In [3]:
```
# Credits: https://github.com/keras-team/keras/blob/master/examples/mnist_cnn.
py
from datetime import datetime
import keras
from keras.datasets import mnist
from keras.models import Sequential
from keras.layers import Dense, Dropout, Flatten
from keras.layers import Conv2D, MaxPooling2D
from keras import backend as K
from keras.initializers import he_normal
from keras.layers.normalization import BatchNormalization

batch_size = 128
num_classes = 10
epochs = 12
# input image dimensions
img_rows, img_cols = 28, 28
```

```
Using TensorFlow backend.
```

In [4]:
```
(x_train, y_train), (x_test, y_test) = mnist.load_data()
```

```
Downloading data from https://s3.amazonaws.com/img-datasets/mnist.npz
11493376/11490434 [==============================] - 1s 0us/step
```

In [5]:
```
if K.image_data_format() == 'channels_first':
    x_train = x_train.reshape(x_train.shape[0], 1, img_rows, img_cols)
    x_test = x_test.reshape(x_test.shape[0], 1, img_rows, img_cols)
    input_shape = (1, img_rows, img_cols)
else:
    x_train = x_train.reshape(x_train.shape[0], img_rows, img_cols, 1)
    x_test = x_test.reshape(x_test.shape[0], img_rows, img_cols, 1)
    input_shape = (img_rows, img_cols, 1)

x_train = x_train.astype('float32')
x_test = x_test.astype('float32')
x_train /= 255
x_test /= 255
print('x_train shape:', x_train.shape)
print(x_train.shape[0], 'train samples')
print(x_test.shape[0], 'test samples')

# convert class vectors to binary class matrices
y_train = keras.utils.to_categorical(y_train, num_classes)
y_test = keras.utils.to_categorical(y_test, num_classes)
```

```
x_train shape: (60000, 28, 28, 1)
60000 train samples
10000 test samples
```

In [6]:
```
print(y_train.shape)
```

```
(60000, 10)
```

In [0]:
```
%matplotlib inline
import matplotlib.pyplot as plt
import numpy as np
import time
# https://gist.github.com/greydanus/f6eee59eaf1d90fcb3b534a25362cea4
# https://stackoverflow.com/a/14434334
# this function is used to update the plots for each epoch and error
def plt_dynamic(x, vy, ty):
  fig = plt.figure( facecolor='y', edgecolor='k')
  plt.plot(x, vy, 'b', label="Validation Loss")
  plt.plot(x, ty, 'r', label="Train Loss")
  plt.xlabel('Epochs')
  plt.ylabel('Categorical Crossentropy Loss')
  plt.legend()
  plt.grid()
  plt.show()
```

Model 1: CNN with 3 ConvNets and 3X3 Kernel size.

In [8]:
```
convnet3=Sequential() # Initializing the model

# First ConvNet
convnet3.add(Conv2D(32,kernel_size=(3,3),activation='relu',input_shape=input_s
hape))
convnet3.add(Conv2D(64,kernel_size=(3,3),activation='relu'))
convnet3.add(Dropout(0.25))
convnet3.add(Conv2D(128,kernel_size=(3,3), activation='relu'))

#maxpooling by (2,2 ) ,dropout,flattening
convnet3.add(MaxPooling2D(pool_size=(2,2)))
convnet3.add(Dropout(0.25))
convnet3.add(Flatten())

#hidden_layer
convnet3.add(Dense(256, activation='relu', kernel_initializer=he_normal(seed=N
one)))
convnet3.add(Dropout(0.5))
convnet3.add(Dense(num_classes,activation='softmax'))
print(convnet3.summary())
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow/pyth
on/framework/op_def_library.py:263: colocate_with (from tensorflow.python.fr
amework.ops) is deprecated and will be removed in a future version.
Instructions for updating:
Colocations handled automatically by placer.
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/
tensorflow_backend.py:3445: calling dropout (from tensorflow.python.ops.nn_op
s) with keep_prob is deprecated and will be removed in a future version.
Instructions for updating:
Please use `rate` instead of `keep_prob`. Rate should be set to `rate = 1 - k
eep_prob`.
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 26, 26, 32)        320
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 24, 24, 64)        18496
_________________________________________________________________
dropout_1 (Dropout)          (None, 24, 24, 64)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 22, 22, 128)       73856
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 11, 11, 128)       0
_________________________________________________________________
dropout_2 (Dropout)          (None, 11, 11, 128)       0
_________________________________________________________________
flatten_1 (Flatten)          (None, 15488)             0
_________________________________________________________________
dense_1 (Dense)              (None, 256)               3965184
_________________________________________________________________
dropout_3 (Dropout)          (None, 256)               0
_________________________________________________________________
dense_2 (Dense)              (None, 10)                2570
=================================================================
Total params: 4,060,426
Trainable params: 4,060,426
Non-trainable params: 0
_________________________________________________________________
None
```

Model Compilation

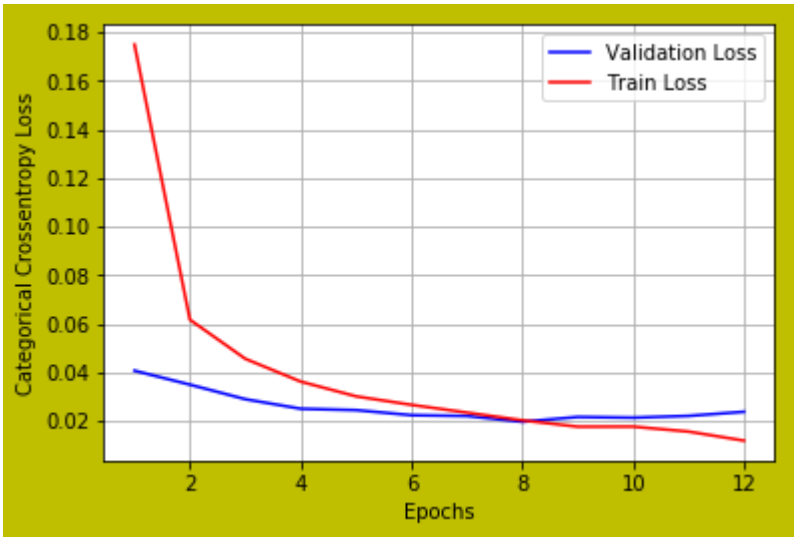
In [9]:
```
start=datetime.now()
convnet3.compile(optimizer=keras.optimizers.Adam(), loss=keras.losses.categori
cal_crossentropy, metrics=['accuracy'])
convnet3_history=convnet3.fit(x_train,y_train,batch_size=batch_size, epochs=ep
ochs, verbose=1, validation_data=(x_test, y_test))
print("Time taken to run this cell :", datetime.now() - start)
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow/pyt
hon/ops/math_ops.py:3066: to_int32 (from tensorflow.python.ops.math_ops) is d
eprecated and will be removed in a future version.
Instructions for updating:
Use tf.cast instead.
Train on 60000 samples, validate on 10000 samples
Epoch 1/12
60000/60000 [==============================] - 515s 9ms/step - loss: 0.1783 -
acc: 0.9450 - val_loss: 0.0405 - val_acc: 0.9862
Epoch 2/12
60000/60000 [==============================] - 512s 9ms/step - loss: 0.0608 -
acc: 0.9814 - val_loss: 0.0347 - val_acc: 0.9892
Epoch 3/12
60000/60000 [==============================] - 513s 9ms/step - loss: 0.0471 -
acc: 0.9855 - val_loss: 0.0285 - val_acc: 0.9905
Epoch 4/12
60000/60000 [==============================] - 515s 9ms/step - loss: 0.0358 -
acc: 0.9889 - val_loss: 0.0276 - val_acc: 0.9903
Epoch 5/12
60000/60000 [==============================] - 516s 9ms/step - loss: 0.0314 -
acc: 0.9904 - val_loss: 0.0272 - val_acc: 0.9904
Epoch 6/12
60000/60000 [==============================] - 514s 9ms/step - loss: 0.0266 -
acc: 0.9912 - val_loss: 0.0243 - val_acc: 0.9928
Epoch 7/12
60000/60000 [==============================] - 513s 9ms/step - loss: 0.0227 -
acc: 0.9930 - val_loss: 0.0233 - val_acc: 0.9936
Epoch 8/12
60000/60000 [==============================] - 514s 9ms/step - loss: 0.0195 -
acc: 0.9934 - val_loss: 0.0254 - val_acc: 0.9927
Epoch 9/12
60000/60000 [==============================] - 512s 9ms/step - loss: 0.0203 -
acc: 0.9934 - val_loss: 0.0210 - val_acc: 0.9940
Epoch 10/12
60000/60000 [==============================] - 511s 9ms/step - loss: 0.0173 -
acc: 0.9943 - val_loss: 0.0237 - val_acc: 0.9937
Epoch 11/12
60000/60000 [==============================] - 511s 9ms/step - loss: 0.0153 -
acc: 0.9950 - val_loss: 0.0219 - val_acc: 0.9930
Epoch 12/12
60000/60000 [==============================] - 511s 9ms/step - loss: 0.0144 -
acc: 0.9954 - val_loss: 0.0252 - val_acc: 0.9927
Time taken to run this cell : 1:42:38.202782
```

Model Evaluation

In [0]:
```
score=convnet3.evaluate(x_test,y_test,verbose=0)
test_score3=score[0]
test_accuracy3=score[1]
train_accuracy3=max(convnet3_history.history['acc'])
print('test score :',test_score3)
print('test sccuracy :',test_accuracy3)
# error plot
x=list(range(1,epochs+1))
vy=convnet3_history.history['val_loss'] #validation loss
ty=convnet3_history.history['loss'] # train loss
plt_dynamic(x, vy, ty)
```

```
test score : 0.023814157019101594
test sccuracy : 0.9933
```



Model 2: CNN with 5 ConvNets and 5X5 Kernel size.

In [0]:
```
convnet5=Sequential() # Initializing the model

# First ConvNet
convnet5.add(Conv2D(32,kernel_size=(5,5), activation='relu', padding='same', i
nput_shape=input_shape))

#Second ConvNet
convnet5.add(Conv2D(64,kernel_size=(5,5),padding='same',activation='relu'))
convnet5.add(MaxPooling2D(pool_size=(2,2)))
convnet5.add(Dropout(0.25))

#Third ConvNet
convnet5.add(Conv2D(96,kernel_size=(5,5),padding='same',activation='relu'))
#maxpooling by (2,2 ) ,dropout,flattening
convnet5.add(MaxPooling2D(pool_size=(2,2)))
convnet5.add(Dropout(0.25))

#Fourth ConvNet
convnet5.add(Conv2D(128,kernel_size=(5,5), padding='same', activation='relu'))
convnet5.add(MaxPooling2D(pool_size=(2,2)))
convnet5.add(Dropout(0.25))

#fifth Convnet
convnet5.add(Conv2D(164,kernel_size=(5,5), padding='same', activation='relu'))
convnet5.add(MaxPooling2D(pool_size=(2,2)))
convnet5.add(Dropout(0.25))
convnet5.add(Flatten())

#hidden_layer
convnet5.add(Dense(256, activation='relu', kernel_initializer=he_normal(seed=N
one)))
convnet5.add(BatchNormalization())
convnet5.add(Dropout(0.5))
convnet5.add(Dense(num_classes,activation='softmax'))
print(convnet5.summary())
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow/pyth
on/framework/op_def_library.py:263: colocate_with (from tensorflow.python.fr
amework.ops) is deprecated and will be removed in a future version.
Instructions for updating:
Colocations handled automatically by placer.
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/
tensorflow_backend.py:3445: calling dropout (from tensorflow.python.ops.nn_op
s) with keep_prob is deprecated and will be removed in a future version.
Instructions for updating:
Please use `rate` instead of `keep_prob`. Rate should be set to `rate = 1 - k
eep_prob`.
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 28, 28, 32)        832
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 28, 28, 64)        51264
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 14, 14, 64)        0
_________________________________________________________________
dropout_1 (Dropout)          (None, 14, 14, 64)        0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 14, 14, 96)        153696
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 7, 7, 96)          0
_________________________________________________________________
dropout_2 (Dropout)          (None, 7, 7, 96)          0
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 7, 7, 128)         307328
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 3, 3, 128)         0
_________________________________________________________________
dropout_3 (Dropout)          (None, 3, 3, 128)         0
_________________________________________________________________
conv2d_5 (Conv2D)            (None, 3, 3, 164)         524964
_________________________________________________________________
max_pooling2d_4 (MaxPooling2 (None, 1, 1, 164)         0
_________________________________________________________________
dropout_4 (Dropout)          (None, 1, 1, 164)         0
_________________________________________________________________
flatten_1 (Flatten)          (None, 164)               0
_________________________________________________________________
dense_1 (Dense)              (None, 256)               42240
_________________________________________________________________
batch_normalization_1 (Batch (None, 256)               1024
_________________________________________________________________
dropout_5 (Dropout)          (None, 256)               0
_________________________________________________________________
dense_2 (Dense)              (None, 10)                2570
=================================================================
Total params: 1,083,918
Trainable params: 1,083,406
Non-trainable params: 512
_________________________________________________________________
None
```

Model Compilation

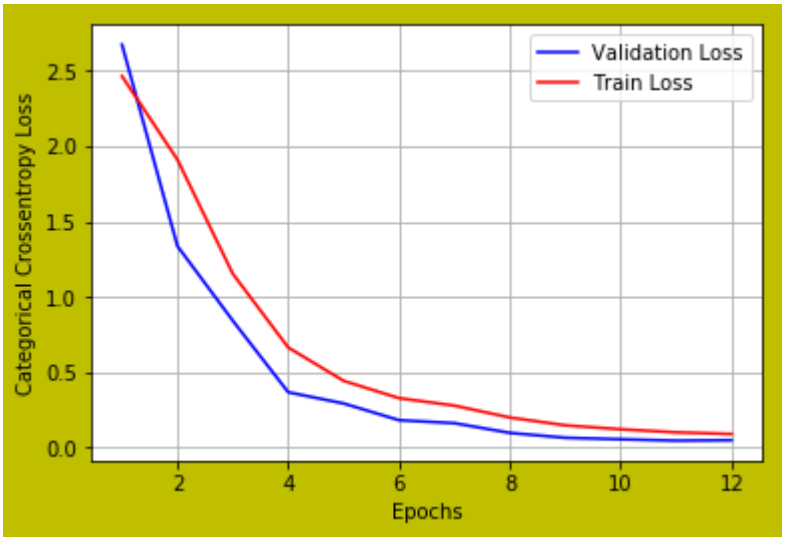
In [0]:
```
start = datetime.now()
convnet5.compile(optimizer=keras.optimizers.Adam(), loss=keras.losses.categori
cal_crossentropy, metrics=['accuracy'])
convnet5_history=convnet5.fit(x_train,y_train,batch_size=batch_size, epochs=ep
ochs, verbose=1, validation_data=(x_test, y_test))
print("Time taken to run this cell :", datetime.now() - start)
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow/pyt
hon/ops/math_ops.py:3066: to_int32 (from tensorflow.python.ops.math_ops) is d
eprecated and will be removed in a future version.
Instructions for updating:
Use tf.cast instead.
Train on 60000 samples, validate on 10000 samples
Epoch 1/12
60000/60000 [==============================] - 843s 14ms/step - loss: 2.4664
- acc: 0.1728 - val_loss: 2.6763 - val_acc: 0.1114
Epoch 2/12
60000/60000 [==============================] - 840s 14ms/step - loss: 1.9119
- acc: 0.2926 - val_loss: 1.3380 - val_acc: 0.5081
Epoch 3/12
60000/60000 [==============================] - 817s 14ms/step - loss: 1.1535
- acc: 0.5858 - val_loss: 0.8421 - val_acc: 0.7205
Epoch 4/12
60000/60000 [==============================] - 803s 13ms/step - loss: 0.6639
- acc: 0.7837 - val_loss: 0.3669 - val_acc: 0.8843
Epoch 5/12
60000/60000 [==============================] - 811s 14ms/step - loss: 0.4424
- acc: 0.8605 - val_loss: 0.2923 - val_acc: 0.9056
Epoch 6/12
60000/60000 [==============================] - 785s 13ms/step - loss: 0.3275
- acc: 0.8986 - val_loss: 0.1812 - val_acc: 0.9409
Epoch 7/12
60000/60000 [==============================] - 772s 13ms/step - loss: 0.2779
- acc: 0.9131 - val_loss: 0.1614 - val_acc: 0.9466
Epoch 8/12
60000/60000 [==============================] - 773s 13ms/step - loss: 0.1989
- acc: 0.9387 - val_loss: 0.0968 - val_acc: 0.9707
Epoch 9/12
60000/60000 [==============================] - 737s 12ms/step - loss: 0.1471
- acc: 0.9553 - val_loss: 0.0644 - val_acc: 0.9785
Epoch 10/12
60000/60000 [==============================] - 743s 12ms/step - loss: 0.1208
- acc: 0.9637 - val_loss: 0.0545 - val_acc: 0.9833
Epoch 11/12
60000/60000 [==============================] - 818s 14ms/step - loss: 0.1005
- acc: 0.9713 - val_loss: 0.0454 - val_acc: 0.9871
Epoch 12/12
60000/60000 [==============================] - 843s 14ms/step - loss: 0.0895
- acc: 0.9730 - val_loss: 0.0482 - val_acc: 0.9860
Time taken to run this cell : 2:39:47.573903
```

Model Evaluation

In [0]:
```
score=convnet5.evaluate(x_test,y_test,verbose=0)
test_score5=score[0]
test_accuracy5=score[1]
train_accuracy5=max(convnet5_history.history['acc'])
print('test score :',test_score5)
print('test Accuracy :',test_accuracy5)
# error plot
x=list(range(1,epochs+1))
vy=convnet5_history.history['val_loss'] #validation loss
ty=convnet5_history.history['loss'] # train loss
plt_dynamic(x, vy, ty)
```

```
test score : 0.048168362715619154
test Accuracy : 0.986
```



Model 3: CNN with 7 ConvNets and2X2 Kernel size.

In [0]:
```
convnet7=Sequential() # Initializing the model

# First ConvNet
convnet7.add(Conv2D(16,kernel_size=(2,2), activation='relu', padding='same', i
nput_shape=input_shape))

#Second Convnet
convnet7.add(Conv2D(32,kernel_size=(2,2), padding='same',strides=(2,2), activa
tion='relu'))
#convnet7.add(MaxPooling2D(pool_size=(2,2)))
#convnet7.add(Dropout(0.25))

# 3rd ConvNet
convnet7.add(Conv2D(64,kernel_size=(2,2), padding='same', activation='relu'))

#maxpooling by (2,2 ) ,dropout,flattening
#convnet7.add(MaxPooling2D(pool_size=(2,2)))
convnet7.add(Dropout(0.15))

#fourth Convnet
convnet7.add(Conv2D(96,kernel_size=(2,2), padding='same', activation='relu'))
convnet7.add(MaxPooling2D(pool_size=(2,2)))
convnet7.add(Dropout(0.39))

#fifth Convnet
convnet7.add(Conv2D(128,kernel_size=(2,2), padding='same', activation='relu'))
convnet7.add(MaxPooling2D(pool_size=(2,2)))
convnet7.add(Dropout(0.3))

#sixth Convnet
convnet7.add(Conv2D(164,kernel_size=(2,2), padding='same', activation='relu'))

#seventh Convnet
convnet7.add(Conv2D(164,kernel_size=(2,2), padding='same', activation='relu'))

convnet7.add(MaxPooling2D(pool_size=(2,2)))
convnet7.add(Dropout(0.4))
convnet7.add(Flatten())

#hidden_layer
convnet7.add(Dense(256, activation='relu', kernel_initializer=he_normal(seed=N
one)))#1 hidden layer
convnet7.add(BatchNormalization())
convnet7.add(Dropout(0.5))
convnet7.add(Dense(148, activation='relu', kernel_initializer=he_normal(seed=N
one)))#2 hidden layer
convnet7.add(BatchNormalization())
convnet7.add(Dropout(0.5))
convnet7.add(Dense(128, activation='relu', kernel_initializer=he_normal(seed=N
one)))#3 hidden layer
convnet7.add(BatchNormalization())
convnet7.add(Dropout(0.5))
convnet7.add(Dense(num_classes,activation='softmax'))
print(convnet7.summary())
```

Layer (type)	Output Shape	Param #
conv2d_6 (Conv2D)	(None, 28, 28, 16)	80
conv2d_7 (Conv2D)	(None, 14, 14, 32)	2080
conv2d_8 (Conv2D)	(None, 14, 14, 64)	8256
dropout_6 (Dropout)	(None, 14, 14, 64)	0
conv2d_9 (Conv2D)	(None, 14, 14, 96)	24672
max_pooling2d_5 (MaxPooling2	(None, 7, 7, 96)	0
dropout_7 (Dropout)	(None, 7, 7, 96)	0
conv2d_10 (Conv2D)	(None, 7, 7, 128)	49280
max_pooling2d_6 (MaxPooling2	(None, 3, 3, 128)	0
dropout_8 (Dropout)	(None, 3, 3, 128)	0
conv2d_11 (Conv2D)	(None, 3, 3, 164)	84132
conv2d_12 (Conv2D)	(None, 3, 3, 164)	107748
max_pooling2d_7 (MaxPooling2	(None, 1, 1, 164)	0
dropout_9 (Dropout)	(None, 1, 1, 164)	0
flatten_2 (Flatten)	(None, 164)	0
dense_3 (Dense)	(None, 256)	42240
batch_normalization_2 (Batch	(None, 256)	1024
dropout_10 (Dropout)	(None, 256)	0
dense_4 (Dense)	(None, 148)	38036
batch_normalization_3 (Batch	(None, 148)	592
dropout_11 (Dropout)	(None, 148)	0
dense_5 (Dense)	(None, 128)	19072
batch_normalization_4 (Batch	(None, 128)	512
dropout_12 (Dropout)	(None, 128)	0
dense_6 (Dense)	(None, 10)	1290

Total params: 379,014
Trainable params: 377,950
Non-trainable params: 1,064

```
_________________________________________________________________
None
```

Model compilation

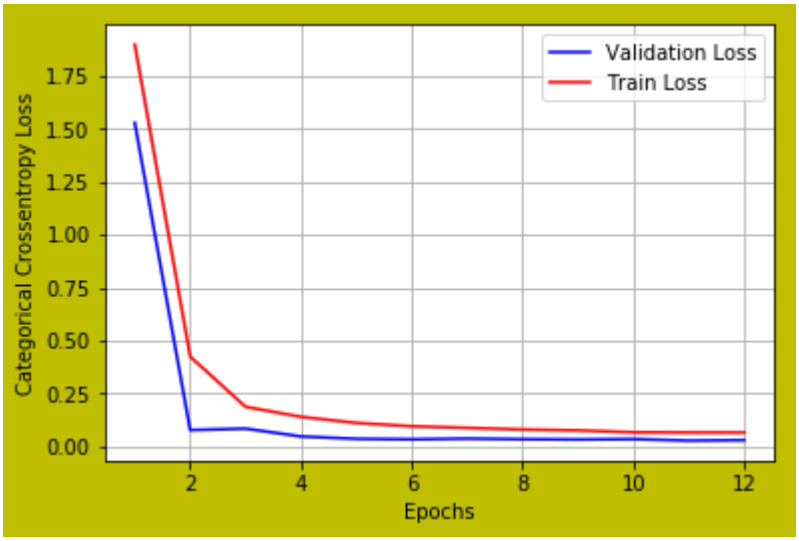
In [0]:
```
start=datetime.now()
convnet7.compile(optimizer=keras.optimizers.Adam(), loss=keras.losses.categori
cal_crossentropy, metrics=['accuracy'])
convnet7_history=convnet7.fit(x_train,y_train,batch_size=batch_size, epochs=ep
ochs, verbose=1, validation_data=(x_test, y_test))
print("Time taken to run this cell :", datetime.now() - start)
```

```
Train on 60000 samples, validate on 10000 samples
Epoch 1/12
60000/60000 [==============================] - 142s 2ms/step - loss: 1.8961 -
acc: 0.3754 - val_loss: 1.5272 - val_acc: 0.4652
Epoch 2/12
60000/60000 [==============================] - 145s 2ms/step - loss: 0.4249 -
acc: 0.8774 - val_loss: 0.0784 - val_acc: 0.9765
Epoch 3/12
60000/60000 [==============================] - 141s 2ms/step - loss: 0.1882 -
acc: 0.9518 - val_loss: 0.0854 - val_acc: 0.9789
Epoch 4/12
60000/60000 [==============================] - 131s 2ms/step - loss: 0.1409 -
acc: 0.9645 - val_loss: 0.0484 - val_acc: 0.9870
Epoch 5/12
60000/60000 [==============================] - 130s 2ms/step - loss: 0.1121 -
acc: 0.9717 - val_loss: 0.0372 - val_acc: 0.9907
Epoch 6/12
60000/60000 [==============================] - 140s 2ms/step - loss: 0.0965 -
acc: 0.9760 - val_loss: 0.0347 - val_acc: 0.9915
Epoch 7/12
60000/60000 [==============================] - 132s 2ms/step - loss: 0.0887 -
acc: 0.9779 - val_loss: 0.0382 - val_acc: 0.9907
Epoch 8/12
60000/60000 [==============================] - 139s 2ms/step - loss: 0.0812 -
acc: 0.9799 - val_loss: 0.0353 - val_acc: 0.9920
Epoch 9/12
60000/60000 [==============================] - 142s 2ms/step - loss: 0.0769 -
acc: 0.9807 - val_loss: 0.0340 - val_acc: 0.9919
Epoch 10/12
60000/60000 [==============================] - 144s 2ms/step - loss: 0.0680 -
acc: 0.9835 - val_loss: 0.0358 - val_acc: 0.9911
Epoch 11/12
60000/60000 [==============================] - 146s 2ms/step - loss: 0.0670 -
acc: 0.9836 - val_loss: 0.0286 - val_acc: 0.9934
Epoch 12/12
60000/60000 [==============================] - 150s 3ms/step - loss: 0.0667 -
acc: 0.9833 - val_loss: 0.0309 - val_acc: 0.9911
Time taken to run this cell : 0:28:02.350113
```

Model Evaluation

In [0]:
```
score=convnet7.evaluate(x_test,y_test,verbose=0)
test_score7=score[0]
test_accuracy7=score[1]
train_accuracy7=max(convnet7_history.history['acc'])
print('test score :',test_score7)
print('test Accuracy :',test_accuracy7)
# error plot
x=list(range(1,epochs+1))
vy=convnet7_history.history['val_loss'] #validation loss
ty=convnet7_history.history['loss'] # train loss
plt_dynamic(x, vy, ty)
```

```
test score : 0.03093639321749797
test Accuracy : 0.9911
```



In [11]:
```
from prettytable import PrettyTable
x = PrettyTable()
x.field_names = ["Model", "Training Accuracy", "Test Accuracy", "Time Taken"]
x.add_row(["3ConvNet with kernel 3x3 ",0.9961, 0.9933, "1:42"])
x.add_row(["5ConvNet with kernel 5x5",0.9730, 0.9860, "2:39"])
x.add_row(["7ConvNet with kernel 2x2", 0.9833, 0.9911, "0:28"])
print(x)
```

```
+---------------------------+-------------------+---------------+------------
+
|           Model           | Training Accuracy | Test Accuracy | Time Taken
|
+---------------------------+-------------------+---------------+------------
+
| 3ConvNet with kernel 3x3  |       0.9961      |     0.9933    |    1:42
|
|  5ConvNet with kernel 5x5 |       0.973       |     0.986     |    2:39
|
|  7ConvNet with kernel 2x2 |       0.9833      |     0.9911    |    0:28
|
+---------------------------+-------------------+---------------+------------
+
```