In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns

from keras.models import Sequential
from keras.layers import Dense
from keras.optimizers import Adam

from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report, confusion_matrix
import matplotlib.pyplot as plt
```

```
Using TensorFlow backend.
```

In [2]:

```
dataset = pd.read_csv('Iris.csv')
dataset.head()
```

Out[2]:

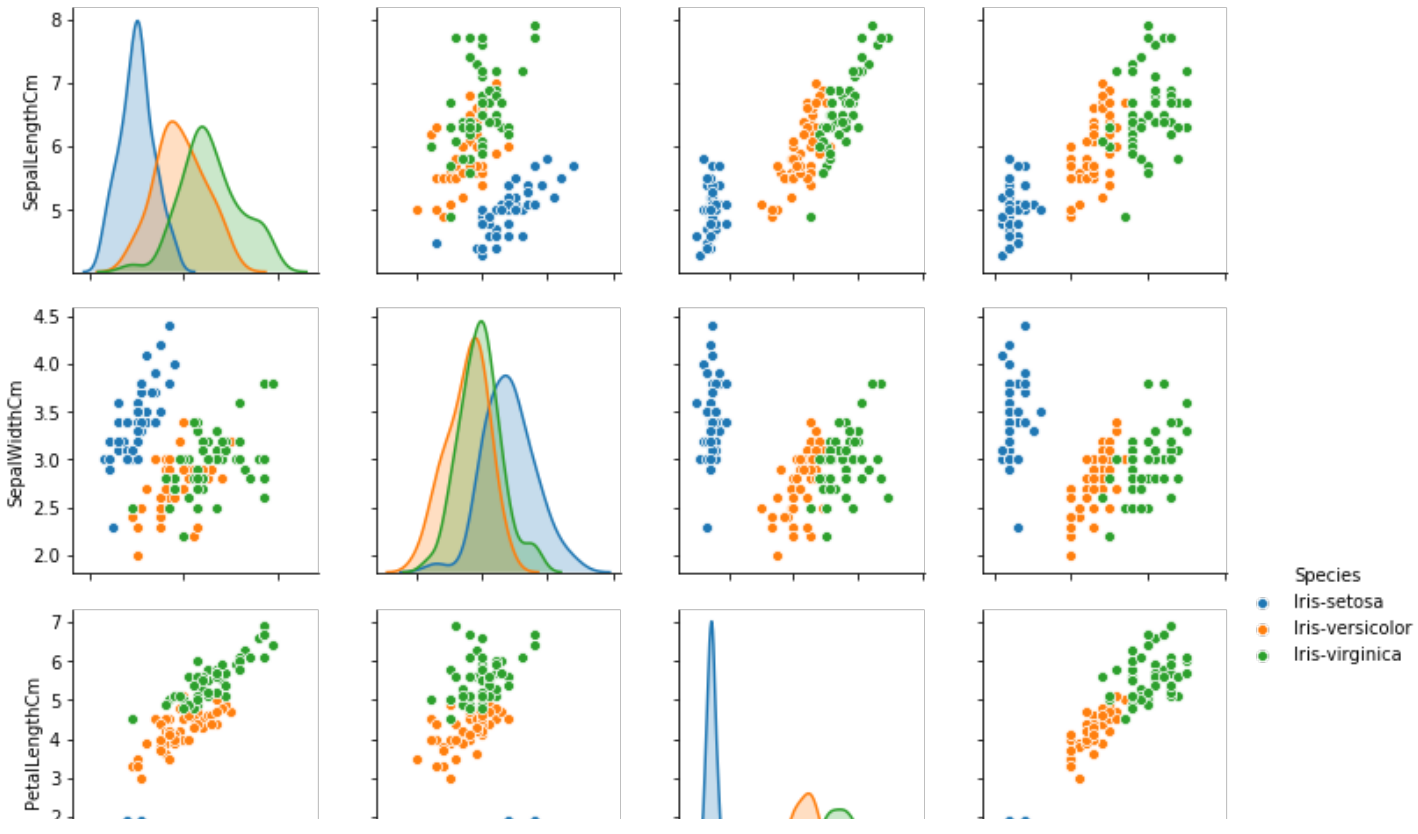
| | Id | SepalLengthCm | SepalWidthCm | PetalLengthCm | PetalWidthCm | Species |
|---|---|---|---|---|---|---|
| 0 | 1 | 5.1 | 3.5 | 1.4 | 0.2 | Iris-setosa |
| 1 | 2 | 4.9 | 3.0 | 1.4 | 0.2 | Iris-setosa |
| 2 | 3 | 4.7 | 3.2 | 1.3 | 0.2 | Iris-setosa |
| 3 | 4 | 4.6 | 3.1 | 1.5 | 0.2 | Iris-setosa |
| 4 | 5 | 5.0 | 3.6 | 1.4 | 0.2 | Iris-setosa |

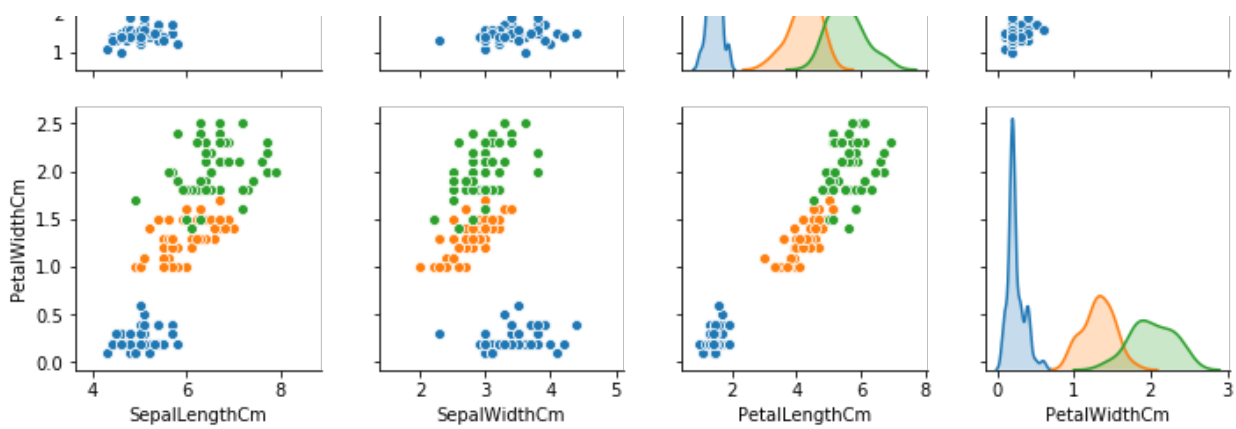
In [3]:

```
sns.pairplot(dataset.iloc[:,1:6],hue="Species")
```

Out[3]:

```
<seaborn.axisgrid.PairGrid at 0x7f84681287f0>
```






In [0]:

```
#Splitting the data into training and test test
X = dataset.iloc[:,1:5].values
y = dataset.iloc[:,5].values

encoder =  LabelEncoder()
y1 = encoder.fit_transform(y)

Y = pd.get_dummies(y1).values

X_train,X_test, y_train,y_test = train_test_split(X,Y,test_size=0.2,random_state=0)
```

In [5]:

```
X_train.shape
```

Out[5]:

```
(120, 4)
```

In [21]:

```
# Model
model = Sequential()

# first input layer with first hidden layer in a single statement
model.add(Dense(3, input_shape=(4,), activation='relu') )
# input_shape=(4,) means input_dim=4

# second hiden layer
model.add(Dense(4,activation='relu')) # 8 = no. of neurons in second hidden layer

# ouput layer
model.add(Dense(3,activation='softmax')) # 3 = no. of neurons in output layer as three ca
tegories of labels are there

# compile method receives three arguments: "an optimizer", "a loss function" and "a list
of metrics"
model.compile(Adam(lr=0.04),'categorical_crossentropy', ['accuracy'])
model.summary()
```

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_13 (Dense)             (None, 3)                 15
_________________________________________________________________
dense_14 (Dense)             (None, 4)                 16
_________________________________________________________________
dense_15 (Dense)             (None, 3)                 15
=================================================================
Total params: 46
Trainable params: 46
Non-trainable params: 0
_________________________________________________________________
```

In [22]:

```
history = model.fit(X_train, y_train, epochs=300, validation_split=0.2)
y_pred = model.predict(X_test)
```

```
Train on 96 samples, validate on 24 samples
Epoch 1/300
96/96 [==============================] - 1s 6ms/step - loss: 0.9455 - acc: 0.4792 - val_l
oss: 1.0133 - val_acc: 0.2917
Epoch 2/300
96/96 [==============================] - 0s 98us/step - loss: 0.8565 - acc: 0.3854 - val_
loss: 0.8730 - val_acc: 0.3333
Epoch 3/300
96/96 [==============================] - 0s 84us/step - loss: 0.7872 - acc: 0.3958 - val_
loss: 0.8187 - val_acc: 0.5833
Epoch 4/300
96/96 [==============================] - 0s 100us/step - loss: 0.7157 - acc: 0.7396 - val
_loss: 0.7464 - val_acc: 0.5833
Epoch 5/300
96/96 [==============================] - 0s 118us/step - loss: 0.6540 - acc: 0.7500 - val
_loss: 0.6798 - val_acc: 0.6250
Epoch 6/300
96/96 [==============================] - 0s 79us/step - loss: 0.6013 - acc: 0.7500 - val_
loss: 0.6399 - val_acc: 0.6250
Epoch 7/300
96/96 [==============================] - 0s 116us/step - loss: 0.5566 - acc: 0.7708 - val
_loss: 0.5944 - val_acc: 0.7083
Epoch 8/300
96/96 [==============================] - 0s 86us/step - loss: 0.5361 - acc: 0.8542 - val_
loss: 0.5654 - val_acc: 0.7083
Epoch 9/300
96/96 [==============================] - 0s 93us/step - loss: 0.4824 - acc: 0.7812 - val_
loss: 0.5933 - val_acc: 0.6250
Epoch 10/300
96/96 [==============================] - 0s 104us/step - loss: 0.4477 - acc: 0.7812 - val
_loss: 0.4975 - val_acc: 0.8750
Epoch 11/300
96/96 [==============================] - 0s 96us/step - loss: 0.4384 - acc: 0.9479 - val_
loss: 0.4779 - val_acc: 0.8750
Epoch 12/300
96/96 [==============================] - 0s 92us/step - loss: 0.4051 - acc: 0.8229 - val_
loss: 0.5514 - val_acc: 0.7083
Epoch 13/300
96/96 [==============================] - 0s 145us/step - loss: 0.3791 - acc: 0.8438 - val
_loss: 0.4403 - val_acc: 0.8333
Epoch 14/300
96/96 [==============================] - 0s 112us/step - loss: 0.3545 - acc: 0.9583 - val
_loss: 0.4190 - val_acc: 0.8750
Epoch 15/300
96/96 [==============================] - 0s 86us/step - loss: 0.3253 - acc: 0.9167 - val_
loss: 0.4356 - val_acc: 0.8333
Epoch 16/300
96/96 [==============================] - 0s 83us/step - loss: 0.3134 - acc: 0.8958 - val_
loss: 0.3732 - val_acc: 0.8750
Epoch 17/300
96/96 [==============================] - 0s 99us/step - loss: 0.2923 - acc: 0.9688 - val_
loss: 0.3418 - val_acc: 0.8750
Epoch 18/300
96/96 [==============================] - 0s 98us/step - loss: 0.2790 - acc: 0.9688 - val_
loss: 0.3438 - val_acc: 0.8750
Epoch 19/300
96/96 [==============================] - 0s 104us/step - loss: 0.2687 - acc: 0.9167 - val
_loss: 0.3442 - val_acc: 0.8750
Epoch 20/300
96/96 [==============================] - 0s 102us/step - loss: 0.2486 - acc: 0.9792 - val
_loss: 0.2862 - val_acc: 0.8750
Epoch 21/300
96/96 [==============================] - 0s 114us/step - loss: 0.2456 - acc: 0.9688 - val
_loss: 0.3215 - val_acc: 0.8750
Epoch 22/300
96/96 [==============================] - 0s 121us/step - loss: 0.2201 - acc: 0.9583 - val
_loss: 0.2708 - val_acc: 0.8333
Epoch 23/300
96/96 [==============================] - 0s 75us/step - loss: 0.2101 - acc: 0.9792 - val
```

96/96 [==============================] - 0s 79us/step - loss: 0.2161 - acc: 0.9792 - val_
loss: 0.2635 - val_acc: 0.8750
Epoch 24/300
96/96 [==============================] - 0s 82us/step - loss: 0.1941 - acc: 0.9896 - val_
loss: 0.2641 - val_acc: 0.8750
Epoch 25/300
96/96 [==============================] - 0s 75us/step - loss: 0.1847 - acc: 0.9688 - val_
loss: 0.2581 - val_acc: 0.8750
Epoch 26/300
96/96 [==============================] - 0s 74us/step - loss: 0.1796 - acc: 0.9896 - val_
loss: 0.2294 - val_acc: 0.8750
Epoch 27/300
96/96 [==============================] - 0s 73us/step - loss: 0.1661 - acc: 0.9792 - val_
loss: 0.2479 - val_acc: 0.8750
Epoch 28/300
96/96 [==============================] - 0s 74us/step - loss: 0.1660 - acc: 0.9688 - val_
loss: 0.1950 - val_acc: 0.9583
Epoch 29/300
96/96 [==============================] - 0s 77us/step - loss: 0.1520 - acc: 0.9896 - val_
loss: 0.2373 - val_acc: 0.8750
Epoch 30/300
96/96 [==============================] - 0s 81us/step - loss: 0.1461 - acc: 0.9688 - val_
loss: 0.2126 - val_acc: 0.8750
Epoch 31/300
96/96 [==============================] - 0s 110us/step - loss: 0.1356 - acc: 0.9896 - val
_loss: 0.1787 - val_acc: 0.9167
Epoch 32/300
96/96 [==============================] - 0s 106us/step - loss: 0.1329 - acc: 0.9896 - val
_loss: 0.1918 - val_acc: 0.8750
Epoch 33/300
96/96 [==============================] - 0s 121us/step - loss: 0.1296 - acc: 0.9792 - val
_loss: 0.1835 - val_acc: 0.8750
Epoch 34/300
96/96 [==============================] - 0s 101us/step - loss: 0.1252 - acc: 0.9896 - val
_loss: 0.1657 - val_acc: 0.9167
Epoch 35/300
96/96 [==============================] - 0s 130us/step - loss: 0.1271 - acc: 0.9896 - val
_loss: 0.2189 - val_acc: 0.8750
Epoch 36/300
96/96 [==============================] - 0s 142us/step - loss: 0.1148 - acc: 0.9896 - val
_loss: 0.1416 - val_acc: 0.9583
Epoch 37/300
96/96 [==============================] - 0s 98us/step - loss: 0.1154 - acc: 0.9792 - val_
loss: 0.1834 - val_acc: 0.8750
Epoch 38/300
96/96 [==============================] - 0s 93us/step - loss: 0.1052 - acc: 0.9896 - val_
loss: 0.1684 - val_acc: 0.8750
Epoch 39/300
96/96 [==============================] - 0s 80us/step - loss: 0.1010 - acc: 0.9896 - val_
loss: 0.1521 - val_acc: 0.8750
Epoch 40/300
96/96 [==============================] - 0s 108us/step - loss: 0.1148 - acc: 0.9792 - val
_loss: 0.1781 - val_acc: 0.8750
Epoch 41/300
96/96 [==============================] - 0s 137us/step - loss: 0.1147 - acc: 0.9688 - val
_loss: 0.2070 - val_acc: 0.8750
Epoch 42/300
96/96 [==============================] - 0s 161us/step - loss: 0.1226 - acc: 0.9792 - val
_loss: 0.1170 - val_acc: 0.9583
Epoch 43/300
96/96 [==============================] - 0s 132us/step - loss: 0.1027 - acc: 0.9688 - val
_loss: 0.2530 - val_acc: 0.8750
Epoch 44/300
96/96 [==============================] - 0s 99us/step - loss: 0.1000 - acc: 0.9896 - val_
loss: 0.1388 - val_acc: 0.9583
Epoch 45/300
96/96 [==============================] - 0s 99us/step - loss: 0.1012 - acc: 0.9792 - val_
loss: 0.1378 - val_acc: 0.9583
Epoch 46/300
96/96 [==============================] - 0s 91us/step - loss: 0.0851 - acc: 0.9896 - val_
loss: 0.2196 - val_acc: 0.8750
Epoch 47/300
96/96 [==============================] - 0s 85us/step - loss: 0.0951 - acc: 0.9792 - val

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96/96 [==============================] - 0s 89us/step - loss: 0.0991 - acc: 0.9792 - val_
loss: 0.1433 - val_acc: 0.8750
Epoch 48/300
96/96 [==============================] - 0s 94us/step - loss: 0.0831 - acc: 0.9896 - val_
loss: 0.1457 - val_acc: 0.8750
Epoch 49/300
96/96 [==============================] - 0s 104us/step - loss: 0.0821 - acc: 0.9792 - val
_loss: 0.1261 - val_acc: 0.9583
Epoch 50/300
96/96 [==============================] - 0s 131us/step - loss: 0.1044 - acc: 0.9688 - val
_loss: 0.1822 - val_acc: 0.8750
Epoch 51/300
96/96 [==============================] - 0s 113us/step - loss: 0.0867 - acc: 0.9896 - val
_loss: 0.0859 - val_acc: 1.0000
Epoch 52/300
96/96 [==============================] - 0s 105us/step - loss: 0.0974 - acc: 0.9688 - val
_loss: 0.2269 - val_acc: 0.8750
Epoch 53/300
96/96 [==============================] - 0s 163us/step - loss: 0.0909 - acc: 0.9792 - val
_loss: 0.1572 - val_acc: 0.8750
Epoch 54/300
96/96 [==============================] - 0s 121us/step - loss: 0.0997 - acc: 0.9688 - val
_loss: 0.1020 - val_acc: 0.9583
Epoch 55/300
96/96 [==============================] - 0s 105us/step - loss: 0.0675 - acc: 0.9896 - val
_loss: 0.2074 - val_acc: 0.8750
Epoch 56/300
96/96 [==============================] - 0s 94us/step - loss: 0.0915 - acc: 0.9688 - val_
loss: 0.1744 - val_acc: 0.8750
Epoch 57/300
96/96 [==============================] - 0s 94us/step - loss: 0.0673 - acc: 0.9896 - val_
loss: 0.0940 - val_acc: 0.9583
Epoch 58/300
96/96 [==============================] - 0s 111us/step - loss: 0.0799 - acc: 0.9792 - val
_loss: 0.1228 - val_acc: 0.9583
Epoch 59/300
96/96 [==============================] - 0s 121us/step - loss: 0.0770 - acc: 0.9792 - val
_loss: 0.2127 - val_acc: 0.8750
Epoch 60/300
96/96 [==============================] - 0s 118us/step - loss: 0.0787 - acc: 0.9792 - val
_loss: 0.0873 - val_acc: 0.9583
Epoch 61/300
96/96 [==============================] - 0s 119us/step - loss: 0.0781 - acc: 0.9792 - val
_loss: 0.1416 - val_acc: 0.8750
Epoch 62/300
96/96 [==============================] - 0s 115us/step - loss: 0.0663 - acc: 0.9896 - val
_loss: 0.2049 - val_acc: 0.8750
Epoch 63/300
96/96 [==============================] - 0s 101us/step - loss: 0.0917 - acc: 0.9688 - val
_loss: 0.1477 - val_acc: 0.8750
Epoch 64/300
96/96 [==============================] - 0s 93us/step - loss: 0.0684 - acc: 0.9896 - val_
loss: 0.0734 - val_acc: 1.0000
Epoch 65/300
96/96 [==============================] - 0s 74us/step - loss: 0.0785 - acc: 0.9792 - val_
loss: 0.1663 - val_acc: 0.8750
Epoch 66/300
96/96 [==============================] - 0s 77us/step - loss: 0.0758 - acc: 0.9792 - val_
loss: 0.1637 - val_acc: 0.8750
Epoch 67/300
96/96 [==============================] - 0s 96us/step - loss: 0.0645 - acc: 0.9896 - val_
loss: 0.1127 - val_acc: 0.9583
Epoch 68/300
96/96 [==============================] - 0s 107us/step - loss: 0.0717 - acc: 0.9792 - val
_loss: 0.1022 - val_acc: 0.9583
Epoch 69/300
96/96 [==============================] - 0s 139us/step - loss: 0.0658 - acc: 0.9896 - val
_loss: 0.1852 - val_acc: 0.8750
Epoch 70/300
96/96 [==============================] - 0s 122us/step - loss: 0.0744 - acc: 0.9792 - val
_loss: 0.1417 - val_acc: 0.8750
Epoch 71/300
96/96 [==============================] - 0s 124us/step - loss: 0.0988 - acc: 0.9688 - val
```

96/96 [==============================] - 0s 124us/step - loss: 0.0960 - acc: 0.9688 - val
_loss: 0.0753 - val_acc: 1.0000
Epoch 72/300
96/96 [==============================] - 0s 96us/step - loss: 0.0780 - acc: 0.9896 - val_
loss: 0.2587 - val_acc: 0.8750
Epoch 73/300
96/96 [==============================] - 0s 95us/step - loss: 0.0765 - acc: 0.9792 - val_
loss: 0.1017 - val_acc: 0.9583
Epoch 74/300
96/96 [==============================] - 0s 93us/step - loss: 0.0684 - acc: 0.9792 - val_
loss: 0.0787 - val_acc: 0.9583
Epoch 75/300
96/96 [==============================] - 0s 90us/step - loss: 0.0680 - acc: 0.9896 - val_
loss: 0.1862 - val_acc: 0.8750
Epoch 76/300
96/96 [==============================] - 0s 121us/step - loss: 0.0641 - acc: 0.9896 - val
_loss: 0.1324 - val_acc: 0.8750
Epoch 77/300
96/96 [==============================] - 0s 134us/step - loss: 0.0717 - acc: 0.9792 - val
_loss: 0.0892 - val_acc: 0.9583
Epoch 78/300
96/96 [==============================] - 0s 110us/step - loss: 0.0747 - acc: 0.9792 - val
_loss: 0.1992 - val_acc: 0.8750
Epoch 79/300
96/96 [==============================] - 0s 117us/step - loss: 0.0627 - acc: 0.9896 - val
_loss: 0.1005 - val_acc: 0.9583
Epoch 80/300
96/96 [==============================] - 0s 118us/step - loss: 0.0831 - acc: 0.9792 - val
_loss: 0.0765 - val_acc: 0.9583
Epoch 81/300
96/96 [==============================] - 0s 94us/step - loss: 0.0581 - acc: 0.9896 - val_
loss: 0.2193 - val_acc: 0.8750
Epoch 82/300
96/96 [==============================] - 0s 100us/step - loss: 0.0709 - acc: 0.9792 - val
_loss: 0.1543 - val_acc: 0.8750
Epoch 83/300
96/96 [==============================] - 0s 122us/step - loss: 0.0604 - acc: 0.9896 - val
_loss: 0.0639 - val_acc: 1.0000
Epoch 84/300
96/96 [==============================] - 0s 174us/step - loss: 0.0726 - acc: 0.9792 - val
_loss: 0.1613 - val_acc: 0.8750
Epoch 85/300
96/96 [==============================] - 0s 144us/step - loss: 0.0719 - acc: 0.9792 - val
_loss: 0.1820 - val_acc: 0.8750
Epoch 86/300
96/96 [==============================] - 0s 130us/step - loss: 0.0629 - acc: 0.9896 - val
_loss: 0.0650 - val_acc: 1.0000
Epoch 87/300
96/96 [==============================] - 0s 106us/step - loss: 0.0635 - acc: 0.9792 - val
_loss: 0.1555 - val_acc: 0.8750
Epoch 88/300
96/96 [==============================] - 0s 99us/step - loss: 0.0575 - acc: 0.9896 - val_
loss: 0.1761 - val_acc: 0.8750
Epoch 89/300
96/96 [==============================] - 0s 108us/step - loss: 0.0631 - acc: 0.9896 - val
_loss: 0.1297 - val_acc: 0.8750
Epoch 90/300
96/96 [==============================] - 0s 121us/step - loss: 0.0556 - acc: 0.9896 - val
_loss: 0.0720 - val_acc: 0.9583
Epoch 91/300
96/96 [==============================] - 0s 115us/step - loss: 0.0653 - acc: 0.9792 - val
_loss: 0.1636 - val_acc: 0.8750
Epoch 92/300
96/96 [==============================] - 0s 98us/step - loss: 0.0658 - acc: 0.9792 - val_
loss: 0.2041 - val_acc: 0.8750
Epoch 93/300
96/96 [==============================] - 0s 97us/step - loss: 0.0630 - acc: 0.9896 - val_
loss: 0.0920 - val_acc: 0.9583
Epoch 94/300
96/96 [==============================] - 0s 98us/step - loss: 0.0577 - acc: 0.9792 - val_
loss: 0.1105 - val_acc: 0.9583
Epoch 95/300
96/96 [==============================] - 0s 97us/step - loss: 0.0711 - acc: 0.9688 - val

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96/96 [==============================] - 0s 97us/step - loss: 0.0711 - acc: 0.9688 - val_
loss: 0.1779 - val_acc: 0.8750
Epoch 96/300
96/96 [==============================] - 0s 93us/step - loss: 0.0546 - acc: 0.9896 - val_
loss: 0.0719 - val_acc: 0.9583
Epoch 97/300
96/96 [==============================] - 0s 126us/step - loss: 0.0644 - acc: 0.9792 - val
_loss: 0.0989 - val_acc: 0.9583
Epoch 98/300
96/96 [==============================] - 0s 93us/step - loss: 0.0529 - acc: 0.9792 - val_
loss: 0.2214 - val_acc: 0.8750
Epoch 99/300
96/96 [==============================] - 0s 98us/step - loss: 0.0748 - acc: 0.9792 - val_
loss: 0.1538 - val_acc: 0.8750
Epoch 100/300
96/96 [==============================] - 0s 94us/step - loss: 0.0532 - acc: 0.9896 - val_
loss: 0.0468 - val_acc: 1.0000
Epoch 101/300
96/96 [==============================] - 0s 109us/step - loss: 0.0826 - acc: 0.9688 - val
_loss: 0.1495 - val_acc: 0.8750
Epoch 102/300
96/96 [==============================] - 0s 176us/step - loss: 0.0548 - acc: 0.9896 - val
_loss: 0.1593 - val_acc: 0.8750
Epoch 103/300
96/96 [==============================] - 0s 139us/step - loss: 0.0577 - acc: 0.9896 - val
_loss: 0.1196 - val_acc: 0.9583
Epoch 104/300
96/96 [==============================] - 0s 126us/step - loss: 0.0517 - acc: 0.9896 - val
_loss: 0.0894 - val_acc: 0.9583
Epoch 105/300
96/96 [==============================] - 0s 169us/step - loss: 0.0560 - acc: 0.9792 - val
_loss: 0.1100 - val_acc: 0.9583
Epoch 106/300
96/96 [==============================] - 0s 114us/step - loss: 0.0544 - acc: 0.9896 - val
_loss: 0.1650 - val_acc: 0.8750
Epoch 107/300
96/96 [==============================] - 0s 133us/step - loss: 0.0533 - acc: 0.9896 - val
_loss: 0.1034 - val_acc: 0.9583
Epoch 108/300
96/96 [==============================] - 0s 120us/step - loss: 0.0673 - acc: 0.9792 - val
_loss: 0.1347 - val_acc: 0.8750
Epoch 109/300
96/96 [==============================] - 0s 98us/step - loss: 0.0614 - acc: 0.9792 - val_
loss: 0.0686 - val_acc: 0.9583
Epoch 110/300
96/96 [==============================] - 0s 125us/step - loss: 0.0535 - acc: 0.9792 - val
_loss: 0.1484 - val_acc: 0.8750
Epoch 111/300
96/96 [==============================] - 0s 110us/step - loss: 0.0526 - acc: 0.9896 - val
_loss: 0.1650 - val_acc: 0.8750
Epoch 112/300
96/96 [==============================] - 0s 121us/step - loss: 0.0588 - acc: 0.9792 - val
_loss: 0.1108 - val_acc: 0.9583
Epoch 113/300
96/96 [==============================] - 0s 118us/step - loss: 0.0523 - acc: 0.9896 - val
_loss: 0.1278 - val_acc: 0.8750
Epoch 114/300
96/96 [==============================] - 0s 121us/step - loss: 0.0545 - acc: 0.9792 - val
_loss: 0.1043 - val_acc: 0.9583
Epoch 115/300
96/96 [==============================] - 0s 113us/step - loss: 0.0584 - acc: 0.9896 - val
_loss: 0.1396 - val_acc: 0.8750
Epoch 116/300
96/96 [==============================] - 0s 109us/step - loss: 0.0507 - acc: 0.9896 - val
_loss: 0.0813 - val_acc: 0.9583
Epoch 117/300
96/96 [==============================] - 0s 166us/step - loss: 0.0538 - acc: 0.9792 - val
_loss: 0.0969 - val_acc: 0.9583
Epoch 118/300
96/96 [==============================] - 0s 119us/step - loss: 0.0585 - acc: 0.9896 - val
_loss: 0.1640 - val_acc: 0.8750
Epoch 119/300
96/96 [==============================] - 0s 112us/step - loss: 0.0565 - acc: 0.9792 - val
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96/96 [==============================] - 0s 112us/step - loss: 0.0565 - acc: 0.9792 - val
_loss: 0.0842 - val_acc: 0.9583
Epoch 120/300
96/96 [==============================] - 0s 162us/step - loss: 0.0566 - acc: 0.9792 - val
_loss: 0.1221 - val_acc: 0.9167
Epoch 121/300
96/96 [==============================] - 0s 124us/step - loss: 0.0621 - acc: 0.9896 - val
_loss: 0.1546 - val_acc: 0.8750
Epoch 122/300
96/96 [==============================] - 0s 107us/step - loss: 0.0510 - acc: 0.9896 - val
_loss: 0.1010 - val_acc: 0.9583
Epoch 123/300
96/96 [==============================] - 0s 120us/step - loss: 0.0776 - acc: 0.9792 - val
_loss: 0.0697 - val_acc: 0.9583
Epoch 124/300
96/96 [==============================] - 0s 102us/step - loss: 0.0572 - acc: 0.9896 - val
_loss: 0.2606 - val_acc: 0.8750
Epoch 125/300
96/96 [==============================] - 0s 153us/step - loss: 0.0798 - acc: 0.9688 - val
_loss: 0.1586 - val_acc: 0.8750
Epoch 126/300
96/96 [==============================] - 0s 106us/step - loss: 0.1005 - acc: 0.9375 - val
_loss: 0.0431 - val_acc: 1.0000
Epoch 127/300
96/96 [==============================] - 0s 89us/step - loss: 0.0545 - acc: 0.9792 - val_
loss: 0.3118 - val_acc: 0.8750
Epoch 128/300
96/96 [==============================] - 0s 83us/step - loss: 0.0786 - acc: 0.9688 - val_
loss: 0.1928 - val_acc: 0.8750
Epoch 129/300
96/96 [==============================] - 0s 99us/step - loss: 0.0549 - acc: 0.9792 - val_
loss: 0.0507 - val_acc: 1.0000
Epoch 130/300
96/96 [==============================] - 0s 68us/step - loss: 0.0605 - acc: 0.9792 - val_
loss: 0.1403 - val_acc: 0.8750
Epoch 131/300
96/96 [==============================] - 0s 64us/step - loss: 0.0491 - acc: 0.9896 - val_
loss: 0.2163 - val_acc: 0.8750
Epoch 132/300
96/96 [==============================] - 0s 63us/step - loss: 0.0630 - acc: 0.9792 - val_
loss: 0.1421 - val_acc: 0.8750
Epoch 133/300
96/96 [==============================] - 0s 67us/step - loss: 0.0731 - acc: 0.9896 - val_
loss: 0.0482 - val_acc: 1.0000
Epoch 134/300
96/96 [==============================] - 0s 66us/step - loss: 0.0693 - acc: 0.9792 - val_
loss: 0.2267 - val_acc: 0.8750
Epoch 135/300
96/96 [==============================] - 0s 76us/step - loss: 0.0582 - acc: 0.9896 - val_
loss: 0.1343 - val_acc: 0.8750
Epoch 136/300
96/96 [==============================] - 0s 164us/step - loss: 0.0595 - acc: 0.9792 - val
_loss: 0.0667 - val_acc: 0.9583
Epoch 137/300
96/96 [==============================] - 0s 98us/step - loss: 0.0524 - acc: 0.9792 - val_
loss: 0.1833 - val_acc: 0.8750
Epoch 138/300
96/96 [==============================] - 0s 104us/step - loss: 0.0545 - acc: 0.9896 - val
_loss: 0.1352 - val_acc: 0.8750
Epoch 139/300
96/96 [==============================] - 0s 94us/step - loss: 0.0506 - acc: 0.9896 - val_
loss: 0.0986 - val_acc: 0.9583
Epoch 140/300
96/96 [==============================] - 0s 115us/step - loss: 0.0495 - acc: 0.9792 - val
_loss: 0.0748 - val_acc: 0.9583
Epoch 141/300
96/96 [==============================] - 0s 100us/step - loss: 0.0501 - acc: 0.9792 - val
_loss: 0.1271 - val_acc: 0.9167
Epoch 142/300
96/96 [==============================] - 0s 78us/step - loss: 0.0488 - acc: 0.9896 - val_
loss: 0.1437 - val_acc: 0.8750
Epoch 143/300
96/96 [==============================] - 0s 74us/step - loss: 0.0518 - acc: 0.9792 - val

96/96 [==============================] - 0s 74us/step - loss: 0.0516 - acc: 0.9792 - val_
loss: 0.1172 - val_acc: 0.9583
Epoch 144/300
96/96 [==============================] - 0s 90us/step - loss: 0.0487 - acc: 0.9896 - val_
loss: 0.1105 - val_acc: 0.9583
Epoch 145/300
96/96 [==============================] - 0s 79us/step - loss: 0.0547 - acc: 0.9896 - val_
loss: 0.1544 - val_acc: 0.8750
Epoch 146/300
96/96 [==============================] - 0s 80us/step - loss: 0.0522 - acc: 0.9792 - val_
loss: 0.0746 - val_acc: 0.9583
Epoch 147/300
96/96 [==============================] - 0s 74us/step - loss: 0.0526 - acc: 0.9792 - val_
loss: 0.1099 - val_acc: 0.9583
Epoch 148/300
96/96 [==============================] - 0s 89us/step - loss: 0.0454 - acc: 0.9896 - val_
loss: 0.1817 - val_acc: 0.8750
Epoch 149/300
96/96 [==============================] - 0s 95us/step - loss: 0.0600 - acc: 0.9896 - val_
loss: 0.1186 - val_acc: 0.9583
Epoch 150/300
96/96 [==============================] - 0s 104us/step - loss: 0.0678 - acc: 0.9792 - val
_loss: 0.0838 - val_acc: 0.9583
Epoch 151/300
96/96 [==============================] - 0s 93us/step - loss: 0.0549 - acc: 0.9896 - val_
loss: 0.2492 - val_acc: 0.8750
Epoch 152/300
96/96 [==============================] - 0s 90us/step - loss: 0.0584 - acc: 0.9896 - val_
loss: 0.1115 - val_acc: 0.9583
Epoch 153/300
96/96 [==============================] - 0s 109us/step - loss: 0.0526 - acc: 0.9792 - val
_loss: 0.0562 - val_acc: 0.9583
Epoch 154/300
96/96 [==============================] - 0s 98us/step - loss: 0.0586 - acc: 0.9792 - val_
loss: 0.1239 - val_acc: 0.9167
Epoch 155/300
96/96 [==============================] - 0s 92us/step - loss: 0.0757 - acc: 0.9896 - val_
loss: 0.3840 - val_acc: 0.8750
Epoch 156/300
96/96 [==============================] - 0s 93us/step - loss: 0.0847 - acc: 0.9688 - val_
loss: 0.0428 - val_acc: 1.0000
Epoch 157/300
96/96 [==============================] - 0s 95us/step - loss: 0.0790 - acc: 0.9583 - val_
loss: 0.1551 - val_acc: 0.8750
Epoch 158/300
96/96 [==============================] - 0s 88us/step - loss: 0.0743 - acc: 0.9792 - val_
loss: 0.3353 - val_acc: 0.8750
Epoch 159/300
96/96 [==============================] - 0s 110us/step - loss: 0.0655 - acc: 0.9896 - val
_loss: 0.0553 - val_acc: 0.9583
Epoch 160/300
96/96 [==============================] - 0s 103us/step - loss: 0.0602 - acc: 0.9792 - val
_loss: 0.0689 - val_acc: 0.9583
Epoch 161/300
96/96 [==============================] - 0s 94us/step - loss: 0.0522 - acc: 0.9896 - val_
loss: 0.2081 - val_acc: 0.8750
Epoch 162/300
96/96 [==============================] - 0s 90us/step - loss: 0.0543 - acc: 0.9896 - val_
loss: 0.1229 - val_acc: 0.9167
Epoch 163/300
96/96 [==============================] - 0s 95us/step - loss: 0.0486 - acc: 0.9896 - val_
loss: 0.0954 - val_acc: 0.9583
Epoch 164/300
96/96 [==============================] - 0s 88us/step - loss: 0.0530 - acc: 0.9792 - val_
loss: 0.0959 - val_acc: 0.9583
Epoch 165/300
96/96 [==============================] - 0s 88us/step - loss: 0.0576 - acc: 0.9792 - val_
loss: 0.0737 - val_acc: 0.9583
Epoch 166/300
96/96 [==============================] - 0s 87us/step - loss: 0.0535 - acc: 0.9792 - val_
loss: 0.2253 - val_acc: 0.8750
Epoch 167/300
96/96 [==============================] - 0s 87us/step - loss: 0.0605 - acc: 0.9896 - val_

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96/96 [==============================] - 0s 87us/step - loss: 0.0609 - acc: 0.9896 - val_
loss: 0.1039 - val_acc: 0.9583
Epoch 168/300
96/96 [==============================] - 0s 89us/step - loss: 0.0531 - acc: 0.9792 - val_
loss: 0.1270 - val_acc: 0.9167
Epoch 169/300
96/96 [==============================] - 0s 83us/step - loss: 0.0517 - acc: 0.9896 - val_
loss: 0.1218 - val_acc: 0.9167
Epoch 170/300
96/96 [==============================] - 0s 90us/step - loss: 0.0516 - acc: 0.9792 - val_
loss: 0.0660 - val_acc: 0.9583
Epoch 171/300
96/96 [==============================] - 0s 96us/step - loss: 0.0544 - acc: 0.9792 - val_
loss: 0.1336 - val_acc: 0.9167
Epoch 172/300
96/96 [==============================] - 0s 85us/step - loss: 0.0479 - acc: 0.9896 - val_
loss: 0.2536 - val_acc: 0.8750
Epoch 173/300
96/96 [==============================] - 0s 94us/step - loss: 0.0660 - acc: 0.9688 - val_
loss: 0.0982 - val_acc: 0.9583
Epoch 174/300
96/96 [==============================] - 0s 97us/step - loss: 0.0498 - acc: 0.9792 - val_
loss: 0.1215 - val_acc: 0.9167
Epoch 175/300
96/96 [==============================] - 0s 91us/step - loss: 0.0536 - acc: 0.9792 - val_
loss: 0.0913 - val_acc: 0.9583
Epoch 176/300
96/96 [==============================] - 0s 87us/step - loss: 0.0711 - acc: 0.9688 - val_
loss: 0.2265 - val_acc: 0.8750
Epoch 177/300
96/96 [==============================] - 0s 85us/step - loss: 0.0573 - acc: 0.9896 - val_
loss: 0.0406 - val_acc: 1.0000
Epoch 178/300
96/96 [==============================] - 0s 84us/step - loss: 0.0660 - acc: 0.9792 - val_
loss: 0.1009 - val_acc: 0.9583
Epoch 179/300
96/96 [==============================] - 0s 81us/step - loss: 0.0668 - acc: 0.9896 - val_
loss: 0.3415 - val_acc: 0.8750
Epoch 180/300
96/96 [==============================] - 0s 91us/step - loss: 0.0645 - acc: 0.9688 - val_
loss: 0.0972 - val_acc: 0.9583
Epoch 181/300
96/96 [==============================] - 0s 86us/step - loss: 0.0622 - acc: 0.9688 - val_
loss: 0.0315 - val_acc: 1.0000
Epoch 182/300
96/96 [==============================] - 0s 92us/step - loss: 0.0592 - acc: 0.9792 - val_
loss: 0.1491 - val_acc: 0.8750
Epoch 183/300
96/96 [==============================] - 0s 90us/step - loss: 0.0528 - acc: 0.9896 - val_
loss: 0.2580 - val_acc: 0.8750
Epoch 184/300
96/96 [==============================] - 0s 85us/step - loss: 0.0699 - acc: 0.9792 - val_
loss: 0.0668 - val_acc: 0.9583
Epoch 185/300
96/96 [==============================] - 0s 86us/step - loss: 0.0515 - acc: 0.9792 - val_
loss: 0.1144 - val_acc: 0.9583
Epoch 186/300
96/96 [==============================] - 0s 95us/step - loss: 0.0481 - acc: 0.9896 - val_
loss: 0.1177 - val_acc: 0.9583
Epoch 187/300
96/96 [==============================] - 0s 103us/step - loss: 0.0490 - acc: 0.9792 - val
_loss: 0.1033 - val_acc: 0.9583
Epoch 188/300
96/96 [==============================] - 0s 85us/step - loss: 0.0480 - acc: 0.9792 - val_
loss: 0.1000 - val_acc: 0.9583
Epoch 189/300
96/96 [==============================] - 0s 89us/step - loss: 0.0543 - acc: 0.9792 - val_
loss: 0.1210 - val_acc: 0.9167
Epoch 190/300
96/96 [==============================] - 0s 100us/step - loss: 0.0524 - acc: 0.9792 - val
_loss: 0.0842 - val_acc: 0.9583
Epoch 191/300
96/96 [==============================] - 0s 90us/step - loss: 0.0570 - acc: 0.9792 - val_
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96/96 [==============================] - 0s 90us/step - loss: 0.0570 - acc: 0.9792 - val_
loss: 0.1675 - val_acc: 0.8750
Epoch 192/300
96/96 [==============================] - 0s 90us/step - loss: 0.0508 - acc: 0.9792 - val_
loss: 0.1028 - val_acc: 0.9583
Epoch 193/300
96/96 [==============================] - 0s 93us/step - loss: 0.0471 - acc: 0.9896 - val_
loss: 0.1175 - val_acc: 0.9583
Epoch 194/300
96/96 [==============================] - 0s 93us/step - loss: 0.0494 - acc: 0.9792 - val_
loss: 0.0882 - val_acc: 0.9583
Epoch 195/300
96/96 [==============================] - 0s 97us/step - loss: 0.0597 - acc: 0.9792 - val_
loss: 0.1107 - val_acc: 0.9583
Epoch 196/300
96/96 [==============================] - 0s 108us/step - loss: 0.0423 - acc: 0.9896 - val
_loss: 0.2187 - val_acc: 0.8750
Epoch 197/300
96/96 [==============================] - 0s 93us/step - loss: 0.0551 - acc: 0.9896 - val_
loss: 0.1191 - val_acc: 0.9167
Epoch 198/300
96/96 [==============================] - 0s 100us/step - loss: 0.0472 - acc: 0.9792 - val
_loss: 0.0782 - val_acc: 0.9583
Epoch 199/300
96/96 [==============================] - 0s 92us/step - loss: 0.0538 - acc: 0.9792 - val_
loss: 0.1089 - val_acc: 0.9583
Epoch 200/300
96/96 [==============================] - 0s 88us/step - loss: 0.0492 - acc: 0.9792 - val_
loss: 0.1012 - val_acc: 0.9583
Epoch 201/300
96/96 [==============================] - 0s 93us/step - loss: 0.0479 - acc: 0.9896 - val_
loss: 0.1412 - val_acc: 0.8750
Epoch 202/300
96/96 [==============================] - 0s 89us/step - loss: 0.0545 - acc: 0.9896 - val_
loss: 0.1520 - val_acc: 0.8750
Epoch 203/300
96/96 [==============================] - 0s 95us/step - loss: 0.0452 - acc: 0.9792 - val_
loss: 0.0609 - val_acc: 0.9583
Epoch 204/300
96/96 [==============================] - 0s 101us/step - loss: 0.0754 - acc: 0.9688 - val
_loss: 0.0980 - val_acc: 0.9583
Epoch 205/300
96/96 [==============================] - 0s 97us/step - loss: 0.0641 - acc: 0.9792 - val_
loss: 0.3046 - val_acc: 0.8750
Epoch 206/300
96/96 [==============================] - 0s 93us/step - loss: 0.0534 - acc: 0.9896 - val_
loss: 0.0710 - val_acc: 0.9583
Epoch 207/300
96/96 [==============================] - 0s 108us/step - loss: 0.0640 - acc: 0.9792 - val
_loss: 0.0606 - val_acc: 0.9583
Epoch 208/300
96/96 [==============================] - 0s 96us/step - loss: 0.0431 - acc: 0.9792 - val_
loss: 0.1828 - val_acc: 0.8750
Epoch 209/300
96/96 [==============================] - 0s 94us/step - loss: 0.0563 - acc: 0.9792 - val_
loss: 0.2294 - val_acc: 0.8750
Epoch 210/300
96/96 [==============================] - 0s 94us/step - loss: 0.0534 - acc: 0.9792 - val_
loss: 0.0604 - val_acc: 0.9583
Epoch 211/300
96/96 [==============================] - 0s 91us/step - loss: 0.0704 - acc: 0.9792 - val_
loss: 0.0775 - val_acc: 0.9583
Epoch 212/300
96/96 [==============================] - 0s 93us/step - loss: 0.0388 - acc: 0.9792 - val_
loss: 0.3349 - val_acc: 0.8750
Epoch 213/300
96/96 [==============================] - 0s 106us/step - loss: 0.1104 - acc: 0.9688 - val
_loss: 0.2422 - val_acc: 0.8750
Epoch 214/300
96/96 [==============================] - 0s 91us/step - loss: 0.0754 - acc: 0.9792 - val_
loss: 0.0257 - val_acc: 1.0000
Epoch 215/300
96/96 [==============================] - 0s 111us/step - loss: 0.0916 - acc: 0.9688 - val
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96/96 [==============================] - 0s 111us/step - loss: 0.0910 - acc: 0.9688 - val
_loss: 0.2502 - val_acc: 0.8750
Epoch 216/300
96/96 [==============================] - 0s 83us/step - loss: 0.0645 - acc: 0.9896 - val_
loss: 0.2228 - val_acc: 0.8750
Epoch 217/300
96/96 [==============================] - 0s 103us/step - loss: 0.0661 - acc: 0.9792 - val
_loss: 0.0462 - val_acc: 1.0000
Epoch 218/300
96/96 [==============================] - 0s 183us/step - loss: 0.0694 - acc: 0.9792 - val
_loss: 0.1744 - val_acc: 0.8750
Epoch 219/300
96/96 [==============================] - 0s 106us/step - loss: 0.0531 - acc: 0.9896 - val
_loss: 0.1590 - val_acc: 0.8750
Epoch 220/300
96/96 [==============================] - 0s 97us/step - loss: 0.0823 - acc: 0.9688 - val_
loss: 0.0487 - val_acc: 1.0000
Epoch 221/300
96/96 [==============================] - 0s 81us/step - loss: 0.0502 - acc: 0.9896 - val_
loss: 0.2003 - val_acc: 0.8750
Epoch 222/300
96/96 [==============================] - 0s 137us/step - loss: 0.0656 - acc: 0.9792 - val
_loss: 0.2321 - val_acc: 0.8750
Epoch 223/300
96/96 [==============================] - 0s 84us/step - loss: 0.0468 - acc: 0.9896 - val_
loss: 0.0507 - val_acc: 1.0000
Epoch 224/300
96/96 [==============================] - 0s 105us/step - loss: 0.0775 - acc: 0.9688 - val
_loss: 0.0867 - val_acc: 0.9583
Epoch 225/300
96/96 [==============================] - 0s 75us/step - loss: 0.0372 - acc: 0.9896 - val_
loss: 0.2549 - val_acc: 0.8750
Epoch 226/300
96/96 [==============================] - 0s 138us/step - loss: 0.0606 - acc: 0.9896 - val
_loss: 0.1851 - val_acc: 0.8750
Epoch 227/300
96/96 [==============================] - 0s 146us/step - loss: 0.0517 - acc: 0.9896 - val
_loss: 0.0472 - val_acc: 1.0000
Epoch 228/300
96/96 [==============================] - 0s 98us/step - loss: 0.0551 - acc: 0.9792 - val_
loss: 0.1013 - val_acc: 0.9583
Epoch 229/300
96/96 [==============================] - 0s 117us/step - loss: 0.0593 - acc: 0.9896 - val
_loss: 0.2470 - val_acc: 0.8750
Epoch 230/300
96/96 [==============================] - 0s 109us/step - loss: 0.0584 - acc: 0.9792 - val
_loss: 0.0907 - val_acc: 0.9583
Epoch 231/300
96/96 [==============================] - 0s 108us/step - loss: 0.0561 - acc: 0.9792 - val
_loss: 0.0785 - val_acc: 0.9583
Epoch 232/300
96/96 [==============================] - 0s 120us/step - loss: 0.0603 - acc: 0.9896 - val
_loss: 0.2589 - val_acc: 0.8750
Epoch 233/300
96/96 [==============================] - 0s 99us/step - loss: 0.0568 - acc: 0.9896 - val_
loss: 0.1388 - val_acc: 0.9167
Epoch 234/300
96/96 [==============================] - 0s 78us/step - loss: 0.0776 - acc: 0.9688 - val_
loss: 0.0558 - val_acc: 0.9583
Epoch 235/300
96/96 [==============================] - 0s 103us/step - loss: 0.0513 - acc: 0.9896 - val
_loss: 0.2349 - val_acc: 0.8750
Epoch 236/300
96/96 [==============================] - 0s 182us/step - loss: 0.0588 - acc: 0.9896 - val
_loss: 0.1394 - val_acc: 0.9167
Epoch 237/300
96/96 [==============================] - 0s 132us/step - loss: 0.0657 - acc: 0.9792 - val
_loss: 0.0885 - val_acc: 0.9583
Epoch 238/300
96/96 [==============================] - 0s 107us/step - loss: 0.0611 - acc: 0.9792 - val
_loss: 0.2292 - val_acc: 0.8750
Epoch 239/300
96/96 [==============================] - 0s 129us/step - loss: 0.0507 - acc: 0.9896 - val
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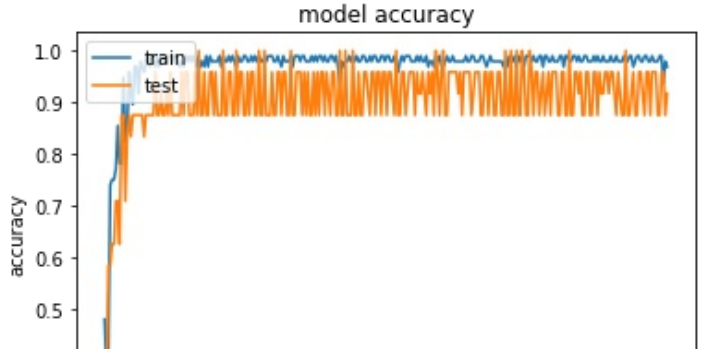
96/96 [==============================] - 0s 129us/step - loss: 0.0507 - acc: 0.9896 - val
_loss: 0.1148 - val_acc: 0.9583
Epoch 240/300
96/96 [==============================] - 0s 153us/step - loss: 0.0415 - acc: 0.9792 - val
_loss: 0.0592 - val_acc: 0.9583
Epoch 241/300
96/96 [==============================] - 0s 109us/step - loss: 0.0537 - acc: 0.9792 - val
_loss: 0.0923 - val_acc: 0.9583
Epoch 242/300
96/96 [==============================] - 0s 132us/step - loss: 0.0424 - acc: 0.9792 - val
_loss: 0.1744 - val_acc: 0.8750
Epoch 243/300
96/96 [==============================] - 0s 134us/step - loss: 0.0577 - acc: 0.9896 - val
_loss: 0.2248 - val_acc: 0.8750
Epoch 244/300
96/96 [==============================] - 0s 101us/step - loss: 0.0507 - acc: 0.9896 - val
_loss: 0.0514 - val_acc: 0.9583
Epoch 245/300
96/96 [==============================] - 0s 192us/step - loss: 0.0723 - acc: 0.9688 - val
_loss: 0.0935 - val_acc: 0.9583
Epoch 246/300
96/96 [==============================] - 0s 152us/step - loss: 0.0382 - acc: 0.9896 - val
_loss: 0.2709 - val_acc: 0.8750
Epoch 247/300
96/96 [==============================] - 0s 99us/step - loss: 0.0654 - acc: 0.9896 - val_
loss: 0.2046 - val_acc: 0.8750
Epoch 248/300
96/96 [==============================] - 0s 114us/step - loss: 0.0695 - acc: 0.9792 - val
_loss: 0.0362 - val_acc: 1.0000
Epoch 249/300
96/96 [==============================] - 0s 127us/step - loss: 0.0589 - acc: 0.9792 - val
_loss: 0.1995 - val_acc: 0.8750
Epoch 250/300
96/96 [==============================] - 0s 137us/step - loss: 0.0512 - acc: 0.9896 - val
_loss: 0.2131 - val_acc: 0.8750
Epoch 251/300
96/96 [==============================] - 0s 108us/step - loss: 0.0518 - acc: 0.9896 - val
_loss: 0.0911 - val_acc: 0.9583
Epoch 252/300
96/96 [==============================] - 0s 78us/step - loss: 0.0472 - acc: 0.9792 - val_
loss: 0.0920 - val_acc: 0.9583
Epoch 253/300
96/96 [==============================] - 0s 198us/step - loss: 0.0454 - acc: 0.9896 - val
_loss: 0.1423 - val_acc: 0.9167
Epoch 254/300
96/96 [==============================] - 0s 94us/step - loss: 0.0558 - acc: 0.9792 - val_
loss: 0.1033 - val_acc: 0.9583
Epoch 255/300
96/96 [==============================] - 0s 83us/step - loss: 0.0459 - acc: 0.9792 - val_
loss: 0.1490 - val_acc: 0.8750
Epoch 256/300
96/96 [==============================] - 0s 100us/step - loss: 0.0694 - acc: 0.9896 - val
_loss: 0.2476 - val_acc: 0.8750
Epoch 257/300
96/96 [==============================] - 0s 120us/step - loss: 0.0441 - acc: 0.9896 - val
_loss: 0.0766 - val_acc: 0.9583
Epoch 258/300
96/96 [==============================] - 0s 120us/step - loss: 0.0500 - acc: 0.9792 - val
_loss: 0.0498 - val_acc: 0.9583
Epoch 259/300
96/96 [==============================] - 0s 108us/step - loss: 0.0576 - acc: 0.9792 - val
_loss: 0.1543 - val_acc: 0.8750
Epoch 260/300
96/96 [==============================] - 0s 107us/step - loss: 0.0695 - acc: 0.9792 - val
_loss: 0.2984 - val_acc: 0.8750
Epoch 261/300
96/96 [==============================] - 0s 95us/step - loss: 0.0561 - acc: 0.9896 - val_
loss: 0.0593 - val_acc: 0.9583
Epoch 262/300
96/96 [==============================] - 0s 112us/step - loss: 0.0618 - acc: 0.9792 - val
_loss: 0.0766 - val_acc: 0.9583
Epoch 263/300
96/96 [==============================] - 0s 96us/step - loss: 0.0473 - acc: 0.9896 - val

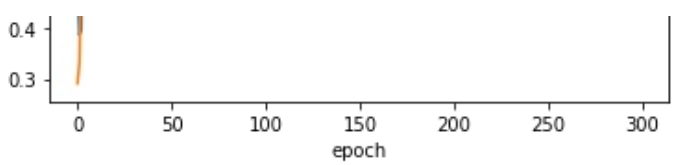
96/96 [==============================] - 0s 96us/step - loss: 0.0475 - acc: 0.9896 - val_
loss: 0.1658 - val_acc: 0.8750
Epoch 264/300
96/96 [==============================] - 0s 95us/step - loss: 0.0524 - acc: 0.9792 - val_
loss: 0.1135 - val_acc: 0.9583
Epoch 265/300
96/96 [==============================] - 0s 97us/step - loss: 0.0499 - acc: 0.9792 - val_
loss: 0.1331 - val_acc: 0.9167
Epoch 266/300
96/96 [==============================] - 0s 92us/step - loss: 0.0476 - acc: 0.9896 - val_
loss: 0.1190 - val_acc: 0.9167
Epoch 267/300
96/96 [==============================] - 0s 85us/step - loss: 0.0447 - acc: 0.9792 - val_
loss: 0.0892 - val_acc: 0.9583
Epoch 268/300
96/96 [==============================] - 0s 89us/step - loss: 0.0459 - acc: 0.9792 - val_
loss: 0.0808 - val_acc: 0.9583
Epoch 269/300
96/96 [==============================] - 0s 92us/step - loss: 0.0539 - acc: 0.9792 - val_
loss: 0.1423 - val_acc: 0.9167
Epoch 270/300
96/96 [==============================] - 0s 82us/step - loss: 0.0445 - acc: 0.9896 - val_
loss: 0.0929 - val_acc: 0.9583
Epoch 271/300
96/96 [==============================] - 0s 92us/step - loss: 0.0519 - acc: 0.9792 - val_
loss: 0.0735 - val_acc: 0.9583
Epoch 272/300
96/96 [==============================] - 0s 115us/step - loss: 0.0436 - acc: 0.9792 - val
_loss: 0.1460 - val_acc: 0.9167
Epoch 273/300
96/96 [==============================] - 0s 93us/step - loss: 0.0505 - acc: 0.9896 - val_
loss: 0.1592 - val_acc: 0.8750
Epoch 274/300
96/96 [==============================] - 0s 92us/step - loss: 0.0509 - acc: 0.9792 - val_
loss: 0.0850 - val_acc: 0.9583
Epoch 275/300
96/96 [==============================] - 0s 100us/step - loss: 0.0491 - acc: 0.9792 - val
_loss: 0.1188 - val_acc: 0.9167
Epoch 276/300
96/96 [==============================] - 0s 87us/step - loss: 0.0434 - acc: 0.9792 - val_
loss: 0.2001 - val_acc: 0.8750
Epoch 277/300
96/96 [==============================] - 0s 103us/step - loss: 0.0616 - acc: 0.9896 - val
_loss: 0.1723 - val_acc: 0.8750
Epoch 278/300
96/96 [==============================] - 0s 91us/step - loss: 0.0624 - acc: 0.9792 - val_
loss: 0.0335 - val_acc: 1.0000
Epoch 279/300
96/96 [==============================] - 0s 84us/step - loss: 0.0561 - acc: 0.9792 - val_
loss: 0.1775 - val_acc: 0.8750
Epoch 280/300
96/96 [==============================] - 0s 98us/step - loss: 0.0487 - acc: 0.9896 - val_
loss: 0.2363 - val_acc: 0.8750
Epoch 281/300
96/96 [==============================] - 0s 80us/step - loss: 0.0510 - acc: 0.9896 - val_
loss: 0.1140 - val_acc: 0.9167
Epoch 282/300
96/96 [==============================] - 0s 89us/step - loss: 0.0654 - acc: 0.9688 - val_
loss: 0.0579 - val_acc: 0.9583
Epoch 283/300
96/96 [==============================] - 0s 107us/step - loss: 0.0388 - acc: 0.9792 - val
_loss: 0.2040 - val_acc: 0.8750
Epoch 284/300
96/96 [==============================] - 0s 108us/step - loss: 0.0648 - acc: 0.9896 - val
_loss: 0.2142 - val_acc: 0.8750
Epoch 285/300
96/96 [==============================] - 0s 92us/step - loss: 0.0417 - acc: 0.9896 - val_
loss: 0.0736 - val_acc: 0.9583
Epoch 286/300
96/96 [==============================] - 0s 72us/step - loss: 0.0571 - acc: 0.9792 - val_
loss: 0.0701 - val_acc: 0.9583
Epoch 287/300
96/96 [==============================] - 0s 92us/step - loss: 0.0471 - acc: 0.9792 - val_

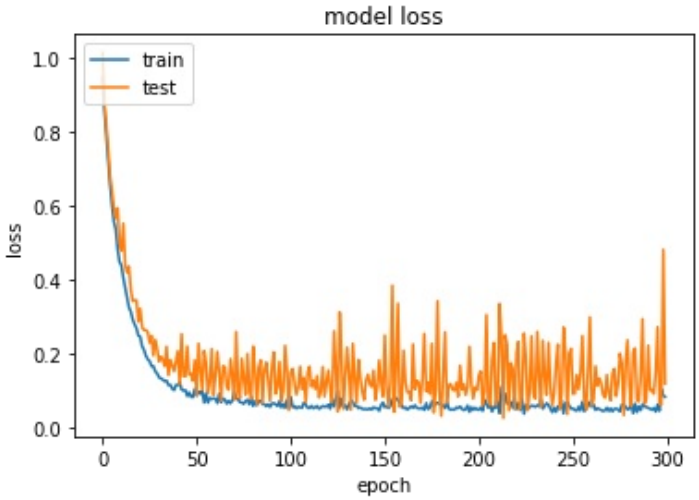
```
loss: 0.1444 - val_acc: 0.9167
Epoch 288/300
96/96 [==============================] - 0s 120us/step - loss: 0.0632 - acc: 0.9896 - val
_loss: 0.2935 - val_acc: 0.8750
Epoch 289/300
96/96 [==============================] - 0s 80us/step - loss: 0.0571 - acc: 0.9896 - val_
loss: 0.0632 - val_acc: 0.9583
Epoch 290/300
96/96 [==============================] - 0s 173us/step - loss: 0.0556 - acc: 0.9792 - val
_loss: 0.0785 - val_acc: 0.9583
Epoch 291/300
96/96 [==============================] - 0s 149us/step - loss: 0.0532 - acc: 0.9792 - val
_loss: 0.2216 - val_acc: 0.8750
Epoch 292/300
96/96 [==============================] - 0s 177us/step - loss: 0.0505 - acc: 0.9896 - val
_loss: 0.1009 - val_acc: 0.9583
Epoch 293/300
96/96 [==============================] - 0s 223us/step - loss: 0.0482 - acc: 0.9792 - val
_loss: 0.1029 - val_acc: 0.9583
Epoch 294/300
96/96 [==============================] - 0s 172us/step - loss: 0.0529 - acc: 0.9792 - val
_loss: 0.0914 - val_acc: 0.9583
Epoch 295/300
96/96 [==============================] - 0s 124us/step - loss: 0.0429 - acc: 0.9792 - val
_loss: 0.1535 - val_acc: 0.8750
Epoch 296/300
96/96 [==============================] - 0s 129us/step - loss: 0.0625 - acc: 0.9896 - val
_loss: 0.2716 - val_acc: 0.8750
Epoch 297/300
96/96 [==============================] - 0s 96us/step - loss: 0.0451 - acc: 0.9896 - val_
loss: 0.0639 - val_acc: 0.9583
Epoch 298/300
96/96 [==============================] - 0s 103us/step - loss: 0.1042 - acc: 0.9375 - val
_loss: 0.0624 - val_acc: 0.9583
Epoch 299/300
96/96 [==============================] - 0s 158us/step - loss: 0.0860 - acc: 0.9792 - val
_loss: 0.4810 - val_acc: 0.8750
Epoch 300/300
96/96 [==============================] - 0s 100us/step - loss: 0.0832 - acc: 0.9688 - val
_loss: 0.1188 - val_acc: 0.9167
```

In [23]:

```
# summarize history for accuracy
plt.plot(history.history['acc'])
plt.plot(history.history['val_acc'])
plt.title('model accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper left')
plt.show()
# summarize history for loss
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train', 'test'], loc='upper left')
plt.show()
```




0.4
0.3
0
50
100
150
200
250
300
epoch


model loss
train
test
1.0
0.8
0.6
0.4
0.2
0.0
loss
0
50
100
150
200
250
300
epoch

In [0]: