0.836601
Iteration 11, loss = 0.42309793
Validation score: 0.823529
Iteration 12, loss = 0.42871949
Validation score: 0.843137
Iteration 13, loss = 0.41118326
Validation score: 0.803922
Iteration 14, loss = 0.42394151
Validation score: 0.830065
Iteration 15, loss = 0.42741422
Validation score: 0.823529
Iteration 16, loss = 0.41706918
Validation score: 0.797386
Iteration 17, loss = 0.43576813
Validation score: 0.816993
Iteration 18, loss = 0.41991206
Validation score: 0.830065
Iteration 19, loss = 0.41801395
Validation score: 0.810458
Iteration 20, loss = 0.40843008
Validation score: 0.816993
Iteration 21, loss = 0.39381703
Validation score: 0.764706
Iteration 22, loss = 0.41531041
Validation score: 0.771242
Iteration 23, loss = 0.39386921
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.57955603
Validation score: 0.836601
Iteration 2, loss = 0.51918210
Validation score: 0.830065
Iteration 3, loss = 0.53395866
Validation score: 0.836601
Iteration 4, loss = 0.49612981
Validation score: 0.810458
Iteration 5, loss = 0.47126642
Validation score: 0.816993
Iteration 6, loss = 0.46086778
Validation score: 0.830065

Iteration 7, loss = 0.47312425
Validation score: 0.823529
Iteration 8, loss = 0.45838007
Validation score: 0.823529
Iteration 9, loss = 0.46576517
Validation score: 0.823529
Iteration 10, loss = 0.45502154
Validation score: 0.810458
Iteration 11, loss = 0.46384982
Validation score: 0.836601
Iteration 12, loss = 0.48086152
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.57424598
Validation score: 0.790850
Iteration 2, loss = 0.50784023
Validation score: 0.790850
Iteration 3, loss = 0.48566956
Validation score: 0.810458
Iteration 4, loss = 0.54375539
Validation score: 0.790850
Iteration 5, loss = 0.48600461
Validation score: 0.810458
Iteration 6, loss = 0.47078762
Validation score: 0.823529
Iteration 7, loss = 0.49577610
Validation score: 0.803922
Iteration 8, loss = 0.48091941
Validation score: 0.816993
Iteration 9, loss = 0.50213723
Validation score: 0.797386
Iteration 10, loss = 0.47483787
Validation score: 0.816993
Iteration 11, loss = 0.46483884
Validation score: 0.816993
Iteration 12, loss = 0.46355006
Validation score: 0.823529
Iteration 13, loss = 0.44747828
Validation score: 0.823529
Iteration 14, loss = 0.45455919
Validation score: 0.810458
Iteration 15, loss = 0.48605759
Validation score: 0.810458
Iteration 16, loss = 0.45104192
Validation score: 0.810458
Iteration 17, loss = 0.45828131
Validation score: 0.797386

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.56644376
Validation score: 0.758170
Iteration 2, loss = 0.47155969
Validation score: 0.764706
Iteration 3, loss = 0.48502724
Validation score: 0.777778
Iteration 4, loss = 0.49694063
Validation score: 0.764706
Iteration 5, loss = 0.44358642
Validation score: 0.764706
Iteration 6, loss = 0.44685810
Validation score: 0.771242
Iteration 7, loss = 0.45641331
Validation score: 0.764706
Iteration 8, loss = 0.43439181
Validation score: 0.771242
Iteration 9, loss = 0.47547780
Validation score: 0.771242
Iteration 10, loss = 0.43096318
Validation score: 0.764706
Iteration 11, loss = 0.44138396
Validation score: 0.764706
Iteration 12, loss = 0.43219127
Validation score: 0.764706
Iteration 13, loss = 0.43695118
Validation score: 0.771242
Iteration 14, loss = 0.42413464
Validation score: 0.758170

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.62006005
Validation score: 0.836601
Iteration 2, loss = 0.57805718
Validation score: 0.836601
Iteration 3, loss = 0.57164100
Validation score: 0.836601
Iteration 4, loss = 0.55230658
Validation score: 0.836601
Iteration 5, loss = 0.51413373
Validation score: 0.830065
Iteration 6, loss = 0.48674967
Validation score: 0.843137
Iteration 7, loss = 0.47403455
Validation score: 0.836601
Iteration 8, loss = 0.48059282
Validation score: 0.843137

Iteration 9, loss = 0.46753629
Validation score: 0.843137
Iteration 10, loss = 0.45287601
Validation score: 0.849673
Iteration 11, loss = 0.45142507
Validation score: 0.862745
Iteration 12, loss = 0.44856956
Validation score: 0.856209
Iteration 13, loss = 0.45384452
Validation score: 0.856209
Iteration 14, loss = 0.45256651
Validation score: 0.849673
Iteration 15, loss = 0.44554705
Validation score: 0.856209
Iteration 16, loss = 0.44432853
Validation score: 0.849673
Iteration 17, loss = 0.44648725
Validation score: 0.843137
Iteration 18, loss = 0.43825510
Validation score: 0.849673
Iteration 19, loss = 0.44518005
Validation score: 0.843137
Iteration 20, loss = 0.43371979
Validation score: 0.849673
Iteration 21, loss = 0.42550571
Validation score: 0.862745
Iteration 22, loss = 0.43193970
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.61610156
Validation score: 0.803922
Iteration 2, loss = 0.56770554
Validation score: 0.803922
Iteration 3, loss = 0.56045306
Validation score: 0.803922
Iteration 4, loss = 0.52688227
Validation score: 0.803922
Iteration 5, loss = 0.49930878
Validation score: 0.810458
Iteration 6, loss = 0.47853583
Validation score: 0.803922
Iteration 7, loss = 0.47223344
Validation score: 0.810458
Iteration 8, loss = 0.46712473
Validation score: 0.803922
Iteration 9, loss = 0.45923739
Validation score: 0.790850

Iteration 10, loss = 0.45069500
Validation score: 0.816993
Iteration 11, loss = 0.46041012
Validation score: 0.810458
Iteration 12, loss = 0.44604672
Validation score: 0.810458
Iteration 13, loss = 0.44569889
Validation score: 0.803922
Iteration 14, loss = 0.45577882
Validation score: 0.797386
Iteration 15, loss = 0.44898545
Validation score: 0.784314
Iteration 16, loss = 0.44717339
Validation score: 0.823529
Iteration 17, loss = 0.45484595
Validation score: 0.816993
Iteration 18, loss = 0.44440995
Validation score: 0.803922
Iteration 19, loss = 0.43734526
Validation score: 0.816993
Iteration 20, loss = 0.43679343
Validation score: 0.816993
Iteration 21, loss = 0.44260185
Validation score: 0.816993
Iteration 22, loss = 0.43355487
Validation score: 0.816993
Iteration 23, loss = 0.43736354
Validation score: 0.797386
Iteration 24, loss = 0.43614912
Validation score: 0.823529
Iteration 25, loss = 0.43657313
Validation score: 0.810458
Iteration 26, loss = 0.43551947
Validation score: 0.823529
Iteration 27, loss = 0.42804742
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.61689196
Validation score: 0.836601
Iteration 2, loss = 0.57789425
Validation score: 0.836601
Iteration 3, loss = 0.57452997
Validation score: 0.836601
Iteration 4, loss = 0.56577026
Validation score: 0.836601
Iteration 5, loss = 0.55123487
Validation score: 0.836601

Iteration 6, loss = 0.51418067
Validation score: 0.241830
Iteration 7, loss = 0.52313634
Validation score: 0.836601
Iteration 8, loss = 0.48765198
Validation score: 0.111111
Iteration 9, loss = 0.67276206
Validation score: 0.836601
Iteration 10, loss = 0.57461250
Validation score: 0.836601
Iteration 11, loss = 0.57028934
Validation score: 0.836601
Iteration 12, loss = 0.56191010
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.60996294
Validation score: 0.790850
Iteration 2, loss = 0.56887701
Validation score: 0.790850
Iteration 3, loss = 0.56365030
Validation score: 0.790850
Iteration 4, loss = 0.55766548
Validation score: 0.790850
Iteration 5, loss = 0.52806971
Validation score: 0.790850
Iteration 6, loss = 0.48895009
Validation score: 0.666667
Iteration 7, loss = 0.48838981
Validation score: 0.790850
Iteration 8, loss = 0.47035506
Validation score: 0.163399
Iteration 9, loss = 0.67702533
Validation score: 0.790850
Iteration 10, loss = 0.57141446
Validation score: 0.790850
Iteration 11, loss = 0.57146866
Validation score: 0.790850
Iteration 12, loss = 0.57083970
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.60891624
Validation score: 0.758170
Iteration 2, loss = 0.55867142
Validation score: 0.758170
Iteration 3, loss = 0.55616347
Validation score: 0.758170

Iteration 4, loss = 0.55763830
Validation score: 0.758170
Iteration 5, loss = 0.51982969
Validation score: 0.758170
Iteration 6, loss = 0.47911397
Validation score: 0.490196
Iteration 7, loss = 0.48233439
Validation score: 0.758170
Iteration 8, loss = 0.47079375
Validation score: 0.196078
Iteration 9, loss = 0.64034623
Validation score: 0.758170
Iteration 10, loss = 0.51522854
Validation score: 0.758170
Iteration 11, loss = 0.47288973
Validation score: 0.758170
Iteration 12, loss = 0.46487976
Validation score: 0.758170
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.66599618
Validation score: 0.836601
Iteration 2, loss = 0.51878657
Validation score: 0.843137
Iteration 3, loss = 0.48005595
Validation score: 0.856209
Iteration 4, loss = 0.46683547
Validation score: 0.849673
Iteration 5, loss = 0.45283498
Validation score: 0.849673
Iteration 6, loss = 0.44928849
Validation score: 0.856209
Iteration 7, loss = 0.44174110
Validation score: 0.875817
Iteration 8, loss = 0.44133051
Validation score: 0.869281
Iteration 9, loss = 0.42792477
Validation score: 0.869281
Iteration 10, loss = 0.41808366
Validation score: 0.862745
Iteration 11, loss = 0.40466548
Validation score: 0.869281
Iteration 12, loss = 0.39979491
Validation score: 0.869281
Iteration 13, loss = 0.38941484
Validation score: 0.862745
Iteration 14, loss = 0.37992570
Validation score: 0.882353

Iteration 15, loss = 0.36804608
Validation score: 0.849673
Iteration 16, loss = 0.36380537
Validation score: 0.882353
Iteration 17, loss = 0.34762727
Validation score: 0.843137
Iteration 18, loss = 0.34547669
Validation score: 0.843137
Iteration 19, loss = 0.31966780
Validation score: 0.849673
Iteration 20, loss = 0.31151394
Validation score: 0.849673
Iteration 21, loss = 0.29493703
Validation score: 0.843137
Iteration 22, loss = 0.30956694
Validation score: 0.856209
Iteration 23, loss = 0.28755423
Validation score: 0.816993
Iteration 24, loss = 0.27129237
Validation score: 0.862745
Iteration 25, loss = 0.25505541
Validation score: 0.830065
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.66216302
Validation score: 0.803922
Iteration 2, loss = 0.51827985
Validation score: 0.803922
Iteration 3, loss = 0.47620806
Validation score: 0.790850
Iteration 4, loss = 0.45798809
Validation score: 0.803922
Iteration 5, loss = 0.45319269
Validation score: 0.823529
Iteration 6, loss = 0.44071207
Validation score: 0.816993
Iteration 7, loss = 0.43707814
Validation score: 0.816993
Iteration 8, loss = 0.42787343
Validation score: 0.810458
Iteration 9, loss = 0.42613168
Validation score: 0.810458
Iteration 10, loss = 0.42291783
Validation score: 0.810458
Iteration 11, loss = 0.41514347
Validation score: 0.816993
Iteration 12, loss = 0.40528791
Validation score: 0.810458

Iteration 13, loss = 0.39987764
Validation score: 0.836601
Iteration 14, loss = 0.38724777
Validation score: 0.810458
Iteration 15, loss = 0.38180148
Validation score: 0.803922
Iteration 16, loss = 0.37538657
Validation score: 0.823529
Iteration 17, loss = 0.36803953
Validation score: 0.810458
Iteration 18, loss = 0.35453877
Validation score: 0.816993
Iteration 19, loss = 0.33175384
Validation score: 0.797386
Iteration 20, loss = 0.32313874
Validation score: 0.810458
Iteration 21, loss = 0.30524763
Validation score: 0.784314
Iteration 22, loss = 0.31817745
Validation score: 0.823529
Iteration 23, loss = 0.28012589
Validation score: 0.810458
Iteration 24, loss = 0.28148293
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.63916159
Validation score: 0.836601
Iteration 2, loss = 0.52488683
Validation score: 0.836601
Iteration 3, loss = 0.48225766
Validation score: 0.823529
Iteration 4, loss = 0.45831169
Validation score: 0.830065
Iteration 5, loss = 0.44852755
Validation score: 0.830065
Iteration 6, loss = 0.44148949
Validation score: 0.830065
Iteration 7, loss = 0.44444738
Validation score: 0.803922
Iteration 8, loss = 0.43811299
Validation score: 0.830065
Iteration 9, loss = 0.44101681
Validation score: 0.790850
Iteration 10, loss = 0.43425848
Validation score: 0.823529
Iteration 11, loss = 0.43119935
Validation score: 0.830065

Iteration 12, loss = 0.43384729
Validation score: 0.830065
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.63587820
Validation score: 0.790850
Iteration 2, loss = 0.52159614
Validation score: 0.790850
Iteration 3, loss = 0.47154446
Validation score: 0.797386
Iteration 4, loss = 0.45139157
Validation score: 0.803922
Iteration 5, loss = 0.44158655
Validation score: 0.810458
Iteration 6, loss = 0.43497630
Validation score: 0.803922
Iteration 7, loss = 0.43377723
Validation score: 0.810458
Iteration 8, loss = 0.42646710
Validation score: 0.803922
Iteration 9, loss = 0.43235378
Validation score: 0.810458
Iteration 10, loss = 0.42729812
Validation score: 0.803922
Iteration 11, loss = 0.41989130
Validation score: 0.810458
Iteration 12, loss = 0.41801135
Validation score: 0.797386
Iteration 13, loss = 0.40653417
Validation score: 0.790850
Iteration 14, loss = 0.40003967
Validation score: 0.784314
Iteration 15, loss = 0.44732813
Validation score: 0.790850
Iteration 16, loss = 0.41429153
Validation score: 0.816993
Iteration 17, loss = 0.40248420
Validation score: 0.790850
Iteration 18, loss = 0.38793591
Validation score: 0.790850
Iteration 19, loss = 0.41619218
Validation score: 0.790850
Iteration 20, loss = 0.37549173
Validation score: 0.784314
Iteration 21, loss = 0.36852391
Validation score: 0.797386
Iteration 22, loss = 0.36636167
Validation score: 0.810458

Iteration 23, loss = 0.35301317
Validation score: 0.797386
Iteration 24, loss = 0.34105142
Validation score: 0.790850
Iteration 25, loss = 0.37754960
Validation score: 0.803922
Iteration 26, loss = 0.34257234
Validation score: 0.797386
Iteration 27, loss = 0.33596862
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.66186343
Validation score: 0.758170
Iteration 2, loss = 0.50513926
Validation score: 0.758170
Iteration 3, loss = 0.46176371
Validation score: 0.764706
Iteration 4, loss = 0.44301782
Validation score: 0.771242
Iteration 5, loss = 0.42640397
Validation score: 0.764706
Iteration 6, loss = 0.41857422
Validation score: 0.771242
Iteration 7, loss = 0.41400695
Validation score: 0.777778
Iteration 8, loss = 0.40703360
Validation score: 0.784314
Iteration 9, loss = 0.41529982
Validation score: 0.784314
Iteration 10, loss = 0.39551694
Validation score: 0.771242
Iteration 11, loss = 0.39464785
Validation score: 0.771242
Iteration 12, loss = 0.37786000
Validation score: 0.764706
Iteration 13, loss = 0.36521580
Validation score: 0.764706
Iteration 14, loss = 0.35116220
Validation score: 0.764706
Iteration 15, loss = 0.37214613
Validation score: 0.751634
Iteration 16, loss = 0.33868889
Validation score: 0.751634
Iteration 17, loss = 0.32173373
Validation score: 0.764706
Iteration 18, loss = 0.30789925
Validation score: 0.764706

Iteration 19, loss = 0.32585539
Validation score: 0.738562
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.73629685
Validation score: 0.836601
Iteration 2, loss = 0.58399147
Validation score: 0.836601
Iteration 3, loss = 0.57674665
Validation score: 0.836601
Iteration 4, loss = 0.57664230
Validation score: 0.836601
Iteration 5, loss = 0.57544496
Validation score: 0.836601
Iteration 6, loss = 0.57492000
Validation score: 0.836601
Iteration 7, loss = 0.57540535
Validation score: 0.836601
Iteration 8, loss = 0.57449632
Validation score: 0.836601
Iteration 9, loss = 0.57451563
Validation score: 0.836601
Iteration 10, loss = 0.57250758
Validation score: 0.836601
Iteration 11, loss = 0.57145497
Validation score: 0.836601
Iteration 12, loss = 0.57185658
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.73241645
Validation score: 0.803922
Iteration 2, loss = 0.57501513
Validation score: 0.803922
Iteration 3, loss = 0.56911562
Validation score: 0.803922
Iteration 4, loss = 0.56830026
Validation score: 0.803922
Iteration 5, loss = 0.56781720
Validation score: 0.803922
Iteration 6, loss = 0.56728078
Validation score: 0.803922
Iteration 7, loss = 0.56715055
Validation score: 0.803922
Iteration 8, loss = 0.56667094
Validation score: 0.803922
Iteration 9, loss = 0.56557948
Validation score: 0.803922

Iteration 10, loss = 0.56497957
Validation score: 0.803922
Iteration 11, loss = 0.56413505
Validation score: 0.803922
Iteration 12, loss = 0.56388640
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.73576650
Validation score: 0.836601
Iteration 2, loss = 0.58178177
Validation score: 0.836601
Iteration 3, loss = 0.57460565
Validation score: 0.836601
Iteration 4, loss = 0.57475456
Validation score: 0.836601
Iteration 5, loss = 0.57260258
Validation score: 0.836601
Iteration 6, loss = 0.57129322
Validation score: 0.836601
Iteration 7, loss = 0.57287110
Validation score: 0.836601
Iteration 8, loss = 0.57116935
Validation score: 0.836601
Iteration 9, loss = 0.57308715
Validation score: 0.836601
Iteration 10, loss = 0.56927578
Validation score: 0.836601
Iteration 11, loss = 0.56962561
Validation score: 0.836601
Iteration 12, loss = 0.56787452
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.73219744
Validation score: 0.790850
Iteration 2, loss = 0.57720742
Validation score: 0.790850
Iteration 3, loss = 0.56876437
Validation score: 0.790850
Iteration 4, loss = 0.56858930
Validation score: 0.790850
Iteration 5, loss = 0.56653268
Validation score: 0.790850
Iteration 6, loss = 0.56539779
Validation score: 0.790850
Iteration 7, loss = 0.56570315
Validation score: 0.790850

Iteration 8, loss = 0.56558286
Validation score: 0.790850
Iteration 9, loss = 0.56655987
Validation score: 0.790850
Iteration 10, loss = 0.56375138
Validation score: 0.790850
Iteration 11, loss = 0.56248627
Validation score: 0.790850
Iteration 12, loss = 0.56087862
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.72984088
Validation score: 0.758170
Iteration 2, loss = 0.56762650
Validation score: 0.758170
Iteration 3, loss = 0.55950657
Validation score: 0.758170
Iteration 4, loss = 0.55930558
Validation score: 0.758170
Iteration 5, loss = 0.55785218
Validation score: 0.758170
Iteration 6, loss = 0.55723685
Validation score: 0.758170
Iteration 7, loss = 0.55756253
Validation score: 0.758170
Iteration 8, loss = 0.55643267
Validation score: 0.758170
Iteration 9, loss = 0.55776443
Validation score: 0.758170
Iteration 10, loss = 0.55490190
Validation score: 0.758170
Iteration 11, loss = 0.55276412
Validation score: 0.758170
Iteration 12, loss = 0.55184761
Validation score: 0.758170
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.00328556
Validation score: 0.836601
Iteration 2, loss = 0.72911738
Validation score: 0.836601
Iteration 3, loss = 0.58420414
Validation score: 0.836601
Iteration 4, loss = 0.56400580
Validation score: 0.836601
Iteration 5, loss = 0.55312787
Validation score: 0.836601

Iteration 6, loss = 0.54418661
Validation score: 0.836601
Iteration 7, loss = 0.53374894
Validation score: 0.836601
Iteration 8, loss = 0.52178776
Validation score: 0.836601
Iteration 9, loss = 0.50691142
Validation score: 0.836601
Iteration 10, loss = 0.49182116
Validation score: 0.843137
Iteration 11, loss = 0.47905765
Validation score: 0.849673
Iteration 12, loss = 0.46820291
Validation score: 0.843137
Iteration 13, loss = 0.46001949
Validation score: 0.843137
Iteration 14, loss = 0.45304816
Validation score: 0.843137
Iteration 15, loss = 0.44891467
Validation score: 0.836601
Iteration 16, loss = 0.44683168
Validation score: 0.843137
Iteration 17, loss = 0.44390790
Validation score: 0.843137
Iteration 18, loss = 0.44050242
Validation score: 0.849673
Iteration 19, loss = 0.43973108
Validation score: 0.849673
Iteration 20, loss = 0.44017285
Validation score: 0.849673
Iteration 21, loss = 0.43364756
Validation score: 0.849673
Iteration 22, loss = 0.43465988
Validation score: 0.849673
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.00765884
Validation score: 0.803922
Iteration 2, loss = 0.73717369
Validation score: 0.803922
Iteration 3, loss = 0.57970662
Validation score: 0.803922
Iteration 4, loss = 0.55828851
Validation score: 0.803922
Iteration 5, loss = 0.54774483
Validation score: 0.803922
Iteration 6, loss = 0.53941248
Validation score: 0.803922

Iteration 7, loss = 0.53001416
Validation score: 0.803922
Iteration 8, loss = 0.52023498
Validation score: 0.803922
Iteration 9, loss = 0.50894379
Validation score: 0.803922
Iteration 10, loss = 0.49765239
Validation score: 0.803922
Iteration 11, loss = 0.48729980
Validation score: 0.803922
Iteration 12, loss = 0.47899924
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.99580213
Validation score: 0.836601
Iteration 2, loss = 0.71455390
Validation score: 0.836601
Iteration 3, loss = 0.58294656
Validation score: 0.836601
Iteration 4, loss = 0.56586018
Validation score: 0.836601
Iteration 5, loss = 0.55661832
Validation score: 0.836601
Iteration 6, loss = 0.54898396
Validation score: 0.836601
Iteration 7, loss = 0.54179998
Validation score: 0.836601
Iteration 8, loss = 0.53435801
Validation score: 0.836601
Iteration 9, loss = 0.52656209
Validation score: 0.836601
Iteration 10, loss = 0.51595885
Validation score: 0.836601
Iteration 11, loss = 0.50750917
Validation score: 0.836601
Iteration 12, loss = 0.49595274
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.99766155
Validation score: 0.790850
Iteration 2, loss = 0.71904418
Validation score: 0.790850
Iteration 3, loss = 0.57796738
Validation score: 0.790850
Iteration 4, loss = 0.55812455
Validation score: 0.790850

Iteration 5, loss = 0.54813239
Validation score: 0.790850
Iteration 6, loss = 0.54016860
Validation score: 0.790850
Iteration 7, loss = 0.53169111
Validation score: 0.790850
Iteration 8, loss = 0.52324752
Validation score: 0.790850
Iteration 9, loss = 0.51393728
Validation score: 0.790850
Iteration 10, loss = 0.50311886
Validation score: 0.790850
Iteration 11, loss = 0.49326826
Validation score: 0.790850
Iteration 12, loss = 0.48420707
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.00358369
Validation score: 0.758170
Iteration 2, loss = 0.71910073
Validation score: 0.758170
Iteration 3, loss = 0.56921297
Validation score: 0.758170
Iteration 4, loss = 0.54961084
Validation score: 0.758170
Iteration 5, loss = 0.53985159
Validation score: 0.758170
Iteration 6, loss = 0.53132062
Validation score: 0.758170
Iteration 7, loss = 0.52255562
Validation score: 0.758170
Iteration 8, loss = 0.51448373
Validation score: 0.758170
Iteration 9, loss = 0.50479447
Validation score: 0.758170
Iteration 10, loss = 0.49335317
Validation score: 0.758170
Iteration 11, loss = 0.48159745
Validation score: 0.758170
Iteration 12, loss = 0.47214755
Validation score: 0.758170
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.02274595
Validation score: 0.836601
Iteration 2, loss = 0.84063863
Validation score: 0.836601

Iteration 3, loss = 0.73371049
Validation score: 0.836601
Iteration 4, loss = 0.67101014
Validation score: 0.836601
Iteration 5, loss = 0.63453713
Validation score: 0.836601
Iteration 6, loss = 0.61395146
Validation score: 0.836601
Iteration 7, loss = 0.60261346
Validation score: 0.836601
Iteration 8, loss = 0.59548825
Validation score: 0.836601
Iteration 9, loss = 0.59108022
Validation score: 0.836601
Iteration 10, loss = 0.58774926
Validation score: 0.836601
Iteration 11, loss = 0.58530345
Validation score: 0.836601
Iteration 12, loss = 0.58349338
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.02194713
Validation score: 0.803922
Iteration 2, loss = 0.83715275
Validation score: 0.803922
Iteration 3, loss = 0.72821277
Validation score: 0.803922
Iteration 4, loss = 0.66440691
Validation score: 0.803922
Iteration 5, loss = 0.62762429
Validation score: 0.803922
Iteration 6, loss = 0.60661561
Validation score: 0.803922
Iteration 7, loss = 0.59515430
Validation score: 0.803922
Iteration 8, loss = 0.58794654
Validation score: 0.803922
Iteration 9, loss = 0.58357057
Validation score: 0.803922
Iteration 10, loss = 0.58007730
Validation score: 0.803922
Iteration 11, loss = 0.57767172
Validation score: 0.803922
Iteration 12, loss = 0.57585161
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 1.02229043
Validation score: 0.836601
Iteration 2, loss = 0.83585385
Validation score: 0.836601
Iteration 3, loss = 0.72781552
Validation score: 0.836601
Iteration 4, loss = 0.66831796
Validation score: 0.836601
Iteration 5, loss = 0.63142625
Validation score: 0.836601
Iteration 6, loss = 0.61054074
Validation score: 0.836601
Iteration 7, loss = 0.59983901
Validation score: 0.836601
Iteration 8, loss = 0.59232541
Validation score: 0.836601
Iteration 9, loss = 0.58765998
Validation score: 0.836601
Iteration 10, loss = 0.58379358
Validation score: 0.836601
Iteration 11, loss = 0.58108227
Validation score: 0.836601
Iteration 12, loss = 0.57887956
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.02146054
Validation score: 0.790850
Iteration 2, loss = 0.83066053
Validation score: 0.790850
Iteration 3, loss = 0.72124998
Validation score: 0.790850
Iteration 4, loss = 0.66114596
Validation score: 0.790850
Iteration 5, loss = 0.62391912
Validation score: 0.790850
Iteration 6, loss = 0.60311460
Validation score: 0.790850
Iteration 7, loss = 0.59280884
Validation score: 0.790850
Iteration 8, loss = 0.58570034
Validation score: 0.790850
Iteration 9, loss = 0.58134232
Validation score: 0.790850
Iteration 10, loss = 0.57781913
Validation score: 0.790850
Iteration 11, loss = 0.57529921
Validation score: 0.790850

Iteration 12, loss = 0.57350560
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 1.02005541
Validation score: 0.758170
Iteration 2, loss = 0.82666712
Validation score: 0.758170
Iteration 3, loss = 0.71529314
Validation score: 0.758170
Iteration 4, loss = 0.65413482
Validation score: 0.758170
Iteration 5, loss = 0.61634012
Validation score: 0.758170
Iteration 6, loss = 0.59522796
Validation score: 0.758170
Iteration 7, loss = 0.58457480
Validation score: 0.758170
Iteration 8, loss = 0.57730855
Validation score: 0.758170
Iteration 9, loss = 0.57277347
Validation score: 0.758170
Iteration 10, loss = 0.56926570
Validation score: 0.758170
Iteration 11, loss = 0.56658915
Validation score: 0.758170
Iteration 12, loss = 0.56475487
Validation score: 0.758170
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.55501555
Validation score: 0.810458
Iteration 2, loss = 0.50309207
Validation score: 0.790850
Iteration 3, loss = 0.47130807
Validation score: 0.810458
Iteration 4, loss = 0.47630495
Validation score: 0.810458
Iteration 5, loss = 0.44401776
Validation score: 0.810458
Iteration 6, loss = 0.45123794
Validation score: 0.777778
Iteration 7, loss = 0.46506383
Validation score: 0.803922
Iteration 8, loss = 0.42873828
Validation score: 0.803922
Iteration 9, loss = 0.42065198
Validation score: 0.797386

Iteration 10, loss = 0.43924083
Validation score: 0.784314
Iteration 11, loss = 0.42906618
Validation score: 0.803922
Iteration 12, loss = 0.44118521
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.57992591
Validation score: 0.764706
Iteration 2, loss = 0.49982190
Validation score: 0.764706
Iteration 3, loss = 0.48419070
Validation score: 0.790850
Iteration 4, loss = 0.48201766
Validation score: 0.784314
Iteration 5, loss = 0.47536480
Validation score: 0.764706
Iteration 6, loss = 0.47596253
Validation score: 0.771242
Iteration 7, loss = 0.45786548
Validation score: 0.784314
Iteration 8, loss = 0.42613243
Validation score: 0.803922
Iteration 9, loss = 0.42313298
Validation score: 0.790850
Iteration 10, loss = 0.42917282
Validation score: 0.777778
Iteration 11, loss = 0.42018457
Validation score: 0.777778
Iteration 12, loss = 0.41472293
Validation score: 0.777778
Iteration 13, loss = 0.42353834
Validation score: 0.764706
Iteration 14, loss = 0.42415741
Validation score: 0.790850
Iteration 15, loss = 0.40451322
Validation score: 0.758170
Iteration 16, loss = 0.41662582
Validation score: 0.790850
Iteration 17, loss = 0.39657004
Validation score: 0.764706
Iteration 18, loss = 0.41016092
Validation score: 0.732026
Iteration 19, loss = 0.42585724
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.59588614
Validation score: 0.784314
Iteration 2, loss = 0.50935059
Validation score: 0.810458
Iteration 3, loss = 0.47461462
Validation score: 0.849673
Iteration 4, loss = 0.47288850
Validation score: 0.823529
Iteration 5, loss = 0.46231154
Validation score: 0.836601
Iteration 6, loss = 0.49063643
Validation score: 0.784314
Iteration 7, loss = 0.49257571
Validation score: 0.816993
Iteration 8, loss = 0.46274685
Validation score: 0.823529
Iteration 9, loss = 0.46554840
Validation score: 0.810458
Iteration 10, loss = 0.46531737
Validation score: 0.810458
Iteration 11, loss = 0.45228552
Validation score: 0.784314
Iteration 12, loss = 0.46820818
Validation score: 0.823529
Iteration 13, loss = 0.44582993
Validation score: 0.816993
Iteration 14, loss = 0.44110974
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.58478942
Validation score: 0.797386
Iteration 2, loss = 0.51020676
Validation score: 0.836601
Iteration 3, loss = 0.48306669
Validation score: 0.816993
Iteration 4, loss = 0.46825577
Validation score: 0.823529
Iteration 5, loss = 0.45186187
Validation score: 0.849673
Iteration 6, loss = 0.45823523
Validation score: 0.849673
Iteration 7, loss = 0.45497067
Validation score: 0.830065
Iteration 8, loss = 0.44629900
Validation score: 0.830065
Iteration 9, loss = 0.43828435
Validation score: 0.849673

Iteration 10, loss = 0.44495006
Validation score: 0.823529
Iteration 11, loss = 0.46022001
Validation score: 0.803922
Iteration 12, loss = 0.44432248
Validation score: 0.823529
Iteration 13, loss = 0.43636882
Validation score: 0.810458
Iteration 14, loss = 0.44330819
Validation score: 0.823529
Iteration 15, loss = 0.46324789
Validation score: 0.823529
Iteration 16, loss = 0.45634875
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.56874792
Validation score: 0.745098
Iteration 2, loss = 0.51442505
Validation score: 0.830065
Iteration 3, loss = 0.49325974
Validation score: 0.810458
Iteration 4, loss = 0.49721644
Validation score: 0.830065
Iteration 5, loss = 0.45958856
Validation score: 0.836601
Iteration 6, loss = 0.47856036
Validation score: 0.836601
Iteration 7, loss = 0.46235754
Validation score: 0.830065
Iteration 8, loss = 0.47466257
Validation score: 0.830065
Iteration 9, loss = 0.46007383
Validation score: 0.823529
Iteration 10, loss = 0.45110028
Validation score: 0.816993
Iteration 11, loss = 0.48339620
Validation score: 0.823529
Iteration 12, loss = 0.49986838
Validation score: 0.816993
Iteration 13, loss = 0.46268093
Validation score: 0.803922
Iteration 14, loss = 0.44946277
Validation score: 0.810458
Iteration 15, loss = 0.46092049
Validation score: 0.810458
Iteration 16, loss = 0.49559620
Validation score: 0.830065

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.60597193
Validation score: 0.771242
Iteration 2, loss = 0.56374352
Validation score: 0.771242
Iteration 3, loss = 0.53730194
Validation score: 0.771242
Iteration 4, loss = 0.50204300
Validation score: 0.784314
Iteration 5, loss = 0.47823951
Validation score: 0.810458
Iteration 6, loss = 0.46054880
Validation score: 0.777778
Iteration 7, loss = 0.45906351
Validation score: 0.816993
Iteration 8, loss = 0.46131962
Validation score: 0.784314
Iteration 9, loss = 0.45049367
Validation score: 0.784314
Iteration 10, loss = 0.44917453
Validation score: 0.816993
Iteration 11, loss = 0.44414413
Validation score: 0.797386
Iteration 12, loss = 0.44783773
Validation score: 0.816993
Iteration 13, loss = 0.43967376
Validation score: 0.797386
Iteration 14, loss = 0.44068170
Validation score: 0.816993
Iteration 15, loss = 0.43834107
Validation score: 0.816993
Iteration 16, loss = 0.42960632
Validation score: 0.810458
Iteration 17, loss = 0.43532842
Validation score: 0.816993
Iteration 18, loss = 0.42923664
Validation score: 0.816993

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.60753053
Validation score: 0.764706
Iteration 2, loss = 0.56226202
Validation score: 0.764706
Iteration 3, loss = 0.54856581
Validation score: 0.764706
Iteration 4, loss = 0.51494067
Validation score: 0.764706

Iteration 5, loss = 0.47815946
Validation score: 0.771242
Iteration 6, loss = 0.46911668
Validation score: 0.790850
Iteration 7, loss = 0.47280943
Validation score: 0.745098
Iteration 8, loss = 0.46963669
Validation score: 0.784314
Iteration 9, loss = 0.44648192
Validation score: 0.777778
Iteration 10, loss = 0.45223645
Validation score: 0.777778
Iteration 11, loss = 0.44629535
Validation score: 0.784314
Iteration 12, loss = 0.44737563
Validation score: 0.771242
Iteration 13, loss = 0.44776071
Validation score: 0.784314
Iteration 14, loss = 0.44216919
Validation score: 0.790850
Iteration 15, loss = 0.44355938
Validation score: 0.797386
Iteration 16, loss = 0.43571818
Validation score: 0.797386
Iteration 17, loss = 0.43332865
Validation score: 0.790850
Iteration 18, loss = 0.42734920
Validation score: 0.777778
Iteration 19, loss = 0.43480327
Validation score: 0.784314
Iteration 20, loss = 0.43929142
Validation score: 0.790850
Iteration 21, loss = 0.43126371
Validation score: 0.784314
Iteration 22, loss = 0.43656274
Validation score: 0.784314
Iteration 23, loss = 0.43130320
Validation score: 0.790850
Iteration 24, loss = 0.42734449
Validation score: 0.777778
Iteration 25, loss = 0.42585256
Validation score: 0.784314
Iteration 26, loss = 0.42467060
Validation score: 0.777778
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.62303653
Validation score: 0.784314

Iteration 2, loss = 0.56661468
Validation score: 0.784314
Iteration 3, loss = 0.55410560
Validation score: 0.784314
Iteration 4, loss = 0.52480157
Validation score: 0.784314
Iteration 5, loss = 0.50385803
Validation score: 0.784314
Iteration 6, loss = 0.52176325
Validation score: 0.784314
Iteration 7, loss = 0.50032608
Validation score: 0.784314
Iteration 8, loss = 0.49089369
Validation score: 0.784314
Iteration 9, loss = 0.48514117
Validation score: 0.784314
Iteration 10, loss = 0.47343991
Validation score: 0.803922
Iteration 11, loss = 0.47806617
Validation score: 0.784314
Iteration 12, loss = 0.47669042
Validation score: 0.836601
Iteration 13, loss = 0.46403155
Validation score: 0.784314
Iteration 14, loss = 0.47527324
Validation score: 0.784314
Iteration 15, loss = 0.47362307
Validation score: 0.803922
Iteration 16, loss = 0.46350971
Validation score: 0.803922
Iteration 17, loss = 0.46390897
Validation score: 0.803922
Iteration 18, loss = 0.46644165
Validation score: 0.176471
Iteration 19, loss = 0.68068704
Validation score: 0.784314
Iteration 20, loss = 0.56865507
Validation score: 0.784314
Iteration 21, loss = 0.57334283
Validation score: 0.784314
Iteration 22, loss = 0.57086141
Validation score: 0.784314
Iteration 23, loss = 0.57045788
Validation score: 0.784314
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.62287394
Validation score: 0.803922

Iteration 2, loss = 0.57058184
Validation score: 0.803922
Iteration 3, loss = 0.55575231
Validation score: 0.183007
Iteration 4, loss = 0.59583132
Validation score: 0.803922
Iteration 5, loss = 0.53756340
Validation score: 0.803922
Iteration 6, loss = 0.51228569
Validation score: 0.797386
Iteration 7, loss = 0.49335190
Validation score: 0.856209
Iteration 8, loss = 0.47669664
Validation score: 0.803922
Iteration 9, loss = 0.46589364
Validation score: 0.803922
Iteration 10, loss = 0.45859089
Validation score: 0.843137
Iteration 11, loss = 0.45958952
Validation score: 0.830065
Iteration 12, loss = 0.47142713
Validation score: 0.836601
Iteration 13, loss = 0.45569001
Validation score: 0.810458
Iteration 14, loss = 0.45189593
Validation score: 0.803922
Iteration 15, loss = 0.45643298
Validation score: 0.830065
Iteration 16, loss = 0.45010772
Validation score: 0.830065
Iteration 17, loss = 0.45006457
Validation score: 0.836601
Iteration 18, loss = 0.45277206
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.62400106
Validation score: 0.797386
Iteration 2, loss = 0.56646018
Validation score: 0.797386
Iteration 3, loss = 0.55298201
Validation score: 0.222222
Iteration 4, loss = 0.60394312
Validation score: 0.797386
Iteration 5, loss = 0.56716263
Validation score: 0.797386
Iteration 6, loss = 0.54947870
Validation score: 0.797386

Iteration 7, loss = 0.52192286
Validation score: 0.790850
Iteration 8, loss = 0.49341921
Validation score: 0.797386
Iteration 9, loss = 0.48495093
Validation score: 0.803922
Iteration 10, loss = 0.46396463
Validation score: 0.797386
Iteration 11, loss = 0.60586053
Validation score: 0.797386
Iteration 12, loss = 0.57943035
Validation score: 0.797386
Iteration 13, loss = 0.51489960
Validation score: 0.797386
Iteration 14, loss = 0.48759316
Validation score: 0.797386
Iteration 15, loss = 0.48592556
Validation score: 0.797386
Iteration 16, loss = 0.47387758
Validation score: 0.803922
Iteration 17, loss = 0.45651640
Validation score: 0.810458
Iteration 18, loss = 0.46284809
Validation score: 0.790850
Iteration 19, loss = 0.47449623
Validation score: 0.810458
Iteration 20, loss = 0.44827207
Validation score: 0.803922
Iteration 21, loss = 0.46600122
Validation score: 0.823529
Iteration 22, loss = 0.45255060
Validation score: 0.823529
Iteration 23, loss = 0.45351754
Validation score: 0.790850
Iteration 24, loss = 0.47209099
Validation score: 0.751634
Iteration 25, loss = 0.47275305
Validation score: 0.823529
Iteration 26, loss = 0.45783653
Validation score: 0.823529
Iteration 27, loss = 0.45051917
Validation score: 0.836601
Iteration 28, loss = 0.45259754
Validation score: 0.803922
Iteration 29, loss = 0.45200455
Validation score: 0.810458
Iteration 30, loss = 0.44771479
Validation score: 0.836601

Iteration 31, loss = 0.44418977
Validation score: 0.836601
Iteration 32, loss = 0.44596571
Validation score: 0.830065
Iteration 33, loss = 0.44305600
Validation score: 0.836601
Iteration 34, loss = 0.44263018
Validation score: 0.823529
Iteration 35, loss = 0.44366092
Validation score: 0.836601
Iteration 36, loss = 0.44116656
Validation score: 0.816993
Iteration 37, loss = 0.44205450
Validation score: 0.830065
Iteration 38, loss = 0.44755290
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.65287833
Validation score: 0.771242
Iteration 2, loss = 0.51000071
Validation score: 0.771242
Iteration 3, loss = 0.48853218
Validation score: 0.790850
Iteration 4, loss = 0.45500529
Validation score: 0.810458
Iteration 5, loss = 0.44801551
Validation score: 0.803922
Iteration 6, loss = 0.43506600
Validation score: 0.810458
Iteration 7, loss = 0.42821226
Validation score: 0.810458
Iteration 8, loss = 0.41984538
Validation score: 0.810458
Iteration 9, loss = 0.42297991
Validation score: 0.797386
Iteration 10, loss = 0.41280094
Validation score: 0.784314
Iteration 11, loss = 0.40572259
Validation score: 0.810458
Iteration 12, loss = 0.39733993
Validation score: 0.803922
Iteration 13, loss = 0.38907870
Validation score: 0.797386
Iteration 14, loss = 0.39239399
Validation score: 0.797386
Iteration 15, loss = 0.37079723
Validation score: 0.790850

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.64596280
Validation score: 0.764706
Iteration 2, loss = 0.50990886
Validation score: 0.764706
Iteration 3, loss = 0.48167655
Validation score: 0.771242
Iteration 4, loss = 0.44741117
Validation score: 0.771242
Iteration 5, loss = 0.44053359
Validation score: 0.790850
Iteration 6, loss = 0.43688374
Validation score: 0.784314
Iteration 7, loss = 0.42420797
Validation score: 0.790850
Iteration 8, loss = 0.42157455
Validation score: 0.790850
Iteration 9, loss = 0.41575981
Validation score: 0.784314
Iteration 10, loss = 0.40602778
Validation score: 0.771242
Iteration 11, loss = 0.39827597
Validation score: 0.790850
Iteration 12, loss = 0.39129649
Validation score: 0.784314
Iteration 13, loss = 0.37863558
Validation score: 0.777778
Iteration 14, loss = 0.37493825
Validation score: 0.777778
Iteration 15, loss = 0.37091297
Validation score: 0.777778
Iteration 16, loss = 0.35735375
Validation score: 0.777778
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.64513772
Validation score: 0.784314
Iteration 2, loss = 0.51717511
Validation score: 0.777778
Iteration 3, loss = 0.48373700
Validation score: 0.816993
Iteration 4, loss = 0.46983584
Validation score: 0.823529
Iteration 5, loss = 0.45694159
Validation score: 0.810458
Iteration 6, loss = 0.45463703
Validation score: 0.816993

Iteration 7, loss = 0.44437208
Validation score: 0.816993
Iteration 8, loss = 0.42702237
Validation score: 0.843137
Iteration 9, loss = 0.41697768
Validation score: 0.823529
Iteration 10, loss = 0.40278272
Validation score: 0.836601
Iteration 11, loss = 0.40157443
Validation score: 0.803922
Iteration 12, loss = 0.38476681
Validation score: 0.836601
Iteration 13, loss = 0.37800034
Validation score: 0.823529
Iteration 14, loss = 0.36300153
Validation score: 0.836601
Iteration 15, loss = 0.35918725
Validation score: 0.830065
Iteration 16, loss = 0.33847100
Validation score: 0.810458
Iteration 17, loss = 0.33447122
Validation score: 0.836601
Iteration 18, loss = 0.32363642
Validation score: 0.816993
Iteration 19, loss = 0.36219728
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.65230515
Validation score: 0.803922
Iteration 2, loss = 0.51855396
Validation score: 0.797386
Iteration 3, loss = 0.48502410
Validation score: 0.849673
Iteration 4, loss = 0.45333322
Validation score: 0.843137
Iteration 5, loss = 0.44576851
Validation score: 0.836601
Iteration 6, loss = 0.43608909
Validation score: 0.836601
Iteration 7, loss = 0.43002813
Validation score: 0.849673
Iteration 8, loss = 0.42014731
Validation score: 0.830065
Iteration 9, loss = 0.41338013
Validation score: 0.849673
Iteration 10, loss = 0.40277521
Validation score: 0.830065

Iteration 11, loss = 0.39985844
Validation score: 0.836601
Iteration 12, loss = 0.38574468
Validation score: 0.816993
Iteration 13, loss = 0.37439204
Validation score: 0.816993
Iteration 14, loss = 0.36294763
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.64698718
Validation score: 0.797386
Iteration 2, loss = 0.51069811
Validation score: 0.797386
Iteration 3, loss = 0.47541572
Validation score: 0.823529
Iteration 4, loss = 0.45734422
Validation score: 0.816993
Iteration 5, loss = 0.43725876
Validation score: 0.823529
Iteration 6, loss = 0.43970624
Validation score: 0.836601
Iteration 7, loss = 0.43131210
Validation score: 0.823529
Iteration 8, loss = 0.41897635
Validation score: 0.816993
Iteration 9, loss = 0.40636271
Validation score: 0.830065
Iteration 10, loss = 0.39619433
Validation score: 0.803922
Iteration 11, loss = 0.40312638
Validation score: 0.803922
Iteration 12, loss = 0.39501206
Validation score: 0.810458
Iteration 13, loss = 0.36470696
Validation score: 0.803922
Iteration 14, loss = 0.34528271
Validation score: 0.797386
Iteration 15, loss = 0.33820519
Validation score: 0.810458
Iteration 16, loss = 0.40192016
Validation score: 0.823529
Iteration 17, loss = 0.33879592
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.73853462
Validation score: 0.771242

Iteration 2, loss = 0.56250523
Validation score: 0.771242
Iteration 3, loss = 0.56198852
Validation score: 0.771242
Iteration 4, loss = 0.55875167
Validation score: 0.771242
Iteration 5, loss = 0.55908387
Validation score: 0.771242
Iteration 6, loss = 0.55977266
Validation score: 0.771242
Iteration 7, loss = 0.55544178
Validation score: 0.771242
Iteration 8, loss = 0.55367888
Validation score: 0.771242
Iteration 9, loss = 0.55341314
Validation score: 0.771242
Iteration 10, loss = 0.55026558
Validation score: 0.771242
Iteration 11, loss = 0.54720680
Validation score: 0.771242
Iteration 12, loss = 0.54437038
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.74421462
Validation score: 0.764706
Iteration 2, loss = 0.55889096
Validation score: 0.764706
Iteration 3, loss = 0.55701684
Validation score: 0.764706
Iteration 4, loss = 0.55597097
Validation score: 0.764706
Iteration 5, loss = 0.55373995
Validation score: 0.764706
Iteration 6, loss = 0.55832115
Validation score: 0.764706
Iteration 7, loss = 0.55443284
Validation score: 0.764706
Iteration 8, loss = 0.55232196
Validation score: 0.764706
Iteration 9, loss = 0.55090169
Validation score: 0.764706
Iteration 10, loss = 0.54859719
Validation score: 0.764706
Iteration 11, loss = 0.54688645
Validation score: 0.764706
Iteration 12, loss = 0.54511688
Validation score: 0.764706

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.73406938

Validation score: 0.784314

Iteration 2, loss = 0.56845832

Validation score: 0.784314

Iteration 3, loss = 0.56565306

Validation score: 0.784314

Iteration 4, loss = 0.56501422

Validation score: 0.784314

Iteration 5, loss = 0.56367878

Validation score: 0.784314

Iteration 6, loss = 0.56323670

Validation score: 0.784314

Iteration 7, loss = 0.56177731

Validation score: 0.784314

Iteration 8, loss = 0.56054616

Validation score: 0.784314

Iteration 9, loss = 0.55954078

Validation score: 0.784314

Iteration 10, loss = 0.55804469

Validation score: 0.784314

Iteration 11, loss = 0.55592473

Validation score: 0.784314

Iteration 12, loss = 0.55420409

Validation score: 0.784314

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.73736851

Validation score: 0.803922

Iteration 2, loss = 0.57136308

Validation score: 0.803922

Iteration 3, loss = 0.56985228

Validation score: 0.803922

Iteration 4, loss = 0.57741524

Validation score: 0.803922

Iteration 5, loss = 0.56850826

Validation score: 0.803922

Iteration 6, loss = 0.56734235

Validation score: 0.803922

Iteration 7, loss = 0.56585471

Validation score: 0.803922

Iteration 8, loss = 0.56500630

Validation score: 0.803922

Iteration 9, loss = 0.56377415

Validation score: 0.803922

Iteration 10, loss = 0.56137251

Validation score: 0.803922

Iteration 11, loss = 0.56086598
Validation score: 0.803922
Iteration 12, loss = 0.55818009
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.74439621
Validation score: 0.797386
Iteration 2, loss = 0.56822656
Validation score: 0.797386
Iteration 3, loss = 0.56715972
Validation score: 0.797386
Iteration 4, loss = 0.57328315
Validation score: 0.797386
Iteration 5, loss = 0.56792859
Validation score: 0.797386
Iteration 6, loss = 0.56415270
Validation score: 0.797386
Iteration 7, loss = 0.56430439
Validation score: 0.797386
Iteration 8, loss = 0.56230434
Validation score: 0.797386
Iteration 9, loss = 0.56059617
Validation score: 0.797386
Iteration 10, loss = 0.55854667
Validation score: 0.797386
Iteration 11, loss = 0.55786377
Validation score: 0.797386
Iteration 12, loss = 0.56174383
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 1.13293841
Validation score: 0.771242
Iteration 2, loss = 0.69869390
Validation score: 0.771242
Iteration 3, loss = 0.56261430
Validation score: 0.771242
Iteration 4, loss = 0.54690594
Validation score: 0.771242
Iteration 5, loss = 0.53856331
Validation score: 0.771242
Iteration 6, loss = 0.53044491
Validation score: 0.771242
Iteration 7, loss = 0.52110627
Validation score: 0.771242
Iteration 8, loss = 0.51227827
Validation score: 0.771242

Iteration 9, loss = 0.50296014
Validation score: 0.771242
Iteration 10, loss = 0.49217084
Validation score: 0.771242
Iteration 11, loss = 0.48020612
Validation score: 0.771242
Iteration 12, loss = 0.46862244
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.13507412
Validation score: 0.764706
Iteration 2, loss = 0.69935873
Validation score: 0.764706
Iteration 3, loss = 0.56103528
Validation score: 0.764706
Iteration 4, loss = 0.54563559
Validation score: 0.764706
Iteration 5, loss = 0.53677312
Validation score: 0.764706
Iteration 6, loss = 0.52997651
Validation score: 0.764706
Iteration 7, loss = 0.52076640
Validation score: 0.764706
Iteration 8, loss = 0.51206271
Validation score: 0.764706
Iteration 9, loss = 0.50239633
Validation score: 0.764706
Iteration 10, loss = 0.49083559
Validation score: 0.764706
Iteration 11, loss = 0.47907267
Validation score: 0.764706
Iteration 12, loss = 0.46799545
Validation score: 0.771242
Iteration 13, loss = 0.45603867
Validation score: 0.764706
Iteration 14, loss = 0.44729977
Validation score: 0.758170
Iteration 15, loss = 0.44120663
Validation score: 0.777778
Iteration 16, loss = 0.43542070
Validation score: 0.771242
Iteration 17, loss = 0.42898051
Validation score: 0.784314
Iteration 18, loss = 0.42672687
Validation score: 0.784314
Iteration 19, loss = 0.42219961
Validation score: 0.784314

Iteration 20, loss = 0.41796867
Validation score: 0.790850
Iteration 21, loss = 0.41589146
Validation score: 0.797386
Iteration 22, loss = 0.41217676
Validation score: 0.784314
Iteration 23, loss = 0.40975549
Validation score: 0.777778
Iteration 24, loss = 0.40594261
Validation score: 0.797386
Iteration 25, loss = 0.40218991
Validation score: 0.797386
Iteration 26, loss = 0.39877783
Validation score: 0.790850
Iteration 27, loss = 0.39747583
Validation score: 0.797386
Iteration 28, loss = 0.39407746
Validation score: 0.797386
Iteration 29, loss = 0.39158229
Validation score: 0.797386
Iteration 30, loss = 0.38980951
Validation score: 0.790850
Iteration 31, loss = 0.38858174
Validation score: 0.784314
Iteration 32, loss = 0.38327726
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.13060164
Validation score: 0.784314
Iteration 2, loss = 0.69268213
Validation score: 0.784314
Iteration 3, loss = 0.56883135
Validation score: 0.784314
Iteration 4, loss = 0.55432899
Validation score: 0.784314
Iteration 5, loss = 0.54462503
Validation score: 0.784314
Iteration 6, loss = 0.53721669
Validation score: 0.784314
Iteration 7, loss = 0.52863289
Validation score: 0.784314
Iteration 8, loss = 0.52009104
Validation score: 0.784314
Iteration 9, loss = 0.51051184
Validation score: 0.784314
Iteration 10, loss = 0.50031376
Validation score: 0.784314

Iteration 11, loss = 0.48868923
Validation score: 0.777778
Iteration 12, loss = 0.47885144
Validation score: 0.784314
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.12908944
Validation score: 0.803922
Iteration 2, loss = 0.69500488
Validation score: 0.803922
Iteration 3, loss = 0.57107429
Validation score: 0.803922
Iteration 4, loss = 0.55772675
Validation score: 0.803922
Iteration 5, loss = 0.54685357
Validation score: 0.803922
Iteration 6, loss = 0.53932221
Validation score: 0.803922
Iteration 7, loss = 0.53098958
Validation score: 0.803922
Iteration 8, loss = 0.52209403
Validation score: 0.803922
Iteration 9, loss = 0.51081297
Validation score: 0.803922
Iteration 10, loss = 0.49758821
Validation score: 0.797386
Iteration 11, loss = 0.48316065
Validation score: 0.803922
Iteration 12, loss = 0.46947535
Validation score: 0.810458
Iteration 13, loss = 0.45843715
Validation score: 0.816993
Iteration 14, loss = 0.44917146
Validation score: 0.823529
Iteration 15, loss = 0.44543950
Validation score: 0.836601
Iteration 16, loss = 0.43946429
Validation score: 0.836601
Iteration 17, loss = 0.43234127
Validation score: 0.836601
Iteration 18, loss = 0.42973524
Validation score: 0.849673
Iteration 19, loss = 0.42671940
Validation score: 0.849673
Iteration 20, loss = 0.42220165
Validation score: 0.843137
Iteration 21, loss = 0.42031783
Validation score: 0.836601

Iteration 22, loss = 0.41704098
Validation score: 0.856209
Iteration 23, loss = 0.41448293
Validation score: 0.849673
Iteration 24, loss = 0.41390629
Validation score: 0.862745
Iteration 25, loss = 0.41593441
Validation score: 0.856209
Iteration 26, loss = 0.40739757
Validation score: 0.849673
Iteration 27, loss = 0.40438486
Validation score: 0.862745
Iteration 28, loss = 0.40198034
Validation score: 0.862745
Iteration 29, loss = 0.39874781
Validation score: 0.849673
Iteration 30, loss = 0.39815741
Validation score: 0.836601
Iteration 31, loss = 0.39436966
Validation score: 0.836601
Iteration 32, loss = 0.39456364
Validation score: 0.856209
Iteration 33, loss = 0.38946202
Validation score: 0.856209
Iteration 34, loss = 0.38753776
Validation score: 0.856209
Iteration 35, loss = 0.38486865
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.13455339
Validation score: 0.797386
Iteration 2, loss = 0.69858924
Validation score: 0.797386
Iteration 3, loss = 0.57088557
Validation score: 0.797386
Iteration 4, loss = 0.55595264
Validation score: 0.797386
Iteration 5, loss = 0.54567309
Validation score: 0.797386
Iteration 6, loss = 0.53750259
Validation score: 0.797386
Iteration 7, loss = 0.52982838
Validation score: 0.797386
Iteration 8, loss = 0.52127814
Validation score: 0.797386
Iteration 9, loss = 0.51233742
Validation score: 0.797386

Iteration 10, loss = 0.50239408
Validation score: 0.797386
Iteration 11, loss = 0.49348138
Validation score: 0.790850
Iteration 12, loss = 0.48411076
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.17870034
Validation score: 0.771242
Iteration 2, loss = 0.82036233
Validation score: 0.771242
Iteration 3, loss = 0.65572471
Validation score: 0.771242
Iteration 4, loss = 0.59804927
Validation score: 0.771242
Iteration 5, loss = 0.57904806
Validation score: 0.771242
Iteration 6, loss = 0.57171229
Validation score: 0.771242
Iteration 7, loss = 0.56805761
Validation score: 0.771242
Iteration 8, loss = 0.56576267
Validation score: 0.771242
Iteration 9, loss = 0.56419933
Validation score: 0.771242
Iteration 10, loss = 0.56301891
Validation score: 0.771242
Iteration 11, loss = 0.56204825
Validation score: 0.771242
Iteration 12, loss = 0.56118661
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.17984992
Validation score: 0.764706
Iteration 2, loss = 0.81964586
Validation score: 0.764706
Iteration 3, loss = 0.65383497
Validation score: 0.764706
Iteration 4, loss = 0.59529869
Validation score: 0.764706
Iteration 5, loss = 0.57636869
Validation score: 0.764706
Iteration 6, loss = 0.56907304
Validation score: 0.764706
Iteration 7, loss = 0.56546216
Validation score: 0.764706

Iteration 8, loss = 0.56302982
Validation score: 0.764706
Iteration 9, loss = 0.56131650
Validation score: 0.764706
Iteration 10, loss = 0.55993288
Validation score: 0.764706
Iteration 11, loss = 0.55892504
Validation score: 0.764706
Iteration 12, loss = 0.55814280
Validation score: 0.764706
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.17962921
Validation score: 0.784314
Iteration 2, loss = 0.81605113
Validation score: 0.784314
Iteration 3, loss = 0.65421491
Validation score: 0.784314
Iteration 4, loss = 0.59943497
Validation score: 0.784314
Iteration 5, loss = 0.58264777
Validation score: 0.784314
Iteration 6, loss = 0.57639047
Validation score: 0.784314
Iteration 7, loss = 0.57312589
Validation score: 0.784314
Iteration 8, loss = 0.57113546
Validation score: 0.784314
Iteration 9, loss = 0.56961464
Validation score: 0.784314
Iteration 10, loss = 0.56847528
Validation score: 0.784314
Iteration 11, loss = 0.56753564
Validation score: 0.784314
Iteration 12, loss = 0.56683429
Validation score: 0.784314
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.17936267
Validation score: 0.803922
Iteration 2, loss = 0.81869848
Validation score: 0.803922
Iteration 3, loss = 0.65816907
Validation score: 0.803922
Iteration 4, loss = 0.60721679
Validation score: 0.803922
Iteration 5, loss = 0.58763382
Validation score: 0.803922

Iteration 6, loss = 0.58050105
Validation score: 0.803922
Iteration 7, loss = 0.57711969
Validation score: 0.803922
Iteration 8, loss = 0.57506450
Validation score: 0.803922
Iteration 9, loss = 0.57368345
Validation score: 0.803922
Iteration 10, loss = 0.57243517
Validation score: 0.803922
Iteration 11, loss = 0.57177867
Validation score: 0.803922
Iteration 12, loss = 0.57098568
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.18045348
Validation score: 0.797386
Iteration 2, loss = 0.81768957
Validation score: 0.797386
Iteration 3, loss = 0.65685575
Validation score: 0.797386
Iteration 4, loss = 0.60539628
Validation score: 0.797386
Iteration 5, loss = 0.58545773
Validation score: 0.797386
Iteration 6, loss = 0.57830672
Validation score: 0.797386
Iteration 7, loss = 0.57477976
Validation score: 0.797386
Iteration 8, loss = 0.57259285
Validation score: 0.797386
Iteration 9, loss = 0.57117057
Validation score: 0.797386
Iteration 10, loss = 0.56984635
Validation score: 0.797386
Iteration 11, loss = 0.56924147
Validation score: 0.797386
Iteration 12, loss = 0.56822913
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.57134749
Validation score: 0.830065
Iteration 2, loss = 0.47288006
Validation score: 0.830065
Iteration 3, loss = 0.45982754
Validation score: 0.849673

Iteration 4, loss = 0.45684589
Validation score: 0.836601
Iteration 5, loss = 0.43807715
Validation score: 0.843137
Iteration 6, loss = 0.44617832
Validation score: 0.843137
Iteration 7, loss = 0.44923816
Validation score: 0.771242
Iteration 8, loss = 0.43826601
Validation score: 0.816993
Iteration 9, loss = 0.42512291
Validation score: 0.810458
Iteration 10, loss = 0.44829273
Validation score: 0.830065
Iteration 11, loss = 0.45397416
Validation score: 0.836601
Iteration 12, loss = 0.41931487
Validation score: 0.843137
Iteration 13, loss = 0.41783400
Validation score: 0.830065
Iteration 14, loss = 0.43205474
Validation score: 0.843137
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.54673550
Validation score: 0.797386
Iteration 2, loss = 0.47871407
Validation score: 0.784314
Iteration 3, loss = 0.46841513
Validation score: 0.830065
Iteration 4, loss = 0.46735173
Validation score: 0.784314
Iteration 5, loss = 0.46406965
Validation score: 0.849673
Iteration 6, loss = 0.46049191
Validation score: 0.810458
Iteration 7, loss = 0.45058343
Validation score: 0.830065
Iteration 8, loss = 0.44634741
Validation score: 0.816993
Iteration 9, loss = 0.42111658
Validation score: 0.810458
Iteration 10, loss = 0.43724024
Validation score: 0.843137
Iteration 11, loss = 0.43833495
Validation score: 0.823529
Iteration 12, loss = 0.43407944
Validation score: 0.810458

Iteration 13, loss = 0.40780646
Validation score: 0.810458
Iteration 14, loss = 0.42809337
Validation score: 0.830065
Iteration 15, loss = 0.39872309
Validation score: 0.797386
Iteration 16, loss = 0.41519848
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.57201513
Validation score: 0.751634
Iteration 2, loss = 0.50432924
Validation score: 0.803922
Iteration 3, loss = 0.52994796
Validation score: 0.816993
Iteration 4, loss = 0.50851037
Validation score: 0.797386
Iteration 5, loss = 0.49428724
Validation score: 0.751634
Iteration 6, loss = 0.50423196
Validation score: 0.816993
Iteration 7, loss = 0.50463750
Validation score: 0.751634
Iteration 8, loss = 0.49170973
Validation score: 0.816993
Iteration 9, loss = 0.46992302
Validation score: 0.777778
Iteration 10, loss = 0.47791437
Validation score: 0.816993
Iteration 11, loss = 0.46648628
Validation score: 0.810458
Iteration 12, loss = 0.46208029
Validation score: 0.830065
Iteration 13, loss = 0.47737399
Validation score: 0.816993
Iteration 14, loss = 0.48172811
Validation score: 0.797386
Iteration 15, loss = 0.49316454
Validation score: 0.790850
Iteration 16, loss = 0.55923529
Validation score: 0.764706
Iteration 17, loss = 0.48148071
Validation score: 0.751634
Iteration 18, loss = 0.47753236
Validation score: 0.777778
Iteration 19, loss = 0.45735735
Validation score: 0.797386

Iteration 20, loss = 0.45587086
Validation score: 0.823529
Iteration 21, loss = 0.45612179
Validation score: 0.823529
Iteration 22, loss = 0.48457902
Validation score: 0.816993
Iteration 23, loss = 0.46138278
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.56855796
Validation score: 0.797386
Iteration 2, loss = 0.49535685
Validation score: 0.790850
Iteration 3, loss = 0.46591476
Validation score: 0.790850
Iteration 4, loss = 0.46831556
Validation score: 0.784314
Iteration 5, loss = 0.45581036
Validation score: 0.764706
Iteration 6, loss = 0.47920981
Validation score: 0.777778
Iteration 7, loss = 0.49691513
Validation score: 0.771242
Iteration 8, loss = 0.46916287
Validation score: 0.777778
Iteration 9, loss = 0.45681489
Validation score: 0.777778
Iteration 10, loss = 0.44873933
Validation score: 0.797386
Iteration 11, loss = 0.43979207
Validation score: 0.784314
Iteration 12, loss = 0.46954500
Validation score: 0.777778
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.55168052
Validation score: 0.816993
Iteration 2, loss = 0.48972265
Validation score: 0.797386
Iteration 3, loss = 0.47416810
Validation score: 0.843137
Iteration 4, loss = 0.46931754
Validation score: 0.810458
Iteration 5, loss = 0.45712113
Validation score: 0.803922
Iteration 6, loss = 0.45647272
Validation score: 0.843137

Iteration 7, loss = 0.43611000
Validation score: 0.816993
Iteration 8, loss = 0.43631076
Validation score: 0.830065
Iteration 9, loss = 0.44332033
Validation score: 0.823529
Iteration 10, loss = 0.47015118
Validation score: 0.849673
Iteration 11, loss = 0.46045304
Validation score: 0.803922
Iteration 12, loss = 0.47887692
Validation score: 0.803922
Iteration 13, loss = 0.44183248
Validation score: 0.816993
Iteration 14, loss = 0.45596360
Validation score: 0.797386
Iteration 15, loss = 0.45694712
Validation score: 0.784314
Iteration 16, loss = 0.52518562
Validation score: 0.784314
Iteration 17, loss = 0.47146686
Validation score: 0.797386
Iteration 18, loss = 0.47594607
Validation score: 0.816993
Iteration 19, loss = 0.44517611
Validation score: 0.849673
Iteration 20, loss = 0.44222650
Validation score: 0.849673
Iteration 21, loss = 0.43141537
Validation score: 0.849673
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.59992411
Validation score: 0.830065
Iteration 2, loss = 0.56213084
Validation score: 0.830065
Iteration 3, loss = 0.52277195
Validation score: 0.836601
Iteration 4, loss = 0.49663499
Validation score: 0.836601
Iteration 5, loss = 0.47731892
Validation score: 0.843137
Iteration 6, loss = 0.46036261
Validation score: 0.843137
Iteration 7, loss = 0.45629343
Validation score: 0.849673
Iteration 8, loss = 0.46516052
Validation score: 0.823529

Iteration 9, loss = 0.45410810
Validation score: 0.816993
Iteration 10, loss = 0.46344721
Validation score: 0.823529
Iteration 11, loss = 0.44880352
Validation score: 0.836601
Iteration 12, loss = 0.44961834
Validation score: 0.816993
Iteration 13, loss = 0.44924533
Validation score: 0.836601
Iteration 14, loss = 0.44378773
Validation score: 0.790850
Iteration 15, loss = 0.43455006
Validation score: 0.797386
Iteration 16, loss = 0.43359873
Validation score: 0.843137
Iteration 17, loss = 0.43150994
Validation score: 0.830065
Iteration 18, loss = 0.43358616
Validation score: 0.849673
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.58962724
Validation score: 0.784314
Iteration 2, loss = 0.56205949
Validation score: 0.784314
Iteration 3, loss = 0.53773136
Validation score: 0.784314
Iteration 4, loss = 0.51870710
Validation score: 0.784314
Iteration 5, loss = 0.49641150
Validation score: 0.790850
Iteration 6, loss = 0.47225631
Validation score: 0.810458
Iteration 7, loss = 0.46123915
Validation score: 0.790850
Iteration 8, loss = 0.46830611
Validation score: 0.790850
Iteration 9, loss = 0.46121817
Validation score: 0.790850
Iteration 10, loss = 0.46582424
Validation score: 0.823529
Iteration 11, loss = 0.45368902
Validation score: 0.836601
Iteration 12, loss = 0.45022703
Validation score: 0.843137
Iteration 13, loss = 0.45379333
Validation score: 0.816993

Iteration 14, loss = 0.45205909
Validation score: 0.836601
Iteration 15, loss = 0.44414985
Validation score: 0.836601
Iteration 16, loss = 0.45060046
Validation score: 0.830065
Iteration 17, loss = 0.44125695
Validation score: 0.849673
Iteration 18, loss = 0.43973492
Validation score: 0.856209
Iteration 19, loss = 0.43768291
Validation score: 0.797386
Iteration 20, loss = 0.43987263
Validation score: 0.830065
Iteration 21, loss = 0.44830737
Validation score: 0.856209
Iteration 22, loss = 0.42807732
Validation score: 0.856209
Iteration 23, loss = 0.43539617
Validation score: 0.843137
Iteration 24, loss = 0.43215064
Validation score: 0.856209
Iteration 25, loss = 0.43157334
Validation score: 0.856209
Iteration 26, loss = 0.42384965
Validation score: 0.830065
Iteration 27, loss = 0.42240279
Validation score: 0.843137
Iteration 28, loss = 0.42327286
Validation score: 0.836601
Iteration 29, loss = 0.41634183
Validation score: 0.856209
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.59872316
Validation score: 0.751634
Iteration 2, loss = 0.56398260
Validation score: 0.751634
Iteration 3, loss = 0.58973144
Validation score: 0.751634
Iteration 4, loss = 0.56135578
Validation score: 0.751634
Iteration 5, loss = 0.56083622
Validation score: 0.751634
Iteration 6, loss = 0.55028536
Validation score: 0.751634
Iteration 7, loss = 0.57921869
Validation score: 0.751634

Iteration 8, loss = 0.55946225
Validation score: 0.751634
Iteration 9, loss = 0.53935862
Validation score: 0.751634
Iteration 10, loss = 0.49630567
Validation score: 0.751634
Iteration 11, loss = 0.48757185
Validation score: 0.751634
Iteration 12, loss = 0.52187015
Validation score: 0.751634
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.60717118
Validation score: 0.771242
Iteration 2, loss = 0.56898064
Validation score: 0.771242
Iteration 3, loss = 0.55790348
Validation score: 0.771242
Iteration 4, loss = 0.52037700
Validation score: 0.771242
Iteration 5, loss = 0.49226798
Validation score: 0.771242
Iteration 6, loss = 0.48400096
Validation score: 0.202614
Iteration 7, loss = 0.63007238
Validation score: 0.771242
Iteration 8, loss = 0.57159015
Validation score: 0.771242
Iteration 9, loss = 0.57085586
Validation score: 0.771242
Iteration 10, loss = 0.57068059
Validation score: 0.771242
Iteration 11, loss = 0.57147426
Validation score: 0.771242
Iteration 12, loss = 0.57257773
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.59696395
Validation score: 0.797386
Iteration 2, loss = 0.56188098
Validation score: 0.797386
Iteration 3, loss = 0.52530529
Validation score: 0.797386
Iteration 4, loss = 0.49846397
Validation score: 0.797386
Iteration 5, loss = 0.49225484
Validation score: 0.797386

Iteration 6, loss = 0.47088688
Validation score: 0.797386
Iteration 7, loss = 0.45198440
Validation score: 0.830065
Iteration 8, loss = 0.46594008
Validation score: 0.830065
Iteration 9, loss = 0.45069991
Validation score: 0.346405
Iteration 10, loss = 0.52469634
Validation score: 0.816993
Iteration 11, loss = 0.45247010
Validation score: 0.797386
Iteration 12, loss = 0.46330163
Validation score: 0.830065
Iteration 13, loss = 0.45425064
Validation score: 0.797386
Iteration 14, loss = 0.45312799
Validation score: 0.509804
Iteration 15, loss = 0.46106851
Validation score: 0.307190
Iteration 16, loss = 0.61343219
Validation score: 0.797386
Iteration 17, loss = 0.46592408
Validation score: 0.797386
Iteration 18, loss = 0.55392840
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.58430243
Validation score: 0.830065
Iteration 2, loss = 0.47452020
Validation score: 0.830065
Iteration 3, loss = 0.44753424
Validation score: 0.830065
Iteration 4, loss = 0.44276252
Validation score: 0.816993
Iteration 5, loss = 0.42510300
Validation score: 0.823529
Iteration 6, loss = 0.42910751
Validation score: 0.816993
Iteration 7, loss = 0.41248344
Validation score: 0.790850
Iteration 8, loss = 0.39389084
Validation score: 0.816993
Iteration 9, loss = 0.37895217
Validation score: 0.823529
Iteration 10, loss = 0.37314723
Validation score: 0.816993

Iteration 11, loss = 0.36277642
Validation score: 0.830065
Iteration 12, loss = 0.33827546
Validation score: 0.830065
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.58167418
Validation score: 0.784314
Iteration 2, loss = 0.48414154
Validation score: 0.830065
Iteration 3, loss = 0.45354412
Validation score: 0.836601
Iteration 4, loss = 0.44048748
Validation score: 0.856209
Iteration 5, loss = 0.42736674
Validation score: 0.856209
Iteration 6, loss = 0.41530475
Validation score: 0.836601
Iteration 7, loss = 0.40927404
Validation score: 0.836601
Iteration 8, loss = 0.39339803
Validation score: 0.823529
Iteration 9, loss = 0.38974545
Validation score: 0.849673
Iteration 10, loss = 0.36899293
Validation score: 0.843137
Iteration 11, loss = 0.34090106
Validation score: 0.830065
Iteration 12, loss = 0.33135888
Validation score: 0.830065
Iteration 13, loss = 0.30344765
Validation score: 0.830065
Iteration 14, loss = 0.29500236
Validation score: 0.810458
Iteration 15, loss = 0.27759294
Validation score: 0.830065
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.60125581
Validation score: 0.751634
Iteration 2, loss = 0.50481003
Validation score: 0.751634
Iteration 3, loss = 0.49023335
Validation score: 0.751634
Iteration 4, loss = 0.47488175
Validation score: 0.810458
Iteration 5, loss = 0.46959002
Validation score: 0.797386

Iteration 6, loss = 0.44884231
Validation score: 0.830065
Iteration 7, loss = 0.46978126
Validation score: 0.830065
Iteration 8, loss = 0.43361954
Validation score: 0.816993
Iteration 9, loss = 0.42062285
Validation score: 0.823529
Iteration 10, loss = 0.40803678
Validation score: 0.816993
Iteration 11, loss = 0.39236707
Validation score: 0.843137
Iteration 12, loss = 0.38328926
Validation score: 0.797386
Iteration 13, loss = 0.40847299
Validation score: 0.810458
Iteration 14, loss = 0.37056591
Validation score: 0.816993
Iteration 15, loss = 0.35852951
Validation score: 0.816993
Iteration 16, loss = 0.37703670
Validation score: 0.810458
Iteration 17, loss = 0.33892351
Validation score: 0.803922
Iteration 18, loss = 0.32609664
Validation score: 0.830065
Iteration 19, loss = 0.31298301
Validation score: 0.816993
Iteration 20, loss = 0.31429020
Validation score: 0.830065
Iteration 21, loss = 0.30756920
Validation score: 0.836601
Iteration 22, loss = 0.29478463
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.59552552
Validation score: 0.771242
Iteration 2, loss = 0.49387569
Validation score: 0.784314
Iteration 3, loss = 0.45234051
Validation score: 0.797386
Iteration 4, loss = 0.43727203
Validation score: 0.790850
Iteration 5, loss = 0.43715253
Validation score: 0.790850
Iteration 6, loss = 0.44505669
Validation score: 0.790850

Iteration 7, loss = 0.43107323
Validation score: 0.790850
Iteration 8, loss = 0.40739237
Validation score: 0.784314
Iteration 9, loss = 0.40097759
Validation score: 0.790850
Iteration 10, loss = 0.39135262
Validation score: 0.784314
Iteration 11, loss = 0.38021312
Validation score: 0.777778
Iteration 12, loss = 0.38817654
Validation score: 0.777778
Iteration 13, loss = 0.36161756
Validation score: 0.777778
Iteration 14, loss = 0.36815088
Validation score: 0.764706
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.58183645
Validation score: 0.797386
Iteration 2, loss = 0.47594503
Validation score: 0.843137
Iteration 3, loss = 0.44658807
Validation score: 0.836601
Iteration 4, loss = 0.44484216
Validation score: 0.843137
Iteration 5, loss = 0.44016434
Validation score: 0.843137
Iteration 6, loss = 0.42411890
Validation score: 0.843137
Iteration 7, loss = 0.41116611
Validation score: 0.810458
Iteration 8, loss = 0.39728843
Validation score: 0.816993
Iteration 9, loss = 0.38703955
Validation score: 0.823529
Iteration 10, loss = 0.36973906
Validation score: 0.816993
Iteration 11, loss = 0.35740456
Validation score: 0.803922
Iteration 12, loss = 0.36168835
Validation score: 0.790850
Iteration 13, loss = 0.33306157
Validation score: 0.816993
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.64183939
Validation score: 0.830065

Iteration 2, loss = 0.57455483
Validation score: 0.830065
Iteration 3, loss = 0.57316921
Validation score: 0.830065
Iteration 4, loss = 0.57206546
Validation score: 0.830065
Iteration 5, loss = 0.56948171
Validation score: 0.830065
Iteration 6, loss = 0.56732229
Validation score: 0.830065
Iteration 7, loss = 0.56323855
Validation score: 0.830065
Iteration 8, loss = 0.55875756
Validation score: 0.830065
Iteration 9, loss = 0.55481573
Validation score: 0.830065
Iteration 10, loss = 0.55157465
Validation score: 0.830065
Iteration 11, loss = 0.54631162
Validation score: 0.830065
Iteration 12, loss = 0.53954468
Validation score: 0.830065
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.63352741
Validation score: 0.784314
Iteration 2, loss = 0.56490521
Validation score: 0.784314
Iteration 3, loss = 0.56379126
Validation score: 0.784314
Iteration 4, loss = 0.56113392
Validation score: 0.784314
Iteration 5, loss = 0.55982396
Validation score: 0.784314
Iteration 6, loss = 0.55760726
Validation score: 0.784314
Iteration 7, loss = 0.55547059
Validation score: 0.784314
Iteration 8, loss = 0.55235603
Validation score: 0.784314
Iteration 9, loss = 0.54872674
Validation score: 0.784314
Iteration 10, loss = 0.54465896
Validation score: 0.784314
Iteration 11, loss = 0.54052178
Validation score: 0.784314
Iteration 12, loss = 0.53639913
Validation score: 0.784314

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.63851476

Validation score: 0.751634

Iteration 2, loss = 0.56422042

Validation score: 0.751634

Iteration 3, loss = 0.56681127

Validation score: 0.751634

Iteration 4, loss = 0.56220322

Validation score: 0.751634

Iteration 5, loss = 0.56013344

Validation score: 0.751634

Iteration 6, loss = 0.55754113

Validation score: 0.751634

Iteration 7, loss = 0.56248461

Validation score: 0.751634

Iteration 8, loss = 0.55456264

Validation score: 0.751634

Iteration 9, loss = 0.55144912

Validation score: 0.751634

Iteration 10, loss = 0.54810172

Validation score: 0.751634

Iteration 11, loss = 0.54615550

Validation score: 0.751634

Iteration 12, loss = 0.54133658

Validation score: 0.751634

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.64642603

Validation score: 0.771242

Iteration 2, loss = 0.56605179

Validation score: 0.771242

Iteration 3, loss = 0.56221024

Validation score: 0.771242

Iteration 4, loss = 0.56037919

Validation score: 0.771242

Iteration 5, loss = 0.55813004

Validation score: 0.771242

Iteration 6, loss = 0.55657751

Validation score: 0.771242

Iteration 7, loss = 0.55764719

Validation score: 0.771242

Iteration 8, loss = 0.55045797

Validation score: 0.771242

Iteration 9, loss = 0.54563734

Validation score: 0.771242

Iteration 10, loss = 0.54013533

Validation score: 0.771242

Iteration 11, loss = 0.53572393
Validation score: 0.771242
Iteration 12, loss = 0.53118304
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.64036524
Validation score: 0.797386
Iteration 2, loss = 0.57010283
Validation score: 0.797386
Iteration 3, loss = 0.56700689
Validation score: 0.797386
Iteration 4, loss = 0.56469904
Validation score: 0.797386
Iteration 5, loss = 0.56319476
Validation score: 0.797386
Iteration 6, loss = 0.56101865
Validation score: 0.797386
Iteration 7, loss = 0.55664208
Validation score: 0.797386
Iteration 8, loss = 0.55399979
Validation score: 0.797386
Iteration 9, loss = 0.54845209
Validation score: 0.797386
Iteration 10, loss = 0.54555849
Validation score: 0.797386
Iteration 11, loss = 0.53608587
Validation score: 0.797386
Iteration 12, loss = 0.53001739
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.73156340
Validation score: 0.830065
Iteration 2, loss = 0.58265846
Validation score: 0.830065
Iteration 3, loss = 0.56203135
Validation score: 0.830065
Iteration 4, loss = 0.54790889
Validation score: 0.830065
Iteration 5, loss = 0.52642726
Validation score: 0.836601
Iteration 6, loss = 0.50320935
Validation score: 0.836601
Iteration 7, loss = 0.48082939
Validation score: 0.849673
Iteration 8, loss = 0.46360050
Validation score: 0.849673

Iteration 9, loss = 0.45234285
Validation score: 0.830065
Iteration 10, loss = 0.44472934
Validation score: 0.830065
Iteration 11, loss = 0.43872827
Validation score: 0.830065
Iteration 12, loss = 0.43321660
Validation score: 0.836601
Iteration 13, loss = 0.42872823
Validation score: 0.830065
Iteration 14, loss = 0.42430940
Validation score: 0.830065
Iteration 15, loss = 0.42140796
Validation score: 0.830065
Iteration 16, loss = 0.41895012
Validation score: 0.810458
Iteration 17, loss = 0.41448659
Validation score: 0.823529
Iteration 18, loss = 0.41327869
Validation score: 0.816993
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.72578643
Validation score: 0.784314
Iteration 2, loss = 0.57700284
Validation score: 0.784314
Iteration 3, loss = 0.55429858
Validation score: 0.784314
Iteration 4, loss = 0.54373393
Validation score: 0.784314
Iteration 5, loss = 0.52771598
Validation score: 0.784314
Iteration 6, loss = 0.50676816
Validation score: 0.784314
Iteration 7, loss = 0.48638737
Validation score: 0.790850
Iteration 8, loss = 0.46975879
Validation score: 0.816993
Iteration 9, loss = 0.45831798
Validation score: 0.830065
Iteration 10, loss = 0.44930990
Validation score: 0.830065
Iteration 11, loss = 0.44303734
Validation score: 0.836601
Iteration 12, loss = 0.43892629
Validation score: 0.836601
Iteration 13, loss = 0.43421932
Validation score: 0.843137

Iteration 14, loss = 0.43112885
Validation score: 0.836601
Iteration 15, loss = 0.42802936
Validation score: 0.836601
Iteration 16, loss = 0.42311964
Validation score: 0.843137
Iteration 17, loss = 0.41861636
Validation score: 0.836601
Iteration 18, loss = 0.41663637
Validation score: 0.843137
Iteration 19, loss = 0.41624765
Validation score: 0.843137
Iteration 20, loss = 0.41129992
Validation score: 0.856209
Iteration 21, loss = 0.40751849
Validation score: 0.836601
Iteration 22, loss = 0.40469084
Validation score: 0.836601
Iteration 23, loss = 0.40257069
Validation score: 0.849673
Iteration 24, loss = 0.39761788
Validation score: 0.849673
Iteration 25, loss = 0.39429963
Validation score: 0.836601
Iteration 26, loss = 0.39054373
Validation score: 0.836601
Iteration 27, loss = 0.38536922
Validation score: 0.823529
Iteration 28, loss = 0.38488172
Validation score: 0.836601
Iteration 29, loss = 0.37848084
Validation score: 0.830065
Iteration 30, loss = 0.37571448
Validation score: 0.849673
Iteration 31, loss = 0.37209188
Validation score: 0.849673
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.73291995
Validation score: 0.751634
Iteration 2, loss = 0.57101040
Validation score: 0.751634
Iteration 3, loss = 0.55468683
Validation score: 0.751634
Iteration 4, loss = 0.54362565
Validation score: 0.751634
Iteration 5, loss = 0.52873392
Validation score: 0.751634

Iteration 6, loss = 0.51248626
Validation score: 0.751634
Iteration 7, loss = 0.50085397
Validation score: 0.751634
Iteration 8, loss = 0.48408904
Validation score: 0.751634
Iteration 9, loss = 0.47089875
Validation score: 0.777778
Iteration 10, loss = 0.46294817
Validation score: 0.784314
Iteration 11, loss = 0.45721748
Validation score: 0.797386
Iteration 12, loss = 0.44910057
Validation score: 0.803922
Iteration 13, loss = 0.44581879
Validation score: 0.830065
Iteration 14, loss = 0.44235958
Validation score: 0.823529
Iteration 15, loss = 0.44006783
Validation score: 0.830065
Iteration 16, loss = 0.44269366
Validation score: 0.823529
Iteration 17, loss = 0.43408139
Validation score: 0.823529
Iteration 18, loss = 0.43205562
Validation score: 0.830065
Iteration 19, loss = 0.42999954
Validation score: 0.830065
Iteration 20, loss = 0.42758551
Validation score: 0.830065
Iteration 21, loss = 0.42503123
Validation score: 0.830065
Iteration 22, loss = 0.42367338
Validation score: 0.830065
Iteration 23, loss = 0.42024020
Validation score: 0.836601
Iteration 24, loss = 0.41648298
Validation score: 0.836601
Iteration 25, loss = 0.41439777
Validation score: 0.843137
Iteration 26, loss = 0.41280565
Validation score: 0.836601
Iteration 27, loss = 0.41221073
Validation score: 0.830065
Iteration 28, loss = 0.40762646
Validation score: 0.836601
Iteration 29, loss = 0.40838141
Validation score: 0.843137

Iteration 30, loss = 0.40164632
Validation score: 0.836601
Iteration 31, loss = 0.40103195
Validation score: 0.843137
Iteration 32, loss = 0.39426742
Validation score: 0.830065
Iteration 33, loss = 0.39181135
Validation score: 0.830065
Iteration 34, loss = 0.38870499
Validation score: 0.836601
Iteration 35, loss = 0.38534350
Validation score: 0.836601
Iteration 36, loss = 0.39003171
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.73696456
Validation score: 0.771242
Iteration 2, loss = 0.57324179
Validation score: 0.771242
Iteration 3, loss = 0.55254094
Validation score: 0.771242
Iteration 4, loss = 0.53981269
Validation score: 0.771242
Iteration 5, loss = 0.52130892
Validation score: 0.771242
Iteration 6, loss = 0.49944882
Validation score: 0.771242
Iteration 7, loss = 0.48227664
Validation score: 0.764706
Iteration 8, loss = 0.46427293
Validation score: 0.764706
Iteration 9, loss = 0.45228792
Validation score: 0.790850
Iteration 10, loss = 0.44272923
Validation score: 0.790850
Iteration 11, loss = 0.43733811
Validation score: 0.790850
Iteration 12, loss = 0.43353328
Validation score: 0.797386
Iteration 13, loss = 0.42588503
Validation score: 0.797386
Iteration 14, loss = 0.42496140
Validation score: 0.790850
Iteration 15, loss = 0.42313696
Validation score: 0.803922
Iteration 16, loss = 0.42533660
Validation score: 0.797386

Iteration 17, loss = 0.41420499
Validation score: 0.784314
Iteration 18, loss = 0.41387966
Validation score: 0.803922
Iteration 19, loss = 0.41024398
Validation score: 0.797386
Iteration 20, loss = 0.40786234
Validation score: 0.790850
Iteration 21, loss = 0.40568678
Validation score: 0.790850
Iteration 22, loss = 0.40526048
Validation score: 0.790850
Iteration 23, loss = 0.40077898
Validation score: 0.784314
Iteration 24, loss = 0.39740904
Validation score: 0.790850
Iteration 25, loss = 0.39568507
Validation score: 0.784314
Iteration 26, loss = 0.39405052
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.73157951
Validation score: 0.797386
Iteration 2, loss = 0.57719749
Validation score: 0.797386
Iteration 3, loss = 0.55533733
Validation score: 0.797386
Iteration 4, loss = 0.54054722
Validation score: 0.797386
Iteration 5, loss = 0.52074876
Validation score: 0.797386
Iteration 6, loss = 0.49954372
Validation score: 0.797386
Iteration 7, loss = 0.47867980
Validation score: 0.803922
Iteration 8, loss = 0.46388388
Validation score: 0.823529
Iteration 9, loss = 0.45207439
Validation score: 0.823529
Iteration 10, loss = 0.44409182
Validation score: 0.823529
Iteration 11, loss = 0.43766768
Validation score: 0.823529
Iteration 12, loss = 0.43451561
Validation score: 0.836601
Iteration 13, loss = 0.43112785
Validation score: 0.830065

Iteration 14, loss = 0.43021211
Validation score: 0.830065
Iteration 15, loss = 0.42621659
Validation score: 0.836601
Iteration 16, loss = 0.42865703
Validation score: 0.843137
Iteration 17, loss = 0.41988296
Validation score: 0.836601
Iteration 18, loss = 0.41814771
Validation score: 0.843137
Iteration 19, loss = 0.41411379
Validation score: 0.849673
Iteration 20, loss = 0.41305071
Validation score: 0.843137
Iteration 21, loss = 0.40832695
Validation score: 0.843137
Iteration 22, loss = 0.40629431
Validation score: 0.843137
Iteration 23, loss = 0.40259320
Validation score: 0.849673
Iteration 24, loss = 0.39898923
Validation score: 0.849673
Iteration 25, loss = 0.39808843
Validation score: 0.843137
Iteration 26, loss = 0.39337145
Validation score: 0.849673
Iteration 27, loss = 0.39225934
Validation score: 0.849673
Iteration 28, loss = 0.39137186
Validation score: 0.836601
Iteration 29, loss = 0.38409472
Validation score: 0.836601
Iteration 30, loss = 0.38287772
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.80330752
Validation score: 0.830065
Iteration 2, loss = 0.65527409
Validation score: 0.830065
Iteration 3, loss = 0.60838086
Validation score: 0.830065
Iteration 4, loss = 0.59254401
Validation score: 0.830065
Iteration 5, loss = 0.58574262
Validation score: 0.830065
Iteration 6, loss = 0.58263856
Validation score: 0.830065

Iteration 7, loss = 0.58019799
Validation score: 0.830065
Iteration 8, loss = 0.57872200
Validation score: 0.830065
Iteration 9, loss = 0.57744275
Validation score: 0.830065
Iteration 10, loss = 0.57652927
Validation score: 0.830065
Iteration 11, loss = 0.57575430
Validation score: 0.830065
Iteration 12, loss = 0.57497938
Validation score: 0.830065
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.79875162
Validation score: 0.784314
Iteration 2, loss = 0.64815604
Validation score: 0.784314
Iteration 3, loss = 0.59914653
Validation score: 0.784314
Iteration 4, loss = 0.58241363
Validation score: 0.784314
Iteration 5, loss = 0.57557032
Validation score: 0.784314
Iteration 6, loss = 0.57208005
Validation score: 0.784314
Iteration 7, loss = 0.57000495
Validation score: 0.784314
Iteration 8, loss = 0.56842297
Validation score: 0.784314
Iteration 9, loss = 0.56718641
Validation score: 0.784314
Iteration 10, loss = 0.56619595
Validation score: 0.784314
Iteration 11, loss = 0.56551386
Validation score: 0.784314
Iteration 12, loss = 0.56466764
Validation score: 0.784314
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.79917142
Validation score: 0.751634
Iteration 2, loss = 0.64203773
Validation score: 0.751634
Iteration 3, loss = 0.59803516
Validation score: 0.751634
Iteration 4, loss = 0.58073713
Validation score: 0.751634

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Iteration 5, loss = 0.57378116
Validation score: 0.751634
Iteration 6, loss = 0.57051726
Validation score: 0.751634
Iteration 7, loss = 0.56882642
Validation score: 0.751634
Iteration 8, loss = 0.56722349
Validation score: 0.751634
Iteration 9, loss = 0.56597017
Validation score: 0.751634
Iteration 10, loss = 0.56505030
Validation score: 0.751634
Iteration 11, loss = 0.56443317
Validation score: 0.751634
Iteration 12, loss = 0.56363002
Validation score: 0.751634
Validation score did not improve more than tol=0.000100 for 10 consecutive
epochs. Stopping.
Iteration 1, loss = 0.80075329
Validation score: 0.771242
Iteration 2, loss = 0.64480515
Validation score: 0.771242
Iteration 3, loss = 0.59675688
Validation score: 0.771242
Iteration 4, loss = 0.58085417
Validation score: 0.771242
Iteration 5, loss = 0.57495130
Validation score: 0.771242
Iteration 6, loss = 0.57198793
Validation score: 0.771242
Iteration 7, loss = 0.57030739
Validation score: 0.771242
Iteration 8, loss = 0.56874981
Validation score: 0.771242
Iteration 9, loss = 0.56754116
Validation score: 0.771242
Iteration 10, loss = 0.56665561
Validation score: 0.771242
Iteration 11, loss = 0.56598803
Validation score: 0.771242
Iteration 12, loss = 0.56529278
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive
epochs. Stopping.
Iteration 1, loss = 0.80183932
Validation score: 0.797386
Iteration 2, loss = 0.64837820
Validation score: 0.797386

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Iteration 3, loss = 0.60148124
Validation score: 0.797386
Iteration 4, loss = 0.58578710
Validation score: 0.797386
Iteration 5, loss = 0.58004785
Validation score: 0.797386
Iteration 6, loss = 0.57714688
Validation score: 0.797386
Iteration 7, loss = 0.57549617
Validation score: 0.797386
Iteration 8, loss = 0.57393482
Validation score: 0.797386
Iteration 9, loss = 0.57274381
Validation score: 0.797386
Iteration 10, loss = 0.57142808
Validation score: 0.797386
Iteration 11, loss = 0.57086621
Validation score: 0.797386
Iteration 12, loss = 0.57010437
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.57806921
Validation score: 0.797386
Iteration 2, loss = 0.51510548
Validation score: 0.797386
Iteration 3, loss = 0.47943951
Validation score: 0.816993
Iteration 4, loss = 0.48129882
Validation score: 0.823529
Iteration 5, loss = 0.48904459
Validation score: 0.803922
Iteration 6, loss = 0.47885536
Validation score: 0.810458
Iteration 7, loss = 0.46969856
Validation score: 0.849673
Iteration 8, loss = 0.47570506
Validation score: 0.803922
Iteration 9, loss = 0.46930938
Validation score: 0.843137
Iteration 10, loss = 0.46363121
Validation score: 0.836601
Iteration 11, loss = 0.45928239
Validation score: 0.843137
Iteration 12, loss = 0.44374670
Validation score: 0.830065
Iteration 13, loss = 0.43874146
Validation score: 0.843137

Iteration 14, loss = 0.44356703
Validation score: 0.836601
Iteration 15, loss = 0.42864533
Validation score: 0.830065
Iteration 16, loss = 0.41778193
Validation score: 0.836601
Iteration 17, loss = 0.45600736
Validation score: 0.830065
Iteration 18, loss = 0.43036571
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.57623449
Validation score: 0.810458
Iteration 2, loss = 0.50882991
Validation score: 0.823529
Iteration 3, loss = 0.47374671
Validation score: 0.810458
Iteration 4, loss = 0.48060347
Validation score: 0.830065
Iteration 5, loss = 0.47301007
Validation score: 0.810458
Iteration 6, loss = 0.45294661
Validation score: 0.810458
Iteration 7, loss = 0.43784260
Validation score: 0.823529
Iteration 8, loss = 0.42046800
Validation score: 0.784314
Iteration 9, loss = 0.44162674
Validation score: 0.784314
Iteration 10, loss = 0.43600129
Validation score: 0.823529
Iteration 11, loss = 0.44154980
Validation score: 0.823529
Iteration 12, loss = 0.44511459
Validation score: 0.823529
Iteration 13, loss = 0.44764387
Validation score: 0.816993
Iteration 14, loss = 0.43393708
Validation score: 0.816993
Iteration 15, loss = 0.41847783
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.60187774
Validation score: 0.790850
Iteration 2, loss = 0.52661478
Validation score: 0.790850

Iteration 3, loss = 0.49055513
Validation score: 0.803922
Iteration 4, loss = 0.50630785
Validation score: 0.797386
Iteration 5, loss = 0.47983933
Validation score: 0.803922
Iteration 6, loss = 0.48005672
Validation score: 0.810458
Iteration 7, loss = 0.48045302
Validation score: 0.797386
Iteration 8, loss = 0.47504634
Validation score: 0.803922
Iteration 9, loss = 0.53077775
Validation score: 0.790850
Iteration 10, loss = 0.51738398
Validation score: 0.797386
Iteration 11, loss = 0.49023576
Validation score: 0.803922
Iteration 12, loss = 0.50581826
Validation score: 0.797386
Iteration 13, loss = 0.50219370
Validation score: 0.790850
Iteration 14, loss = 0.48722378
Validation score: 0.823529
Iteration 15, loss = 0.46968609
Validation score: 0.816993
Iteration 16, loss = 0.46477029
Validation score: 0.803922
Iteration 17, loss = 0.46093134
Validation score: 0.803922
Iteration 18, loss = 0.46852160
Validation score: 0.816993
Iteration 19, loss = 0.44597639
Validation score: 0.823529
Iteration 20, loss = 0.45421593
Validation score: 0.816993
Iteration 21, loss = 0.45452642
Validation score: 0.803922
Iteration 22, loss = 0.48671319
Validation score: 0.810458
Iteration 23, loss = 0.45366879
Validation score: 0.810458
Iteration 24, loss = 0.45802386
Validation score: 0.803922
Iteration 25, loss = 0.44495615
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.59368474
Validation score: 0.797386
Iteration 2, loss = 0.50017047
Validation score: 0.810458
Iteration 3, loss = 0.47013323
Validation score: 0.797386
Iteration 4, loss = 0.51666212
Validation score: 0.764706
Iteration 5, loss = 0.50372180
Validation score: 0.797386
Iteration 6, loss = 0.46244385
Validation score: 0.790850
Iteration 7, loss = 0.46992476
Validation score: 0.790850
Iteration 8, loss = 0.46512878
Validation score: 0.784314
Iteration 9, loss = 0.50991875
Validation score: 0.784314
Iteration 10, loss = 0.47157076
Validation score: 0.777778
Iteration 11, loss = 0.45769306
Validation score: 0.810458
Iteration 12, loss = 0.46247950
Validation score: 0.777778
Iteration 13, loss = 0.45937768
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.59435681
Validation score: 0.816993
Iteration 2, loss = 0.50688756
Validation score: 0.816993
Iteration 3, loss = 0.48202535
Validation score: 0.830065
Iteration 4, loss = 0.51765407
Validation score: 0.830065
Iteration 5, loss = 0.46809315
Validation score: 0.823529
Iteration 6, loss = 0.48437934
Validation score: 0.816993
Iteration 7, loss = 0.55096568
Validation score: 0.816993
Iteration 8, loss = 0.48938094
Validation score: 0.836601
Iteration 9, loss = 0.50793770
Validation score: 0.823529
Iteration 10, loss = 0.47336765
Validation score: 0.803922

Iteration 11, loss = 0.46165961
Validation score: 0.803922
Iteration 12, loss = 0.47151138
Validation score: 0.830065
Iteration 13, loss = 0.46002023
Validation score: 0.830065
Iteration 14, loss = 0.44491246
Validation score: 0.823529
Iteration 15, loss = 0.45596528
Validation score: 0.823529
Iteration 16, loss = 0.44734667
Validation score: 0.823529
Iteration 17, loss = 0.45390134
Validation score: 0.830065
Iteration 18, loss = 0.46047552
Validation score: 0.836601
Iteration 19, loss = 0.44585584
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.60922528
Validation score: 0.797386
Iteration 2, loss = 0.56692086
Validation score: 0.797386
Iteration 3, loss = 0.54938617
Validation score: 0.797386
Iteration 4, loss = 0.50714510
Validation score: 0.803922
Iteration 5, loss = 0.49085613
Validation score: 0.849673
Iteration 6, loss = 0.47606205
Validation score: 0.856209
Iteration 7, loss = 0.46773001
Validation score: 0.836601
Iteration 8, loss = 0.46492998
Validation score: 0.836601
Iteration 9, loss = 0.46413060
Validation score: 0.836601
Iteration 10, loss = 0.45397605
Validation score: 0.843137
Iteration 11, loss = 0.44339157
Validation score: 0.830065
Iteration 12, loss = 0.45354341
Validation score: 0.843137
Iteration 13, loss = 0.45547401
Validation score: 0.843137
Iteration 14, loss = 0.45102756
Validation score: 0.843137

Iteration 15, loss = 0.44405067
Validation score: 0.830065
Iteration 16, loss = 0.44414912
Validation score: 0.836601
Iteration 17, loss = 0.44640788
Validation score: 0.830065
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.61103911
Validation score: 0.810458
Iteration 2, loss = 0.57336882
Validation score: 0.810458
Iteration 3, loss = 0.56476267
Validation score: 0.810458
Iteration 4, loss = 0.54457783
Validation score: 0.810458
Iteration 5, loss = 0.50570225
Validation score: 0.810458
Iteration 6, loss = 0.48501660
Validation score: 0.816993
Iteration 7, loss = 0.47557908
Validation score: 0.764706
Iteration 8, loss = 0.47216123
Validation score: 0.830065
Iteration 9, loss = 0.46321661
Validation score: 0.810458
Iteration 10, loss = 0.46049448
Validation score: 0.823529
Iteration 11, loss = 0.45663843
Validation score: 0.823529
Iteration 12, loss = 0.47044581
Validation score: 0.810458
Iteration 13, loss = 0.45893708
Validation score: 0.823529
Iteration 14, loss = 0.44484466
Validation score: 0.823529
Iteration 15, loss = 0.44721019
Validation score: 0.816993
Iteration 16, loss = 0.44707529
Validation score: 0.830065
Iteration 17, loss = 0.45314727
Validation score: 0.823529
Iteration 18, loss = 0.44322059
Validation score: 0.830065
Iteration 19, loss = 0.44198853
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.61847430
Validation score: 0.790850
Iteration 2, loss = 0.57273933
Validation score: 0.790850
Iteration 3, loss = 0.56594208
Validation score: 0.790850
Iteration 4, loss = 0.58455248
Validation score: 0.790850
Iteration 5, loss = 0.56908105
Validation score: 0.790850
Iteration 6, loss = 0.57848003
Validation score: 0.790850
Iteration 7, loss = 0.56460455
Validation score: 0.790850
Iteration 8, loss = 0.54505465
Validation score: 0.176471
Iteration 9, loss = 0.59788736
Validation score: 0.790850
Iteration 10, loss = 0.52879293
Validation score: 0.797386
Iteration 11, loss = 0.48301264
Validation score: 0.823529
Iteration 12, loss = 0.47501767
Validation score: 0.797386
Iteration 13, loss = 0.47775233
Validation score: 0.797386
Iteration 14, loss = 0.50434012
Validation score: 0.810458
Iteration 15, loss = 0.45173048
Validation score: 0.797386
Iteration 16, loss = 0.47384698
Validation score: 0.797386
Iteration 17, loss = 0.46793547
Validation score: 0.803922
Iteration 18, loss = 0.46102980
Validation score: 0.816993
Iteration 19, loss = 0.45510053
Validation score: 0.810458
Iteration 20, loss = 0.45356477
Validation score: 0.816993
Iteration 21, loss = 0.44954941
Validation score: 0.267974
Iteration 22, loss = 0.55351964
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.61841102
Validation score: 0.797386

Iteration 2, loss = 0.57062464
Validation score: 0.797386
Iteration 3, loss = 0.56673245
Validation score: 0.797386
Iteration 4, loss = 0.58554174
Validation score: 0.797386
Iteration 5, loss = 0.58675458
Validation score: 0.797386
Iteration 6, loss = 0.57351563
Validation score: 0.797386
Iteration 7, loss = 0.56246154
Validation score: 0.797386
Iteration 8, loss = 0.54153280
Validation score: 0.156863
Iteration 9, loss = 0.60107225
Validation score: 0.797386
Iteration 10, loss = 0.57477257
Validation score: 0.797386
Iteration 11, loss = 0.56812471
Validation score: 0.797386
Iteration 12, loss = 0.56706181
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.62391771
Validation score: 0.816993
Iteration 2, loss = 0.57616495
Validation score: 0.816993
Iteration 3, loss = 0.57071114
Validation score: 0.816993
Iteration 4, loss = 0.59284007
Validation score: 0.816993
Iteration 5, loss = 0.57178527
Validation score: 0.816993
Iteration 6, loss = 0.58540711
Validation score: 0.816993
Iteration 7, loss = 0.58093008
Validation score: 0.816993
Iteration 8, loss = 0.56226642
Validation score: 0.379085
Iteration 9, loss = 0.55084498
Validation score: 0.816993
Iteration 10, loss = 0.49549720
Validation score: 0.816993
Iteration 11, loss = 0.49258852
Validation score: 0.810458
Iteration 12, loss = 0.46349219
Validation score: 0.816993

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.64359615
Validation score: 0.797386
Iteration 2, loss = 0.51412568
Validation score: 0.797386
Iteration 3, loss = 0.47363441
Validation score: 0.830065
Iteration 4, loss = 0.44954582
Validation score: 0.830065
Iteration 5, loss = 0.45784141
Validation score: 0.843137
Iteration 6, loss = 0.43631658
Validation score: 0.843137
Iteration 7, loss = 0.42392987
Validation score: 0.843137
Iteration 8, loss = 0.41961698
Validation score: 0.830065
Iteration 9, loss = 0.40646982
Validation score: 0.849673
Iteration 10, loss = 0.39056255
Validation score: 0.830065
Iteration 11, loss = 0.37831154
Validation score: 0.843137
Iteration 12, loss = 0.36253559
Validation score: 0.843137
Iteration 13, loss = 0.34140582
Validation score: 0.836601
Iteration 14, loss = 0.33024789
Validation score: 0.830065
Iteration 15, loss = 0.31799682
Validation score: 0.836601
Iteration 16, loss = 0.29628747
Validation score: 0.816993
Iteration 17, loss = 0.28172025
Validation score: 0.816993
Iteration 18, loss = 0.26472857
Validation score: 0.843137
Iteration 19, loss = 0.25419673
Validation score: 0.823529
Iteration 20, loss = 0.23911509
Validation score: 0.816993
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.63982909
Validation score: 0.810458
Iteration 2, loss = 0.51052968
Validation score: 0.810458

Iteration 3, loss = 0.47401000
Validation score: 0.816993
Iteration 4, loss = 0.46109467
Validation score: 0.830065
Iteration 5, loss = 0.45394122
Validation score: 0.830065
Iteration 6, loss = 0.44687435
Validation score: 0.823529
Iteration 7, loss = 0.43153268
Validation score: 0.823529
Iteration 8, loss = 0.42542190
Validation score: 0.810458
Iteration 9, loss = 0.42930750
Validation score: 0.816993
Iteration 10, loss = 0.41141182
Validation score: 0.816993
Iteration 11, loss = 0.40325680
Validation score: 0.823529
Iteration 12, loss = 0.39998972
Validation score: 0.823529
Iteration 13, loss = 0.38606334
Validation score: 0.810458
Iteration 14, loss = 0.37655546
Validation score: 0.810458
Iteration 15, loss = 0.37101993
Validation score: 0.816993
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.65266441
Validation score: 0.790850
Iteration 2, loss = 0.52184112
Validation score: 0.790850
Iteration 3, loss = 0.48274033
Validation score: 0.810458
Iteration 4, loss = 0.47565474
Validation score: 0.823529
Iteration 5, loss = 0.45315157
Validation score: 0.810458
Iteration 6, loss = 0.46329176
Validation score: 0.810458
Iteration 7, loss = 0.43842879
Validation score: 0.823529
Iteration 8, loss = 0.43366402
Validation score: 0.810458
Iteration 9, loss = 0.43114916
Validation score: 0.810458
Iteration 10, loss = 0.42400391
Validation score: 0.810458

Iteration 11, loss = 0.40966863
Validation score: 0.803922
Iteration 12, loss = 0.41064531
Validation score: 0.803922
Iteration 13, loss = 0.39971006
Validation score: 0.797386
Iteration 14, loss = 0.38761434
Validation score: 0.803922
Iteration 15, loss = 0.38112990
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.64465768
Validation score: 0.797386
Iteration 2, loss = 0.51071669
Validation score: 0.797386
Iteration 3, loss = 0.46786005
Validation score: 0.810458
Iteration 4, loss = 0.45791642
Validation score: 0.797386
Iteration 5, loss = 0.46872368
Validation score: 0.803922
Iteration 6, loss = 0.43088018
Validation score: 0.790850
Iteration 7, loss = 0.42323234
Validation score: 0.790850
Iteration 8, loss = 0.42544916
Validation score: 0.784314
Iteration 9, loss = 0.42696365
Validation score: 0.777778
Iteration 10, loss = 0.41262215
Validation score: 0.784314
Iteration 11, loss = 0.39708582
Validation score: 0.764706
Iteration 12, loss = 0.39306753
Validation score: 0.784314
Iteration 13, loss = 0.38600547
Validation score: 0.790850
Iteration 14, loss = 0.37443695
Validation score: 0.777778
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.64631784
Validation score: 0.816993
Iteration 2, loss = 0.51076842
Validation score: 0.816993
Iteration 3, loss = 0.47124023
Validation score: 0.823529

Iteration 4, loss = 0.45922282
Validation score: 0.836601
Iteration 5, loss = 0.43638375
Validation score: 0.836601
Iteration 6, loss = 0.44137138
Validation score: 0.830065
Iteration 7, loss = 0.44395142
Validation score: 0.830065
Iteration 8, loss = 0.42648514
Validation score: 0.836601
Iteration 9, loss = 0.42137035
Validation score: 0.836601
Iteration 10, loss = 0.41049309
Validation score: 0.830065
Iteration 11, loss = 0.39575901
Validation score: 0.830065
Iteration 12, loss = 0.39196131
Validation score: 0.830065
Iteration 13, loss = 0.38169557
Validation score: 0.830065
Iteration 14, loss = 0.37407260
Validation score: 0.830065
Iteration 15, loss = 0.37380625
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.73608325
Validation score: 0.797386
Iteration 2, loss = 0.57161995
Validation score: 0.797386
Iteration 3, loss = 0.57042966
Validation score: 0.797386
Iteration 4, loss = 0.56620635
Validation score: 0.797386
Iteration 5, loss = 0.56552813
Validation score: 0.797386
Iteration 6, loss = 0.56272078
Validation score: 0.797386
Iteration 7, loss = 0.56017901
Validation score: 0.797386
Iteration 8, loss = 0.55845075
Validation score: 0.797386
Iteration 9, loss = 0.55591586
Validation score: 0.797386
Iteration 10, loss = 0.55360193
Validation score: 0.797386
Iteration 11, loss = 0.54891699
Validation score: 0.797386

Iteration 12, loss = 0.54762558
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.74325137
Validation score: 0.810458
Iteration 2, loss = 0.57525567
Validation score: 0.810458
Iteration 3, loss = 0.57193757
Validation score: 0.810458
Iteration 4, loss = 0.56930165
Validation score: 0.810458
Iteration 5, loss = 0.56975433
Validation score: 0.810458
Iteration 6, loss = 0.56674842
Validation score: 0.810458
Iteration 7, loss = 0.56430469
Validation score: 0.810458
Iteration 8, loss = 0.56366987
Validation score: 0.810458
Iteration 9, loss = 0.56403015
Validation score: 0.810458
Iteration 10, loss = 0.55864422
Validation score: 0.810458
Iteration 11, loss = 0.55423777
Validation score: 0.810458
Iteration 12, loss = 0.55132038
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.75593349
Validation score: 0.790850
Iteration 2, loss = 0.57148077
Validation score: 0.790850
Iteration 3, loss = 0.56831682
Validation score: 0.790850
Iteration 4, loss = 0.57095606
Validation score: 0.790850
Iteration 5, loss = 0.56585339
Validation score: 0.790850
Iteration 6, loss = 0.57305195
Validation score: 0.790850
Iteration 7, loss = 0.56372518
Validation score: 0.790850
Iteration 8, loss = 0.56259606
Validation score: 0.790850
Iteration 9, loss = 0.56926649
Validation score: 0.790850

Iteration 10, loss = 0.55899316
Validation score: 0.790850
Iteration 11, loss = 0.55711488
Validation score: 0.790850
Iteration 12, loss = 0.55597849
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.74840023
Validation score: 0.797386
Iteration 2, loss = 0.57217872
Validation score: 0.797386
Iteration 3, loss = 0.56715604
Validation score: 0.797386
Iteration 4, loss = 0.56894998
Validation score: 0.797386
Iteration 5, loss = 0.56947219
Validation score: 0.797386
Iteration 6, loss = 0.56780625
Validation score: 0.797386
Iteration 7, loss = 0.56106266
Validation score: 0.797386
Iteration 8, loss = 0.55893693
Validation score: 0.797386
Iteration 9, loss = 0.55924802
Validation score: 0.797386
Iteration 10, loss = 0.55355582
Validation score: 0.797386
Iteration 11, loss = 0.54845601
Validation score: 0.797386
Iteration 12, loss = 0.54479581
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.74836398
Validation score: 0.816993
Iteration 2, loss = 0.57759580
Validation score: 0.816993
Iteration 3, loss = 0.57298781
Validation score: 0.816993
Iteration 4, loss = 0.57586449
Validation score: 0.816993
Iteration 5, loss = 0.57045843
Validation score: 0.816993
Iteration 6, loss = 0.57674464
Validation score: 0.816993
Iteration 7, loss = 0.57086808
Validation score: 0.816993

Iteration 8, loss = 0.56715566
Validation score: 0.816993
Iteration 9, loss = 0.56883666
Validation score: 0.816993
Iteration 10, loss = 0.56308106
Validation score: 0.816993
Iteration 11, loss = 0.55982575
Validation score: 0.816993
Iteration 12, loss = 0.55591569
Validation score: 0.816993
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.01970966
Validation score: 0.797386
Iteration 2, loss = 0.74268982
Validation score: 0.797386
Iteration 3, loss = 0.57688933
Validation score: 0.797386
Iteration 4, loss = 0.55063840
Validation score: 0.797386
Iteration 5, loss = 0.53724550
Validation score: 0.797386
Iteration 6, loss = 0.51959124
Validation score: 0.797386
Iteration 7, loss = 0.49678511
Validation score: 0.797386
Iteration 8, loss = 0.47632410
Validation score: 0.810458
Iteration 9, loss = 0.45992607
Validation score: 0.830065
Iteration 10, loss = 0.44994073
Validation score: 0.836601
Iteration 11, loss = 0.44157310
Validation score: 0.843137
Iteration 12, loss = 0.43935545
Validation score: 0.843137
Iteration 13, loss = 0.43153294
Validation score: 0.843137
Iteration 14, loss = 0.42867631
Validation score: 0.843137
Iteration 15, loss = 0.42476687
Validation score: 0.843137
Iteration 16, loss = 0.42275820
Validation score: 0.843137
Iteration 17, loss = 0.42029764
Validation score: 0.843137
Iteration 18, loss = 0.41757709
Validation score: 0.843137

Iteration 19, loss = 0.41924155
Validation score: 0.843137
Iteration 20, loss = 0.41519425
Validation score: 0.843137
Iteration 21, loss = 0.41487337
Validation score: 0.843137
Iteration 22, loss = 0.40870745
Validation score: 0.843137
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.01968760
Validation score: 0.810458
Iteration 2, loss = 0.73241444
Validation score: 0.810458
Iteration 3, loss = 0.57764516
Validation score: 0.810458
Iteration 4, loss = 0.55191751
Validation score: 0.810458
Iteration 5, loss = 0.53828508
Validation score: 0.810458
Iteration 6, loss = 0.51745421
Validation score: 0.810458
Iteration 7, loss = 0.49210972
Validation score: 0.816993
Iteration 8, loss = 0.47247741
Validation score: 0.816993
Iteration 9, loss = 0.46229437
Validation score: 0.823529
Iteration 10, loss = 0.44948772
Validation score: 0.823529
Iteration 11, loss = 0.44187781
Validation score: 0.823529
Iteration 12, loss = 0.43896737
Validation score: 0.823529
Iteration 13, loss = 0.43379299
Validation score: 0.823529
Iteration 14, loss = 0.43099409
Validation score: 0.823529
Iteration 15, loss = 0.42924972
Validation score: 0.823529
Iteration 16, loss = 0.42714404
Validation score: 0.823529
Iteration 17, loss = 0.42591693
Validation score: 0.823529
Iteration 18, loss = 0.42337938
Validation score: 0.823529
Iteration 19, loss = 0.42350466
Validation score: 0.823529

Iteration 20, loss = 0.41959316
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.02364848
Validation score: 0.790850
Iteration 2, loss = 0.74791779
Validation score: 0.790850
Iteration 3, loss = 0.57525329
Validation score: 0.790850
Iteration 4, loss = 0.55509040
Validation score: 0.790850
Iteration 5, loss = 0.54605422
Validation score: 0.790850
Iteration 6, loss = 0.53810415
Validation score: 0.790850
Iteration 7, loss = 0.52311291
Validation score: 0.790850
Iteration 8, loss = 0.50366829
Validation score: 0.797386
Iteration 9, loss = 0.49213987
Validation score: 0.797386
Iteration 10, loss = 0.47173709
Validation score: 0.797386
Iteration 11, loss = 0.46051751
Validation score: 0.810458
Iteration 12, loss = 0.45425550
Validation score: 0.810458
Iteration 13, loss = 0.44631311
Validation score: 0.803922
Iteration 14, loss = 0.44239542
Validation score: 0.810458
Iteration 15, loss = 0.43891696
Validation score: 0.797386
Iteration 16, loss = 0.43573314
Validation score: 0.803922
Iteration 17, loss = 0.43350004
Validation score: 0.797386
Iteration 18, loss = 0.43033001
Validation score: 0.810458
Iteration 19, loss = 0.42735424
Validation score: 0.816993
Iteration 20, loss = 0.42461867
Validation score: 0.797386
Iteration 21, loss = 0.42510803
Validation score: 0.797386
Iteration 22, loss = 0.42745765
Validation score: 0.797386

Iteration 23, loss = 0.41899567
Validation score: 0.810458
Iteration 24, loss = 0.41550518
Validation score: 0.803922
Iteration 25, loss = 0.41162790
Validation score: 0.810458
Iteration 26, loss = 0.40955767
Validation score: 0.790850
Iteration 27, loss = 0.40671986
Validation score: 0.797386
Iteration 28, loss = 0.40221124
Validation score: 0.803922
Iteration 29, loss = 0.40009352
Validation score: 0.810458
Iteration 30, loss = 0.39846462
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.02257211
Validation score: 0.797386
Iteration 2, loss = 0.73699257
Validation score: 0.797386
Iteration 3, loss = 0.56896226
Validation score: 0.797386
Iteration 4, loss = 0.54938579
Validation score: 0.797386
Iteration 5, loss = 0.53883255
Validation score: 0.797386
Iteration 6, loss = 0.52689717
Validation score: 0.797386
Iteration 7, loss = 0.50844986
Validation score: 0.803922
Iteration 8, loss = 0.49004916
Validation score: 0.790850
Iteration 9, loss = 0.47496709
Validation score: 0.790850
Iteration 10, loss = 0.46026048
Validation score: 0.803922
Iteration 11, loss = 0.44848670
Validation score: 0.803922
Iteration 12, loss = 0.44070809
Validation score: 0.797386
Iteration 13, loss = 0.43379157
Validation score: 0.797386
Iteration 14, loss = 0.43012208
Validation score: 0.797386
Iteration 15, loss = 0.42601416
Validation score: 0.803922

Iteration 16, loss = 0.42150987
Validation score: 0.803922
Iteration 17, loss = 0.41902494
Validation score: 0.797386
Iteration 18, loss = 0.41649472
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 1.02199154
Validation score: 0.816993
Iteration 2, loss = 0.74348157
Validation score: 0.816993
Iteration 3, loss = 0.57678193
Validation score: 0.816993
Iteration 4, loss = 0.55501603
Validation score: 0.816993
Iteration 5, loss = 0.54312491
Validation score: 0.816993
Iteration 6, loss = 0.53197540
Validation score: 0.816993
Iteration 7, loss = 0.51550918
Validation score: 0.816993
Iteration 8, loss = 0.49836300
Validation score: 0.816993
Iteration 9, loss = 0.48487968
Validation score: 0.810458
Iteration 10, loss = 0.47002878
Validation score: 0.810458
Iteration 11, loss = 0.45837073
Validation score: 0.810458
Iteration 12, loss = 0.44966075
Validation score: 0.816993
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 1.05905117
Validation score: 0.797386
Iteration 2, loss = 0.86368179
Validation score: 0.797386
Iteration 3, loss = 0.71858696
Validation score: 0.797386
Iteration 4, loss = 0.64293622
Validation score: 0.797386
Iteration 5, loss = 0.60797246
Validation score: 0.797386
Iteration 6, loss = 0.59157302
Validation score: 0.797386
Iteration 7, loss = 0.58359945
Validation score: 0.797386

Iteration 8, loss = 0.57916645
Validation score: 0.797386
Iteration 9, loss = 0.57638347
Validation score: 0.797386
Iteration 10, loss = 0.57424890
Validation score: 0.797386
Iteration 11, loss = 0.57267212
Validation score: 0.797386
Iteration 12, loss = 0.57139748
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.05976111
Validation score: 0.810458
Iteration 2, loss = 0.86925055
Validation score: 0.810458
Iteration 3, loss = 0.72440229
Validation score: 0.810458
Iteration 4, loss = 0.64740397
Validation score: 0.810458
Iteration 5, loss = 0.61204754
Validation score: 0.810458
Iteration 6, loss = 0.59528496
Validation score: 0.810458
Iteration 7, loss = 0.58733764
Validation score: 0.810458
Iteration 8, loss = 0.58286118
Validation score: 0.810458
Iteration 9, loss = 0.57992214
Validation score: 0.810458
Iteration 10, loss = 0.57768135
Validation score: 0.810458
Iteration 11, loss = 0.57595432
Validation score: 0.810458
Iteration 12, loss = 0.57464487
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.05924764
Validation score: 0.790850
Iteration 2, loss = 0.85691596
Validation score: 0.790850
Iteration 3, loss = 0.71048740
Validation score: 0.790850
Iteration 4, loss = 0.64134418
Validation score: 0.790850
Iteration 5, loss = 0.60702040
Validation score: 0.790850

Iteration 6, loss = 0.59215579
Validation score: 0.790850
Iteration 7, loss = 0.58345934
Validation score: 0.790850
Iteration 8, loss = 0.57865986
Validation score: 0.790850
Iteration 9, loss = 0.57624990
Validation score: 0.790850
Iteration 10, loss = 0.57387503
Validation score: 0.790850
Iteration 11, loss = 0.57226790
Validation score: 0.790850
Iteration 12, loss = 0.57123091
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.05847169
Validation score: 0.797386
Iteration 2, loss = 0.85448977
Validation score: 0.797386
Iteration 3, loss = 0.70919204
Validation score: 0.797386
Iteration 4, loss = 0.64147987
Validation score: 0.797386
Iteration 5, loss = 0.60975738
Validation score: 0.797386
Iteration 6, loss = 0.59385208
Validation score: 0.797386
Iteration 7, loss = 0.58397276
Validation score: 0.797386
Iteration 8, loss = 0.57867135
Validation score: 0.797386
Iteration 9, loss = 0.57604699
Validation score: 0.797386
Iteration 10, loss = 0.57379196
Validation score: 0.797386
Iteration 11, loss = 0.57205328
Validation score: 0.797386
Iteration 12, loss = 0.57089576
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.05944410
Validation score: 0.816993
Iteration 2, loss = 0.85940724
Validation score: 0.816993
Iteration 3, loss = 0.71500798
Validation score: 0.816993

Iteration 4, loss = 0.64662916
Validation score: 0.816993
Iteration 5, loss = 0.61246102
Validation score: 0.816993
Iteration 6, loss = 0.59875623
Validation score: 0.816993
Iteration 7, loss = 0.59122814
Validation score: 0.816993
Iteration 8, loss = 0.58523279
Validation score: 0.816993
Iteration 9, loss = 0.58235178
Validation score: 0.816993
Iteration 10, loss = 0.57973456
Validation score: 0.816993
Iteration 11, loss = 0.57788597
Validation score: 0.816993
Iteration 12, loss = 0.57656094
Validation score: 0.816993
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.57276254
Validation score: 0.836601
Iteration 2, loss = 0.49404967
Validation score: 0.843137
Iteration 3, loss = 0.48360572
Validation score: 0.862745
Iteration 4, loss = 0.46276396
Validation score: 0.862745
Iteration 5, loss = 0.45870262
Validation score: 0.875817
Iteration 6, loss = 0.44928322
Validation score: 0.862745
Iteration 7, loss = 0.43835058
Validation score: 0.862745
Iteration 8, loss = 0.45374870
Validation score: 0.882353
Iteration 9, loss = 0.44368985
Validation score: 0.869281
Iteration 10, loss = 0.44932242
Validation score: 0.875817
Iteration 11, loss = 0.41919250
Validation score: 0.843137
Iteration 12, loss = 0.43617598
Validation score: 0.869281
Iteration 13, loss = 0.42633001
Validation score: 0.862745
Iteration 14, loss = 0.43142347
Validation score: 0.862745

Iteration 15, loss = 0.41190136
Validation score: 0.816993
Iteration 16, loss = 0.41102970
Validation score: 0.830065
Iteration 17, loss = 0.39674455
Validation score: 0.856209
Iteration 18, loss = 0.40925484
Validation score: 0.849673
Iteration 19, loss = 0.41706560
Validation score: 0.869281
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.56684550
Validation score: 0.803922
Iteration 2, loss = 0.50179408
Validation score: 0.810458
Iteration 3, loss = 0.50448619
Validation score: 0.803922
Iteration 4, loss = 0.47758065
Validation score: 0.836601
Iteration 5, loss = 0.47568571
Validation score: 0.823529
Iteration 6, loss = 0.45461228
Validation score: 0.823529
Iteration 7, loss = 0.44870524
Validation score: 0.816993
Iteration 8, loss = 0.43691406
Validation score: 0.816993
Iteration 9, loss = 0.43984341
Validation score: 0.823529
Iteration 10, loss = 0.44803601
Validation score: 0.836601
Iteration 11, loss = 0.42309793
Validation score: 0.823529
Iteration 12, loss = 0.42871949
Validation score: 0.843137
Iteration 13, loss = 0.41118326
Validation score: 0.803922
Iteration 14, loss = 0.42394151
Validation score: 0.830065
Iteration 15, loss = 0.42741422
Validation score: 0.823529
Iteration 16, loss = 0.41706918
Validation score: 0.797386
Iteration 17, loss = 0.43576813
Validation score: 0.816993
Iteration 18, loss = 0.41991206
Validation score: 0.830065

Iteration 19, loss = 0.41801395
Validation score: 0.810458
Iteration 20, loss = 0.40843008
Validation score: 0.816993
Iteration 21, loss = 0.39381703
Validation score: 0.764706
Iteration 22, loss = 0.41531041
Validation score: 0.771242
Iteration 23, loss = 0.39386921
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.57955603
Validation score: 0.836601
Iteration 2, loss = 0.51918210
Validation score: 0.830065
Iteration 3, loss = 0.53395866
Validation score: 0.836601
Iteration 4, loss = 0.49612981
Validation score: 0.810458
Iteration 5, loss = 0.47126642
Validation score: 0.816993
Iteration 6, loss = 0.46086778
Validation score: 0.830065
Iteration 7, loss = 0.47312425
Validation score: 0.823529
Iteration 8, loss = 0.45838007
Validation score: 0.823529
Iteration 9, loss = 0.46576517
Validation score: 0.823529
Iteration 10, loss = 0.45502154
Validation score: 0.810458
Iteration 11, loss = 0.46384982
Validation score: 0.836601
Iteration 12, loss = 0.48086152
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.57424598
Validation score: 0.790850
Iteration 2, loss = 0.50784023
Validation score: 0.790850
Iteration 3, loss = 0.48566956
Validation score: 0.810458
Iteration 4, loss = 0.54375539
Validation score: 0.790850
Iteration 5, loss = 0.48600461
Validation score: 0.810458

Iteration 6, loss = 0.47078762
Validation score: 0.823529
Iteration 7, loss = 0.49577610
Validation score: 0.803922
Iteration 8, loss = 0.48091941
Validation score: 0.816993
Iteration 9, loss = 0.50213723
Validation score: 0.797386
Iteration 10, loss = 0.47483787
Validation score: 0.816993
Iteration 11, loss = 0.46483884
Validation score: 0.816993
Iteration 12, loss = 0.46355006
Validation score: 0.823529
Iteration 13, loss = 0.44747828
Validation score: 0.823529
Iteration 14, loss = 0.45455919
Validation score: 0.810458
Iteration 15, loss = 0.48605759
Validation score: 0.810458
Iteration 16, loss = 0.45104192
Validation score: 0.810458
Iteration 17, loss = 0.45828131
Validation score: 0.797386
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.56644376
Validation score: 0.758170
Iteration 2, loss = 0.47155969
Validation score: 0.764706
Iteration 3, loss = 0.48502724
Validation score: 0.777778
Iteration 4, loss = 0.49694063
Validation score: 0.764706
Iteration 5, loss = 0.44358642
Validation score: 0.764706
Iteration 6, loss = 0.44685810
Validation score: 0.771242
Iteration 7, loss = 0.45641331
Validation score: 0.764706
Iteration 8, loss = 0.43439181
Validation score: 0.771242
Iteration 9, loss = 0.47547780
Validation score: 0.771242
Iteration 10, loss = 0.43096318
Validation score: 0.764706
Iteration 11, loss = 0.44138396
Validation score: 0.764706

Iteration 12, loss = 0.43219127
Validation score: 0.764706
Iteration 13, loss = 0.43695118
Validation score: 0.771242
Iteration 14, loss = 0.42413464
Validation score: 0.758170
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.62006005
Validation score: 0.836601
Iteration 2, loss = 0.57805718
Validation score: 0.836601
Iteration 3, loss = 0.57164100
Validation score: 0.836601
Iteration 4, loss = 0.55230658
Validation score: 0.836601
Iteration 5, loss = 0.51413373
Validation score: 0.830065
Iteration 6, loss = 0.48674967
Validation score: 0.843137
Iteration 7, loss = 0.47403455
Validation score: 0.836601
Iteration 8, loss = 0.48059282
Validation score: 0.843137
Iteration 9, loss = 0.46753629
Validation score: 0.843137
Iteration 10, loss = 0.45287601
Validation score: 0.849673
Iteration 11, loss = 0.45142507
Validation score: 0.862745
Iteration 12, loss = 0.44856956
Validation score: 0.856209
Iteration 13, loss = 0.45384452
Validation score: 0.856209
Iteration 14, loss = 0.45256651
Validation score: 0.849673
Iteration 15, loss = 0.44554705
Validation score: 0.856209
Iteration 16, loss = 0.44432853
Validation score: 0.849673
Iteration 17, loss = 0.44648725
Validation score: 0.843137
Iteration 18, loss = 0.43825510
Validation score: 0.849673
Iteration 19, loss = 0.44518005
Validation score: 0.843137
Iteration 20, loss = 0.43371979
Validation score: 0.849673

Iteration 21, loss = 0.42550571
Validation score: 0.862745
Iteration 22, loss = 0.43193970
Validation score: 0.771242
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.61610156
Validation score: 0.803922
Iteration 2, loss = 0.56770554
Validation score: 0.803922
Iteration 3, loss = 0.56045306
Validation score: 0.803922
Iteration 4, loss = 0.52688227
Validation score: 0.803922
Iteration 5, loss = 0.49930878
Validation score: 0.810458
Iteration 6, loss = 0.47853583
Validation score: 0.803922
Iteration 7, loss = 0.47223344
Validation score: 0.810458
Iteration 8, loss = 0.46712473
Validation score: 0.803922
Iteration 9, loss = 0.45923739
Validation score: 0.790850
Iteration 10, loss = 0.45069500
Validation score: 0.816993
Iteration 11, loss = 0.46041012
Validation score: 0.810458
Iteration 12, loss = 0.44604672
Validation score: 0.810458
Iteration 13, loss = 0.44569889
Validation score: 0.803922
Iteration 14, loss = 0.45577882
Validation score: 0.797386
Iteration 15, loss = 0.44898545
Validation score: 0.784314
Iteration 16, loss = 0.44717339
Validation score: 0.823529
Iteration 17, loss = 0.45484595
Validation score: 0.816993
Iteration 18, loss = 0.44440995
Validation score: 0.803922
Iteration 19, loss = 0.43734526
Validation score: 0.816993
Iteration 20, loss = 0.43679343
Validation score: 0.816993
Iteration 21, loss = 0.44260185
Validation score: 0.816993

Iteration 22, loss = 0.43355487
Validation score: 0.816993
Iteration 23, loss = 0.43736354
Validation score: 0.797386
Iteration 24, loss = 0.43614912
Validation score: 0.823529
Iteration 25, loss = 0.43657313
Validation score: 0.810458
Iteration 26, loss = 0.43551947
Validation score: 0.823529
Iteration 27, loss = 0.42804742
Validation score: 0.823529
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.61689196
Validation score: 0.836601
Iteration 2, loss = 0.57789425
Validation score: 0.836601
Iteration 3, loss = 0.57452997
Validation score: 0.836601
Iteration 4, loss = 0.56577026
Validation score: 0.836601
Iteration 5, loss = 0.55123487
Validation score: 0.836601
Iteration 6, loss = 0.51418067
Validation score: 0.241830
Iteration 7, loss = 0.52313634
Validation score: 0.836601
Iteration 8, loss = 0.48765198
Validation score: 0.111111
Iteration 9, loss = 0.67276206
Validation score: 0.836601
Iteration 10, loss = 0.57461250
Validation score: 0.836601
Iteration 11, loss = 0.57028934
Validation score: 0.836601
Iteration 12, loss = 0.56191010
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.60996294
Validation score: 0.790850
Iteration 2, loss = 0.56887701
Validation score: 0.790850
Iteration 3, loss = 0.56365030
Validation score: 0.790850
Iteration 4, loss = 0.55766548
Validation score: 0.790850

Iteration 5, loss = 0.52806971
Validation score: 0.790850
Iteration 6, loss = 0.48895009
Validation score: 0.666667
Iteration 7, loss = 0.48838981
Validation score: 0.790850
Iteration 8, loss = 0.47035506
Validation score: 0.163399
Iteration 9, loss = 0.67702533
Validation score: 0.790850
Iteration 10, loss = 0.57141446
Validation score: 0.790850
Iteration 11, loss = 0.57146866
Validation score: 0.790850
Iteration 12, loss = 0.57083970
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.60891624
Validation score: 0.758170
Iteration 2, loss = 0.55867142
Validation score: 0.758170
Iteration 3, loss = 0.55616347
Validation score: 0.758170
Iteration 4, loss = 0.55763830
Validation score: 0.758170
Iteration 5, loss = 0.51982969
Validation score: 0.758170
Iteration 6, loss = 0.47911397
Validation score: 0.490196
Iteration 7, loss = 0.48233439
Validation score: 0.758170
Iteration 8, loss = 0.47079375
Validation score: 0.196078
Iteration 9, loss = 0.64034623
Validation score: 0.758170
Iteration 10, loss = 0.51522854
Validation score: 0.758170
Iteration 11, loss = 0.47288973
Validation score: 0.758170
Iteration 12, loss = 0.46487976
Validation score: 0.758170
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.66599618
Validation score: 0.836601
Iteration 2, loss = 0.51878657
Validation score: 0.843137

Iteration 3, loss = 0.48005595
Validation score: 0.856209
Iteration 4, loss = 0.46683547
Validation score: 0.849673
Iteration 5, loss = 0.45283498
Validation score: 0.849673
Iteration 6, loss = 0.44928849
Validation score: 0.856209
Iteration 7, loss = 0.44174110
Validation score: 0.875817
Iteration 8, loss = 0.44133051
Validation score: 0.869281
Iteration 9, loss = 0.42792477
Validation score: 0.869281
Iteration 10, loss = 0.41808366
Validation score: 0.862745
Iteration 11, loss = 0.40466548
Validation score: 0.869281
Iteration 12, loss = 0.39979491
Validation score: 0.869281
Iteration 13, loss = 0.38941484
Validation score: 0.862745
Iteration 14, loss = 0.37992570
Validation score: 0.882353
Iteration 15, loss = 0.36804608
Validation score: 0.849673
Iteration 16, loss = 0.36380537
Validation score: 0.882353
Iteration 17, loss = 0.34762727
Validation score: 0.843137
Iteration 18, loss = 0.34547669
Validation score: 0.843137
Iteration 19, loss = 0.31966780
Validation score: 0.849673
Iteration 20, loss = 0.31151394
Validation score: 0.849673
Iteration 21, loss = 0.29493703
Validation score: 0.843137
Iteration 22, loss = 0.30956694
Validation score: 0.856209
Iteration 23, loss = 0.28755423
Validation score: 0.816993
Iteration 24, loss = 0.27129237
Validation score: 0.862745
Iteration 25, loss = 0.25505541
Validation score: 0.830065
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.66216302
Validation score: 0.803922
Iteration 2, loss = 0.51827985
Validation score: 0.803922
Iteration 3, loss = 0.47620806
Validation score: 0.790850
Iteration 4, loss = 0.45798809
Validation score: 0.803922
Iteration 5, loss = 0.45319269
Validation score: 0.823529
Iteration 6, loss = 0.44071207
Validation score: 0.816993
Iteration 7, loss = 0.43707814
Validation score: 0.816993
Iteration 8, loss = 0.42787343
Validation score: 0.810458
Iteration 9, loss = 0.42613168
Validation score: 0.810458
Iteration 10, loss = 0.42291783
Validation score: 0.810458
Iteration 11, loss = 0.41514347
Validation score: 0.816993
Iteration 12, loss = 0.40528791
Validation score: 0.810458
Iteration 13, loss = 0.39987764
Validation score: 0.836601
Iteration 14, loss = 0.38724777
Validation score: 0.810458
Iteration 15, loss = 0.38180148
Validation score: 0.803922
Iteration 16, loss = 0.37538657
Validation score: 0.823529
Iteration 17, loss = 0.36803953
Validation score: 0.810458
Iteration 18, loss = 0.35453877
Validation score: 0.816993
Iteration 19, loss = 0.33175384
Validation score: 0.797386
Iteration 20, loss = 0.32313874
Validation score: 0.810458
Iteration 21, loss = 0.30524763
Validation score: 0.784314
Iteration 22, loss = 0.31817745
Validation score: 0.823529
Iteration 23, loss = 0.28012589
Validation score: 0.810458
Iteration 24, loss = 0.28148293
Validation score: 0.823529

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.63916159

Validation score: 0.836601

Iteration 2, loss = 0.52488683

Validation score: 0.836601

Iteration 3, loss = 0.48225766

Validation score: 0.823529

Iteration 4, loss = 0.45831169

Validation score: 0.830065

Iteration 5, loss = 0.44852755

Validation score: 0.830065

Iteration 6, loss = 0.44148949

Validation score: 0.830065

Iteration 7, loss = 0.44444738

Validation score: 0.803922

Iteration 8, loss = 0.43811299

Validation score: 0.830065

Iteration 9, loss = 0.44101681

Validation score: 0.790850

Iteration 10, loss = 0.43425848

Validation score: 0.823529

Iteration 11, loss = 0.43119935

Validation score: 0.830065

Iteration 12, loss = 0.43384729

Validation score: 0.830065

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.63587820

Validation score: 0.790850

Iteration 2, loss = 0.52159614

Validation score: 0.790850

Iteration 3, loss = 0.47154446

Validation score: 0.797386

Iteration 4, loss = 0.45139157

Validation score: 0.803922

Iteration 5, loss = 0.44158655

Validation score: 0.810458

Iteration 6, loss = 0.43497630

Validation score: 0.803922

Iteration 7, loss = 0.43377723

Validation score: 0.810458

Iteration 8, loss = 0.42646710

Validation score: 0.803922

Iteration 9, loss = 0.43235378

Validation score: 0.810458

Iteration 10, loss = 0.42729812

Validation score: 0.803922

Iteration 11, loss = 0.41989130
Validation score: 0.810458
Iteration 12, loss = 0.41801135
Validation score: 0.797386
Iteration 13, loss = 0.40653417
Validation score: 0.790850
Iteration 14, loss = 0.40003967
Validation score: 0.784314
Iteration 15, loss = 0.44732813
Validation score: 0.790850
Iteration 16, loss = 0.41429153
Validation score: 0.816993
Iteration 17, loss = 0.40248420
Validation score: 0.790850
Iteration 18, loss = 0.38793591
Validation score: 0.790850
Iteration 19, loss = 0.41619218
Validation score: 0.790850
Iteration 20, loss = 0.37549173
Validation score: 0.784314
Iteration 21, loss = 0.36852391
Validation score: 0.797386
Iteration 22, loss = 0.36636167
Validation score: 0.810458
Iteration 23, loss = 0.35301317
Validation score: 0.797386
Iteration 24, loss = 0.34105142
Validation score: 0.790850
Iteration 25, loss = 0.37754960
Validation score: 0.803922
Iteration 26, loss = 0.34257234
Validation score: 0.797386
Iteration 27, loss = 0.33596862
Validation score: 0.810458
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.66186343
Validation score: 0.758170
Iteration 2, loss = 0.50513926
Validation score: 0.758170
Iteration 3, loss = 0.46176371
Validation score: 0.764706
Iteration 4, loss = 0.44301782
Validation score: 0.771242
Iteration 5, loss = 0.42640397
Validation score: 0.764706
Iteration 6, loss = 0.41857422
Validation score: 0.771242

Iteration 7, loss = 0.41400695
Validation score: 0.777778
Iteration 8, loss = 0.40703360
Validation score: 0.784314
Iteration 9, loss = 0.41529982
Validation score: 0.784314
Iteration 10, loss = 0.39551694
Validation score: 0.771242
Iteration 11, loss = 0.39464785
Validation score: 0.771242
Iteration 12, loss = 0.37786000
Validation score: 0.764706
Iteration 13, loss = 0.36521580
Validation score: 0.764706
Iteration 14, loss = 0.35116220
Validation score: 0.764706
Iteration 15, loss = 0.37214613
Validation score: 0.751634
Iteration 16, loss = 0.33868889
Validation score: 0.751634
Iteration 17, loss = 0.32173373
Validation score: 0.764706
Iteration 18, loss = 0.30789925
Validation score: 0.764706
Iteration 19, loss = 0.32585539
Validation score: 0.738562
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.73629685
Validation score: 0.836601
Iteration 2, loss = 0.58399147
Validation score: 0.836601
Iteration 3, loss = 0.57674665
Validation score: 0.836601
Iteration 4, loss = 0.57664230
Validation score: 0.836601
Iteration 5, loss = 0.57544496
Validation score: 0.836601
Iteration 6, loss = 0.57492000
Validation score: 0.836601
Iteration 7, loss = 0.57540535
Validation score: 0.836601
Iteration 8, loss = 0.57449632
Validation score: 0.836601
Iteration 9, loss = 0.57451563
Validation score: 0.836601
Iteration 10, loss = 0.57250758
Validation score: 0.836601

Iteration 11, loss = 0.57145497
Validation score: 0.836601
Iteration 12, loss = 0.57185658
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.73241645
Validation score: 0.803922
Iteration 2, loss = 0.57501513
Validation score: 0.803922
Iteration 3, loss = 0.56911562
Validation score: 0.803922
Iteration 4, loss = 0.56830026
Validation score: 0.803922
Iteration 5, loss = 0.56781720
Validation score: 0.803922
Iteration 6, loss = 0.56728078
Validation score: 0.803922
Iteration 7, loss = 0.56715055
Validation score: 0.803922
Iteration 8, loss = 0.56667094
Validation score: 0.803922
Iteration 9, loss = 0.56557948
Validation score: 0.803922
Iteration 10, loss = 0.56497957
Validation score: 0.803922
Iteration 11, loss = 0.56413505
Validation score: 0.803922
Iteration 12, loss = 0.56388640
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.73576650
Validation score: 0.836601
Iteration 2, loss = 0.58178177
Validation score: 0.836601
Iteration 3, loss = 0.57460565
Validation score: 0.836601
Iteration 4, loss = 0.57475456
Validation score: 0.836601
Iteration 5, loss = 0.57260258
Validation score: 0.836601
Iteration 6, loss = 0.57129322
Validation score: 0.836601
Iteration 7, loss = 0.57287110
Validation score: 0.836601
Iteration 8, loss = 0.57116935
Validation score: 0.836601

Iteration 9, loss = 0.57308715
Validation score: 0.836601
Iteration 10, loss = 0.56927578
Validation score: 0.836601
Iteration 11, loss = 0.56962561
Validation score: 0.836601
Iteration 12, loss = 0.56787452
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.73219744
Validation score: 0.790850
Iteration 2, loss = 0.57720742
Validation score: 0.790850
Iteration 3, loss = 0.56876437
Validation score: 0.790850
Iteration 4, loss = 0.56858930
Validation score: 0.790850
Iteration 5, loss = 0.56653268
Validation score: 0.790850
Iteration 6, loss = 0.56539779
Validation score: 0.790850
Iteration 7, loss = 0.56570315
Validation score: 0.790850
Iteration 8, loss = 0.56558286
Validation score: 0.790850
Iteration 9, loss = 0.56655987
Validation score: 0.790850
Iteration 10, loss = 0.56375138
Validation score: 0.790850
Iteration 11, loss = 0.56248627
Validation score: 0.790850
Iteration 12, loss = 0.56087862
Validation score: 0.790850
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 0.72984088
Validation score: 0.758170
Iteration 2, loss = 0.56762650
Validation score: 0.758170
Iteration 3, loss = 0.55950657
Validation score: 0.758170
Iteration 4, loss = 0.55930558
Validation score: 0.758170
Iteration 5, loss = 0.55785218
Validation score: 0.758170
Iteration 6, loss = 0.55723685
Validation score: 0.758170

Iteration 7, loss = 0.55756253
Validation score: 0.758170
Iteration 8, loss = 0.55643267
Validation score: 0.758170
Iteration 9, loss = 0.55776443
Validation score: 0.758170
Iteration 10, loss = 0.55490190
Validation score: 0.758170
Iteration 11, loss = 0.55276412
Validation score: 0.758170
Iteration 12, loss = 0.55184761
Validation score: 0.758170
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.00328556
Validation score: 0.836601
Iteration 2, loss = 0.72911738
Validation score: 0.836601
Iteration 3, loss = 0.58420414
Validation score: 0.836601
Iteration 4, loss = 0.56400580
Validation score: 0.836601
Iteration 5, loss = 0.55312787
Validation score: 0.836601
Iteration 6, loss = 0.54418661
Validation score: 0.836601
Iteration 7, loss = 0.53374894
Validation score: 0.836601
Iteration 8, loss = 0.52178776
Validation score: 0.836601
Iteration 9, loss = 0.50691142
Validation score: 0.836601
Iteration 10, loss = 0.49182116
Validation score: 0.843137
Iteration 11, loss = 0.47905765
Validation score: 0.849673
Iteration 12, loss = 0.46820291
Validation score: 0.843137
Iteration 13, loss = 0.46001949
Validation score: 0.843137
Iteration 14, loss = 0.45304816
Validation score: 0.843137
Iteration 15, loss = 0.44891467
Validation score: 0.836601
Iteration 16, loss = 0.44683168
Validation score: 0.843137
Iteration 17, loss = 0.44390790
Validation score: 0.843137

Iteration 18, loss = 0.44050242
Validation score: 0.849673
Iteration 19, loss = 0.43973108
Validation score: 0.849673
Iteration 20, loss = 0.44017285
Validation score: 0.849673
Iteration 21, loss = 0.43364756
Validation score: 0.849673
Iteration 22, loss = 0.43465988
Validation score: 0.849673
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.00765884
Validation score: 0.803922
Iteration 2, loss = 0.73717369
Validation score: 0.803922
Iteration 3, loss = 0.57970662
Validation score: 0.803922
Iteration 4, loss = 0.55828851
Validation score: 0.803922
Iteration 5, loss = 0.54774483
Validation score: 0.803922
Iteration 6, loss = 0.53941248
Validation score: 0.803922
Iteration 7, loss = 0.53001416
Validation score: 0.803922
Iteration 8, loss = 0.52023498
Validation score: 0.803922
Iteration 9, loss = 0.50894379
Validation score: 0.803922
Iteration 10, loss = 0.49765239
Validation score: 0.803922
Iteration 11, loss = 0.48729980
Validation score: 0.803922
Iteration 12, loss = 0.47899924
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 0.99580213
Validation score: 0.836601
Iteration 2, loss = 0.71455390
Validation score: 0.836601
Iteration 3, loss = 0.58294656
Validation score: 0.836601
Iteration 4, loss = 0.56586018
Validation score: 0.836601
Iteration 5, loss = 0.55661832
Validation score: 0.836601

Iteration 6, loss = 0.54898396
 Validation score: 0.836601
 Iteration 7, loss = 0.54179998
 Validation score: 0.836601
 Iteration 8, loss = 0.53435801
 Validation score: 0.836601
 Iteration 9, loss = 0.52656209
 Validation score: 0.836601
 Iteration 10, loss = 0.51595885
 Validation score: 0.836601
 Iteration 11, loss = 0.50750917
 Validation score: 0.836601
 Iteration 12, loss = 0.49595274
 Validation score: 0.836601
 Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
 Iteration 1, loss = 0.99766155
 Validation score: 0.790850
 Iteration 2, loss = 0.71904418
 Validation score: 0.790850
 Iteration 3, loss = 0.57796738
 Validation score: 0.790850
 Iteration 4, loss = 0.55812455
 Validation score: 0.790850
 Iteration 5, loss = 0.54813239
 Validation score: 0.790850
 Iteration 6, loss = 0.54016860
 Validation score: 0.790850
 Iteration 7, loss = 0.53169111
 Validation score: 0.790850
 Iteration 8, loss = 0.52324752
 Validation score: 0.790850
 Iteration 9, loss = 0.51393728
 Validation score: 0.790850
 Iteration 10, loss = 0.50311886
 Validation score: 0.790850
 Iteration 11, loss = 0.49326826
 Validation score: 0.790850
 Iteration 12, loss = 0.48420707
 Validation score: 0.790850
 Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
 Iteration 1, loss = 1.00358369
 Validation score: 0.758170
 Iteration 2, loss = 0.71910073
 Validation score: 0.758170
 Iteration 3, loss = 0.56921297
 Validation score: 0.758170

Iteration 4, loss = 0.54961084
Validation score: 0.758170
Iteration 5, loss = 0.53985159
Validation score: 0.758170
Iteration 6, loss = 0.53132062
Validation score: 0.758170
Iteration 7, loss = 0.52255562
Validation score: 0.758170
Iteration 8, loss = 0.51448373
Validation score: 0.758170
Iteration 9, loss = 0.50479447
Validation score: 0.758170
Iteration 10, loss = 0.49335317
Validation score: 0.758170
Iteration 11, loss = 0.48159745
Validation score: 0.758170
Iteration 12, loss = 0.47214755
Validation score: 0.758170
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.02274595
Validation score: 0.836601
Iteration 2, loss = 0.84063863
Validation score: 0.836601
Iteration 3, loss = 0.73371049
Validation score: 0.836601
Iteration 4, loss = 0.67101014
Validation score: 0.836601
Iteration 5, loss = 0.63453713
Validation score: 0.836601
Iteration 6, loss = 0.61395146
Validation score: 0.836601
Iteration 7, loss = 0.60261346
Validation score: 0.836601
Iteration 8, loss = 0.59548825
Validation score: 0.836601
Iteration 9, loss = 0.59108022
Validation score: 0.836601
Iteration 10, loss = 0.58774926
Validation score: 0.836601
Iteration 11, loss = 0.58530345
Validation score: 0.836601
Iteration 12, loss = 0.58349338
Validation score: 0.836601
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.02194713
Validation score: 0.803922

Iteration 2, loss = 0.83715275
Validation score: 0.803922
Iteration 3, loss = 0.72821277
Validation score: 0.803922
Iteration 4, loss = 0.66440691
Validation score: 0.803922
Iteration 5, loss = 0.62762429
Validation score: 0.803922
Iteration 6, loss = 0.60661561
Validation score: 0.803922
Iteration 7, loss = 0.59515430
Validation score: 0.803922
Iteration 8, loss = 0.58794654
Validation score: 0.803922
Iteration 9, loss = 0.58357057
Validation score: 0.803922
Iteration 10, loss = 0.58007730
Validation score: 0.803922
Iteration 11, loss = 0.57767172
Validation score: 0.803922
Iteration 12, loss = 0.57585161
Validation score: 0.803922
Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.
Iteration 1, loss = 1.02229043
Validation score: 0.836601
Iteration 2, loss = 0.83585385
Validation score: 0.836601
Iteration 3, loss = 0.72781552
Validation score: 0.836601
Iteration 4, loss = 0.66831796
Validation score: 0.836601
Iteration 5, loss = 0.63142625
Validation score: 0.836601
Iteration 6, loss = 0.61054074
Validation score: 0.836601
Iteration 7, loss = 0.59983901
Validation score: 0.836601
Iteration 8, loss = 0.59232541
Validation score: 0.836601
Iteration 9, loss = 0.58765998
Validation score: 0.836601
Iteration 10, loss = 0.58379358
Validation score: 0.836601
Iteration 11, loss = 0.58108227
Validation score: 0.836601
Iteration 12, loss = 0.57887956
Validation score: 0.836601

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 1.02146054

Validation score: 0.790850

Iteration 2, loss = 0.83066053

Validation score: 0.790850

Iteration 3, loss = 0.72124998

Validation score: 0.790850

Iteration 4, loss = 0.66114596

Validation score: 0.790850

Iteration 5, loss = 0.62391912

Validation score: 0.790850

Iteration 6, loss = 0.60311460

Validation score: 0.790850

Iteration 7, loss = 0.59280884

Validation score: 0.790850

Iteration 8, loss = 0.58570034

Validation score: 0.790850

Iteration 9, loss = 0.58134232

Validation score: 0.790850

Iteration 10, loss = 0.57781913

Validation score: 0.790850

Iteration 11, loss = 0.57529921

Validation score: 0.790850

Iteration 12, loss = 0.57350560

Validation score: 0.790850

Validation score did not improve more than tol=0.000100 for 10 consecutive epochs. Stopping.

Iteration 1, loss = 1.02005541

Validation score: 0.758170

Iteration 2, loss = 0.82666712

Validation score: 0.758170

Iteration 3, loss = 0.71529314

Validation score: 0.758170

Iteration 4, loss = 0.65413482

Validation score: 0.758170

Iteration 5, loss = 0.61634012

Validation score: 0.758170

Iteration 6, loss = 0.59522796

Validation score: 0.758170

Iteration 7, loss = 0.58457480

Validation score: 0.758170

Iteration 8, loss = 0.57730855

Validation score: 0.758170

Iteration 9, loss = 0.57277347

Validation score: 0.758170

Iteration 10, loss = 0.56926570

Validation score: 0.758170

```

Iteration 11, loss = 0.56658915
Validation score: 0.758170
Iteration 12, loss = 0.56475487
Validation score: 0.758170
Validation score did not improve more than tol=0.000100 for 10 consecutive
epochs. Stopping.
Iteration 1, loss = 0.58637901
Validation score: 0.817708
Iteration 2, loss = 0.49876835
Validation score: 0.848958
Iteration 3, loss = 0.47677184
Validation score: 0.828125
Iteration 4, loss = 0.47449156
Validation score: 0.848958
Iteration 5, loss = 0.46256745
Validation score: 0.843750
Iteration 6, loss = 0.45651169
Validation score: 0.843750
Iteration 7, loss = 0.44605079
Validation score: 0.854167
Iteration 8, loss = 0.44779774
Validation score: 0.828125
Iteration 9, loss = 0.43955756
Validation score: 0.843750
Iteration 10, loss = 0.42829320
Validation score: 0.848958
Iteration 11, loss = 0.42327725
Validation score: 0.833333
Iteration 12, loss = 0.41955420
Validation score: 0.817708
Iteration 13, loss = 0.41712404
Validation score: 0.796875
Iteration 14, loss = 0.40991398
Validation score: 0.838542
Iteration 15, loss = 0.40831997
Validation score: 0.822917
Iteration 16, loss = 0.39840054
Validation score: 0.838542
Iteration 17, loss = 0.40586310
Validation score: 0.817708
Iteration 18, loss = 0.39104926
Validation score: 0.822917
Validation score did not improve more than tol=0.000100 for 10 consecutive
epochs. Stopping.

```

```

[460]: GridSearchCV(cv=5, error_score='raise',
                  estimator=MLPClassifier(alpha=0.01, batch_size=32,

```

```

        early_stopping=True,
        hidden_layer_sizes=(52,),
        learning_rate_init=0.01, max_iter=100,
        random_state=1, verbose=True),
    param_grid={'alpha': [0.01, 0.001, 0.001],
                'hidden_layer_sizes': [(40, 30), (45, 25), (50, 20),
                                       (55, 10)],
                'learning_rate_init': [0.1, 0.01, 0.001],
                'solver': ['adam', 'sgd']},
    scoring='f1_weighted')

```

```

[463]: bestParamsMLPGridSCV=gridSearchCvMLP.best_params_
print(bestParamsMLPGridSCV)
print(gridSearchCvMLP.best_score_)
NNMLPModelFinal.set_params(**bestParamsMLPGridSCV)

```

```

{'alpha': 0.01, 'hidden_layer_sizes': (45, 25), 'learning_rate_init': 0.01,
'solver': 'adam'}
0.7981775249146903

```

```

[463]: MLPClassifier(alpha=0.01, batch_size=32, early_stopping=True,
        hidden_layer_sizes=(45, 25), learning_rate_init=0.01,
        max_iter=100, random_state=1, verbose=True)

```

```

[464]: NNMLPModelFinal.fit(hocWordsArray3, yTrainList)

```

```

Iteration 1, loss = 0.58637901
Validation score: 0.817708
Iteration 2, loss = 0.49876835
Validation score: 0.848958
Iteration 3, loss = 0.47677184
Validation score: 0.828125
Iteration 4, loss = 0.47449156
Validation score: 0.848958
Iteration 5, loss = 0.46256745
Validation score: 0.843750
Iteration 6, loss = 0.45651169
Validation score: 0.843750
Iteration 7, loss = 0.44605079
Validation score: 0.854167
Iteration 8, loss = 0.44779774
Validation score: 0.828125
Iteration 9, loss = 0.43955756
Validation score: 0.843750
Iteration 10, loss = 0.42829320
Validation score: 0.848958
Iteration 11, loss = 0.42327725
Validation score: 0.833333

```

```

Iteration 12, loss = 0.41955420
Validation score: 0.817708
Iteration 13, loss = 0.41712404
Validation score: 0.796875
Iteration 14, loss = 0.40991398
Validation score: 0.838542
Iteration 15, loss = 0.40831997
Validation score: 0.822917
Iteration 16, loss = 0.39840054
Validation score: 0.838542
Iteration 17, loss = 0.40586310
Validation score: 0.817708
Iteration 18, loss = 0.39104926
Validation score: 0.822917
Validation score did not improve more than tol=0.000100 for 10 consecutive
epochs. Stopping.

```

```

[464]: MLPClassifier(alpha=0.01, batch_size=32, early_stopping=True,
                    hidden_layer_sizes=(45, 25), learning_rate_init=0.01,
                    max_iter=100, random_state=1, verbose=True)

```

```

[ ]: ##### The model trained on the best hyper parameter seems to be reduced in the
      ↳evaluation metrics such as f1 score and macro average as well so well
      ↳consider the MLP model 2

```

```

[465]: PredNNMLPMaskModelSift = NNMLPModelFinal.predict(hocWordsArrayTest3).tolist()

print(f""""Classification report for classifier {NNMLPModelFinal}:
      {metrics.classification_report(ytestAll1, PredNNMLPMaskModelSift)}\n""")
accuracyFinalMLPModel = accuracy_score(ytestAll3, PredNNMLPMaskModelSift)
print("Accuracy on test set:", accuracyFinalMLPModel)

```

Classification report for classifier MLPClassifier(alpha=0.01, batch_size=32, early_stopping=True,

```

                    hidden_layer_sizes=(45, 25), learning_rate_init=0.01,
                    max_iter=100, random_state=1, verbose=True):
                    precision    recall  f1-score   support

```

0	0.10	0.14	0.11	74
1	0.80	0.78	0.79	387
2	0.00	0.00	0.00	15

accuracy			0.65	476
macro avg	0.30	0.30	0.30	476
weighted avg	0.67	0.65	0.66	476

Accuracy on test set: 0.6512605042016807

```
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
```

```
_warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
```

```
_warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.9/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
```

```
_warn_prf(average, modifier, msg_start, len(result))
```

```
[329]: dump(NNMLPModelFinal, os.path.join(GOOGLE_DRIVE_PATH, 'Models/BestMLPMaskModel.
↪joblib'))
```

```
[329]: ['/content/drive/MyDrive/ComputerVision/CVCourseWork_Mohsin/CW_Folder_PG/Models/
BestMLPMaskModel.joblib']
```

0.3 CNN

Consumed and developed the model based on the Lab 7 of Computer Vision course

```
[36]: device = torch.device("cuda:0" if torch.cuda.is_available() else "cpu")

# Assuming that we are on a CUDA machine, this should print a CUDA device:
print(device)
```

cuda:0

The CNN architecture was designed by using 2 convolution layers that takes feature maps to extract features from the image. Max pooling layers were also used that are used necessarily for dimensionality reduction in terms of spatial dimension while preserving the information. Additionally, 3 fully connected layers were used to attain the abstract features.

```
[244]: import torch
import torch.nn as nn
import torch.nn.functional as F

class CNNFaceMaskModel(nn.Module):
```

```

def __init__(self):
    super(CNNFaceMaskModel, self).__init__()
    self.conv1 = nn.Conv2d(3, 6, 5)
    self.pool = nn.MaxPool2d(2, 2)
    self.conv2 = nn.Conv2d(6, 16, 5)
    self.fc1 = nn.Linear(16*12*12, 120)
    self.fc2 = nn.Linear(120, 84)
    self.fc3 = nn.Linear(84, 3)

def forward(self, x):
    x = self.pool(F.relu(self.conv1(x)))
    x = self.pool(F.relu(self.conv2(x)))
    x = x.view(-1, 16*12*12)
    x = F.relu(self.fc1(x))
    x = F.relu(self.fc2(x))
    x = self.fc3(x)
    return x

```

```
CFMM = CNNFaceMaskModel()
```

It convert the array to tensor while transforming it

```

[245]: class faceMaskDataset(Dataset):
    def __init__(self, XFeatures, yLabel, transform=None):
        self.XFeatures = XFeatures
        self.yLabel = yLabel
        self.transform = transform

    def __len__(self):
        return len(self.XFeatures)

    def __getitem__(self, index):
        x = Image.fromarray(self.XFeatures[index])
        y = self.yLabel[index]
        if self.transform:
            x = self.transform(x)

        return x, y
    def numOfSamples(self):
        return len(self)

```

This part of Code was inspired and developed based on the documentation on https://medium.com/@ml_kid/what-is-transform-and-transform-normalize-

lesson-4-neural-networks-in-pytorch-ca97842336bd

```
[246]: transform = transforms.Compose(
        [transforms.ToTensor(), transforms.Resize((60, 60), antialias=True),
         transforms.Normalize((0.5, 0.5, 0.5), (0.5, 0.5, 0.5))])
trainSetCFMM= faceMaskDataset(X,y, transform)
testSetCFMM= faceMaskDataset(XTest,yTest, transform)
classes = trainSetCFMM.XFeatures
```

Loading into data loader for training model

```
[247]: from torch.utils.data import random_split
train_size = int(0.8 * len(trainSetCFMM))
val_size = len(trainSetCFMM) - train_size
testSetCFMMLoader, validationSetCFMM = random_split(trainSetCFMM, [train_size,
    ↪val_size])

# create dataloaders for training and validation sets
trainLoaderCFMM = torch.utils.data.DataLoader(testSetCFMMLoader, batch_size=32,
    ↪shuffle=True,num_workers=2)
validationLoaderCFMM = torch.utils.data.DataLoader(validationSetCFMM,
    ↪batch_size=32, shuffle=True,num_workers=2)

testLoaderCFMM = torch.utils.data.DataLoader(testSetCFMM, batch_size=32,
    ↪shuffle=True, num_workers=2)
```

Code was adapted from Lab 8

```
[249]: criterion = nn.CrossEntropyLoss()
optimizer = torch.optim.SGD(CFMM.parameters(), lr=0.01)
```

```
[60]: import time
from tqdm import tqdm
t0 = time.time()
trainLosses=[]
validationLosses=[]
epochs = 85

patience = 5
best_loss = float('inf')
counter = 0
stop = False

for epoch in range(epochs): # loop over the training set two times

    running_loss = 0.0
    for i, data in enumerate(trainLoaderCFMM, 0):
        # get the inputs; data is a list of [inputs, labels]
```

```

inputs, labels = data

# zero the parameter gradients
optimizer.zero_grad()

# forward + backward + optimize

outputs = CFMM(inputs)
loss = criterion(outputs, labels)
loss.backward()
optimizer.step()

# print statistics (loss.item() returns the mean loss in the mini-batch)
running_loss += loss.item()
trainLosses.append(running_loss/len(trainLoaderCFMM))

CFMM.eval()
with torch.no_grad():
    valid_loss = 0.0
    for inputs, labels in validationLoaderCFMM:
        # inputs = inputs.to(device)
        # labels = labels.to(device)
        outputs = CFMM(inputs)
        loss = criterion(outputs, labels)
        valid_loss += loss.item()
    valid_loss /= len(validationLoaderCFMM)
    validationLosses.append(valid_loss)

    if valid_loss < best_loss:
        best_loss = valid_loss
        counter = 0
    else:
        counter += 1
        if counter >= patience:
            print(f'Early stopping after {epoch+1} epochs.')
            stop = True
            break

print(f'Epoch {epoch}:{trainLosses}')
trainLosses=[]
print('Finished Training: total time in seconds =', time.time() - t0)

```

```

Epoch 0: [0.16482768002897502]
Epoch 1: [0.16294945329427718]
Epoch 2: [0.153488345661511]
Epoch 3: [0.1508143241206805]
Epoch 4: [0.14891555039212107]
Epoch 5: [0.14634726447984575]

```



```
Epoch 6:[0.1490580067348977]
Epoch 7:[0.1421358479807774]
Epoch 8:[0.14131358559243382]
Epoch 9:[0.1404890387629469]
Epoch 10:[0.13764642101402083]
Epoch 11:[0.137217758440723]
Early stopping after 13 epochs.
Finished Training: total time in seconds = 14.424656867980957
```

Save the best CNN Model using Joblib

```
[69]: torch.save(CFMM.state_dict(), os.path.join(GOOGLE_DRIVE_PATH, 'Models/
↳BestCFMM_MODEL.pth'))
```

Load the best CNN Model

```
[251]: pathModelCFMM='Models/BestCFMM_MODEL.pth'
CFMM.load_state_dict(torch.load(os.path.join(GOOGLE_DRIVE_PATH,pathModelCFMM)))
```

```
[251]: <All keys matched successfully>
```

```
[253]: from sklearn.metrics import classification_report

# Initialize variables for storing true labels and predicted labels
y_true = []
y_pred = []
classLabelTestCFMM=['0','1','2']
# Test the model on all labels and store the true labels and predicted labels
with torch.no_grad():
    for i, data in enumerate(testLoaderCFMM, 0):
        images, labels = data
        outputs = CFMM(images)
        _, predicted = torch.max(outputs, 1)
        y_true.extend(labels.tolist())
        y_pred.extend(predicted.tolist())

# Print the classification report for all labels
print(classification_report(y_true, y_pred, target_names=classLabelTestCFMM))
```

	precision	recall	f1-score	support
0	0.89	0.91	0.90	75
1	0.97	0.98	0.97	388
2	0.64	0.44	0.52	16
accuracy			0.95	479
macro avg	0.83	0.77	0.80	479
weighted avg	0.95	0.95	0.95	479

0.3.1 Confusion Matrix Plot to get the specificity and sensitivity

```
[347]: # Code is inspired from here https://scikit-learn.org/stable/modules/generated/sklearn.metrics.ConfusionMatrixDisplay.html#sklearn.metrics.ConfusionMatrixDisplay.from\_estimator

classifierSVMLoaded = load(os.path.join(GOOGLE_DRIVE_PATH, 'Models/
↳bestSVMMaskModelFinal.joblib'))

classifierSVMLoaded.predict(hocWordsArrayTest3).tolist()
yArr = np.array(y)

titlesOptionsSVM= [("Confusion matrix of Best Trained SVM for Face Mask", None),
                    ("Normalized confusion matrix of Best Trained SVM for Face
↳Mask", 'true')]
for title, normalize in titlesOptionsSVM:
    dispSVM = ConfusionMatrixDisplay.from_estimator(classifierSVMLoaded,
↳hocWordsArrayTest3, ytestAll3,
                                                    display_labels=np.unique(yArr),
                                                    cmap=plt.cm.BuGn,
                                                    normalize=normalize)

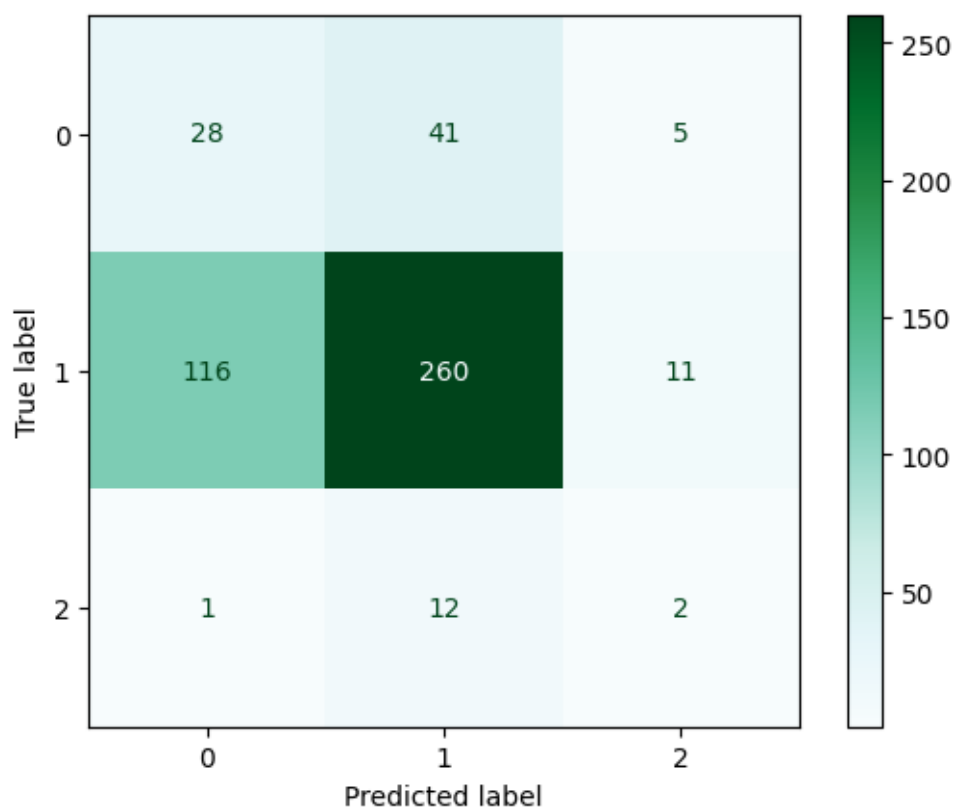
    plt.title(title, loc='left', x=-0.1, fontweight='bold', pad=20)

plt.show()
```

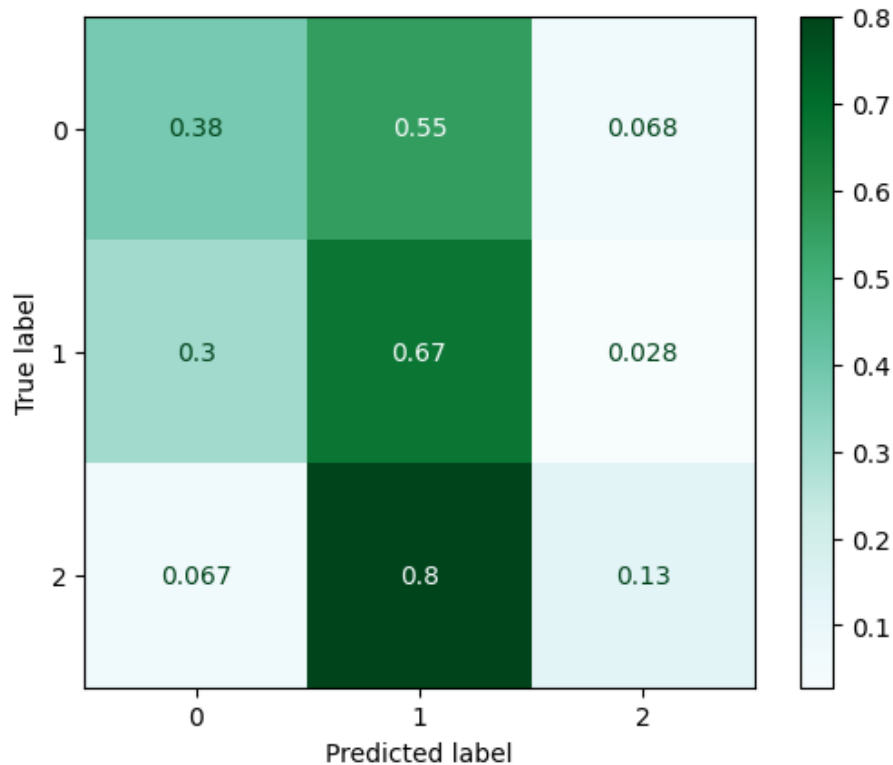
Normalized confusion matrix of Best Trained SVM for Face Mask

```
[[0.37837838 0.55405405 0.06756757]
 [0.2997416  0.67183463 0.02842377]
 [0.06666667 0.8       0.13333333]]
```

Confusion matrix of Best Trained SVM for Face Mask



Normalized confusion matrix of Best Trained SVM for Face Mask



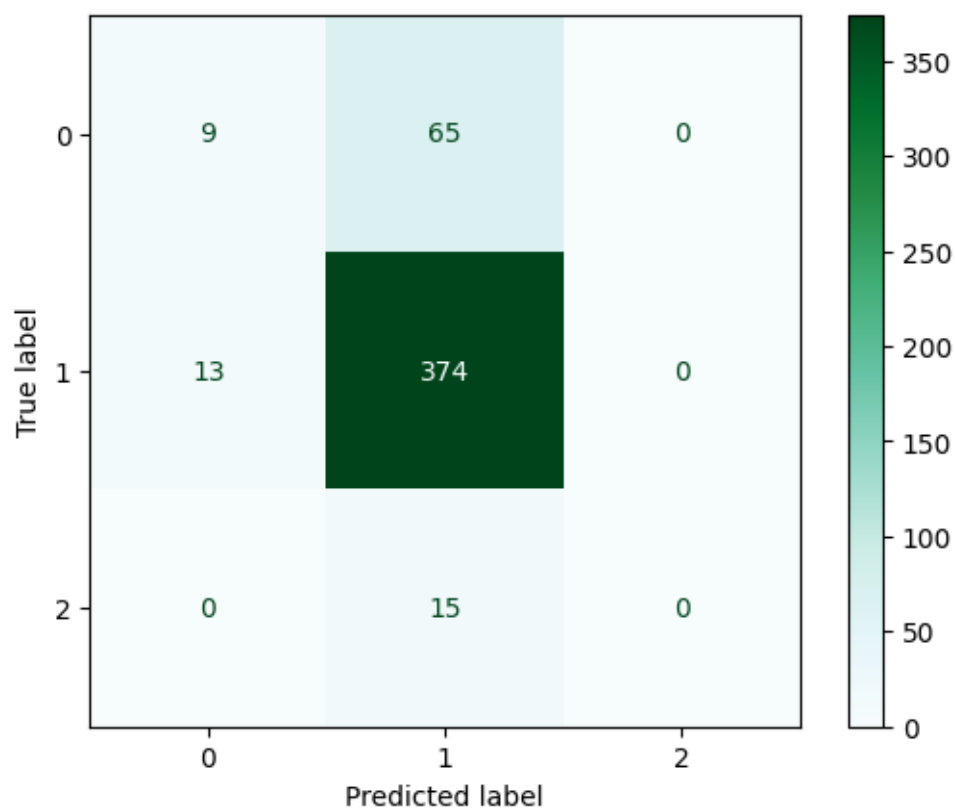
```
[348]: classifierMLPLoadedMask = load(os.path.join(GOOGLE_DRIVE_PATH, 'Models/
↳BestMLPMaskModel.joblib'))

classifierMLPLoadedMask.predict(hocWordsArrayTest3).tolist()
yArr = np.array(y)

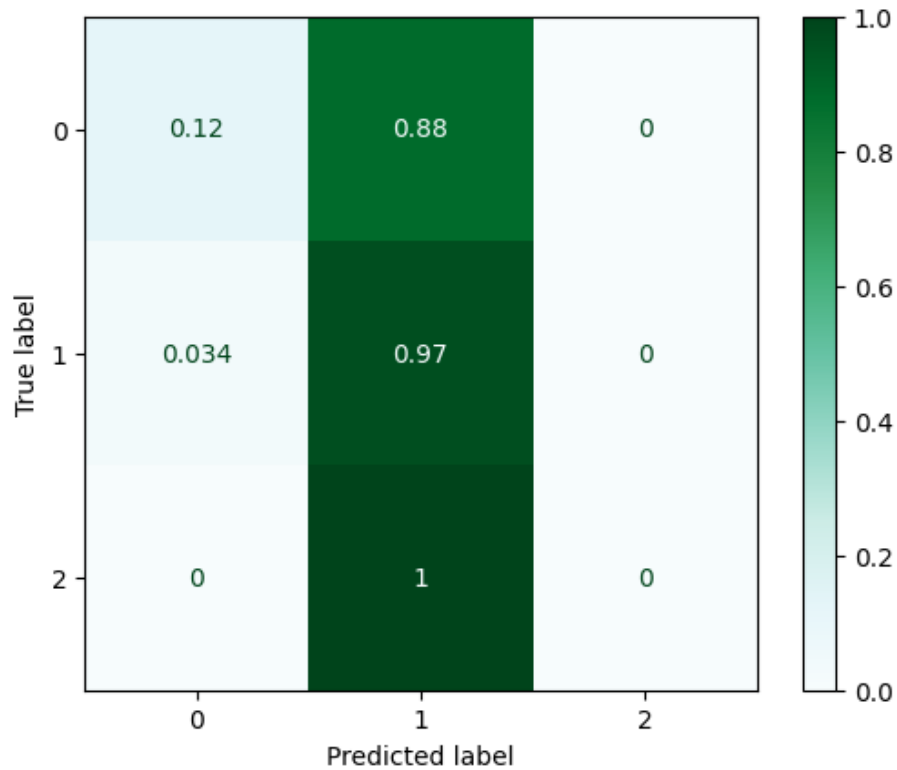
titlesOptionsSVM= [("Confusion matrix of Best Trained MLP for Face Mask", None),
                    ("", 'true')]
for title, normalize in titlesOptionsSVM:
    dispSVM = ConfusionMatrixDisplay.from_estimator(classifierMLPLoadedMask,
↳hocWordsArrayTest3, ytestAll3,
                                                    display_labels=np.unique(yArr),
                                                    cmap=plt.cm.BuGn,
                                                    normalize=normalize)
    plt.title(title, loc='left', x=-0.1, fontweight='bold', pad=20)

plt.show()
```

Confusion matrix of Best Trained MLP for Face Mask



Normalized confusion matrix of Best Trained MLP for Face Mask



```
[359]: yTrue = []
yPred = []
classLabelTestCFMM=['0','1','2']
# Test the model on all labels and store the true labels and predicted labels
with torch.no_grad():
    for i, data in enumerate(testLoaderCFMM, 0):
        images, labels = data
        outputs = CFMM(images)
        _, predicted = torch.max(outputs, 1)
        yTrue.extend(labels.tolist())
        yPred.extend(predicted.tolist())

print(classification_report(yTrue, yPred, target_names=classLabelTestCFMM))

confusionMatrixCFMM = confusion_matrix(yTrue, yPred)

confusionMatrixNormalizeCFMM = confusionMatrixCFMM.astype('float') /
    ↪confusionMatrixCFMM.sum(axis=1)[:, np.newaxis]
```

```

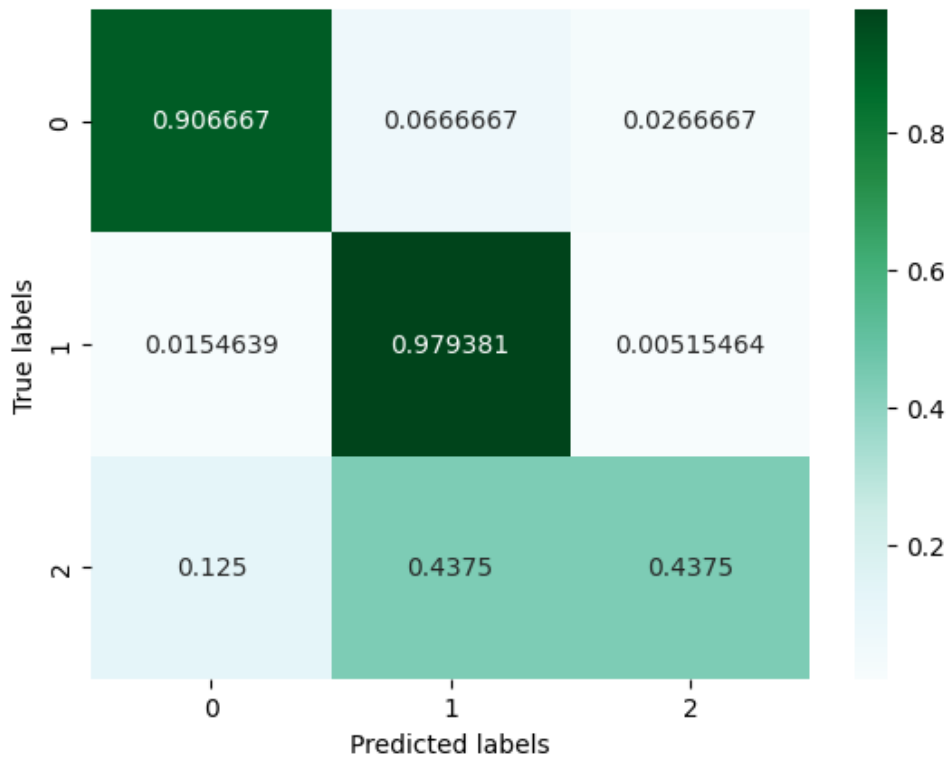
sns.heatmap(confusionMatrixNormalizeCFMM, annot=True, fmt='g', cmap=plt.cm.
BuGn, xticklabels=classLabelTestCFMM, yticklabels=classLabelTestCFMM)
plt.xlabel('Predicted labels')
plt.ylabel('True labels')
plt.title('Normalized confusion matrix of Best Trained MLP for Face_
Mask',loc='left',x=-0.1,fontweight='bold', pad=20)

plt.show()

```

	precision	recall	f1-score	support
0	0.89	0.91	0.90	75
1	0.97	0.98	0.97	388
2	0.64	0.44	0.52	16
accuracy			0.95	479
macro avg	0.83	0.77	0.80	479
weighted avg	0.95	0.95	0.95	479

Normalized confusion matrix of Best Trained MLP for Face Mask



[]: