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Machine Learning II
— Visual Question Answer

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Outline

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- Introduction
- Data Process
- VAQ Model
- Results
- Conclusion

Introduction

What is the mustache made of?

AI System

bananas

View Dataset - MSCOCO

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Image Set

204,721 Image quantities

Input: 4096 dimensions feature

Question Set

1,105,904 questions

Input: 384 dimensions feature

```
sipeng_wang@ml-class-ubuntu16:~/final/data/preprocessed$ cat questions_val2014.t
xt | head -10
Where is he looking?
What are the people in the background doing?
What is he on top of?
What website copyrighted the picture?
Is this a creamy soup?
Is this rice noodle soup?
What is to the right of the soup?
What is the man doing in the street?
How many photo's can you see?
What does the truck on the left sell?
```

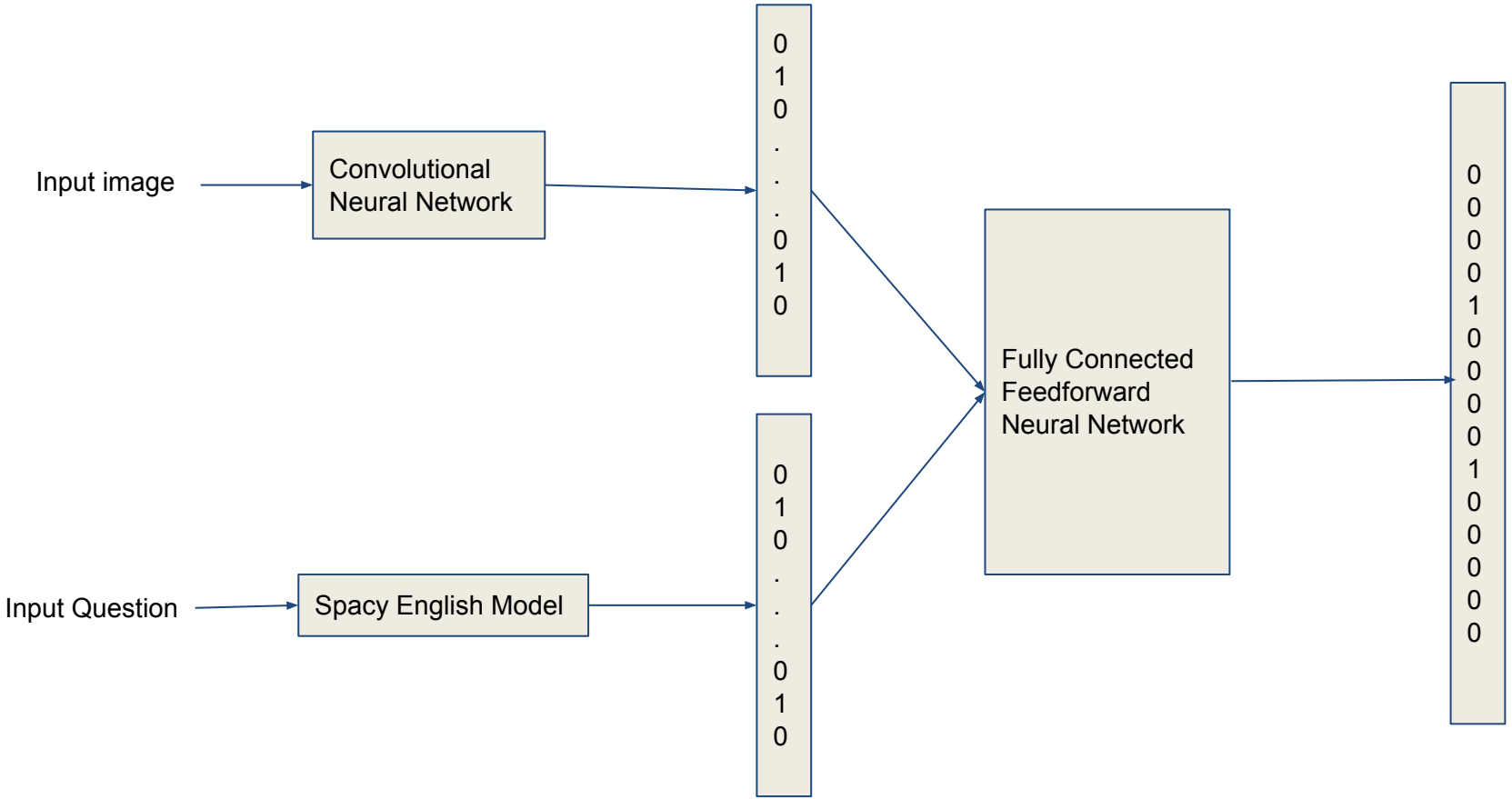
Answer Set

Top 1000 answers from

11,059,040 ground truth answer

```
sipeng_wang@ml-class-ubuntu16:~/final/data/preprocessed$ cat answers_val2014_mod
al.txt |head -10
down
watching
picnic table
foodiebakercom
no
yes
chopsticks
walking
1
ice cream
```

VQA Model



Data Pre-process

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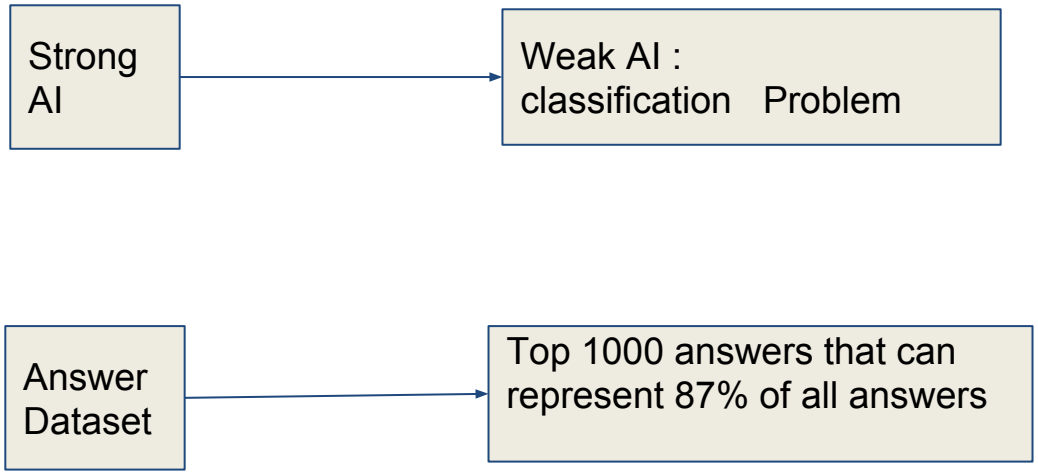
- Extract data
- Generate Answer
- Categorize answer data

VQA Model

- Generate Answers



VQA Model

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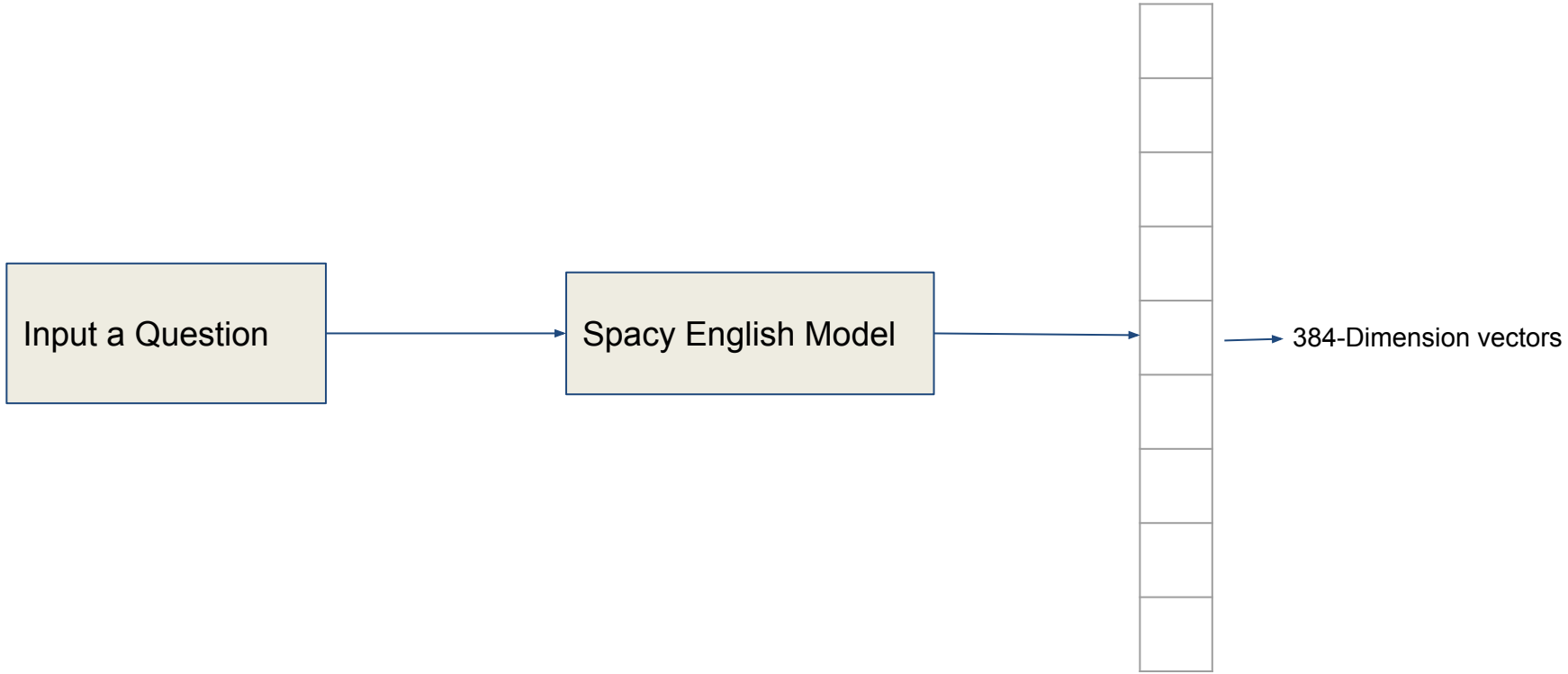
- Flatten Questions



VQA Model

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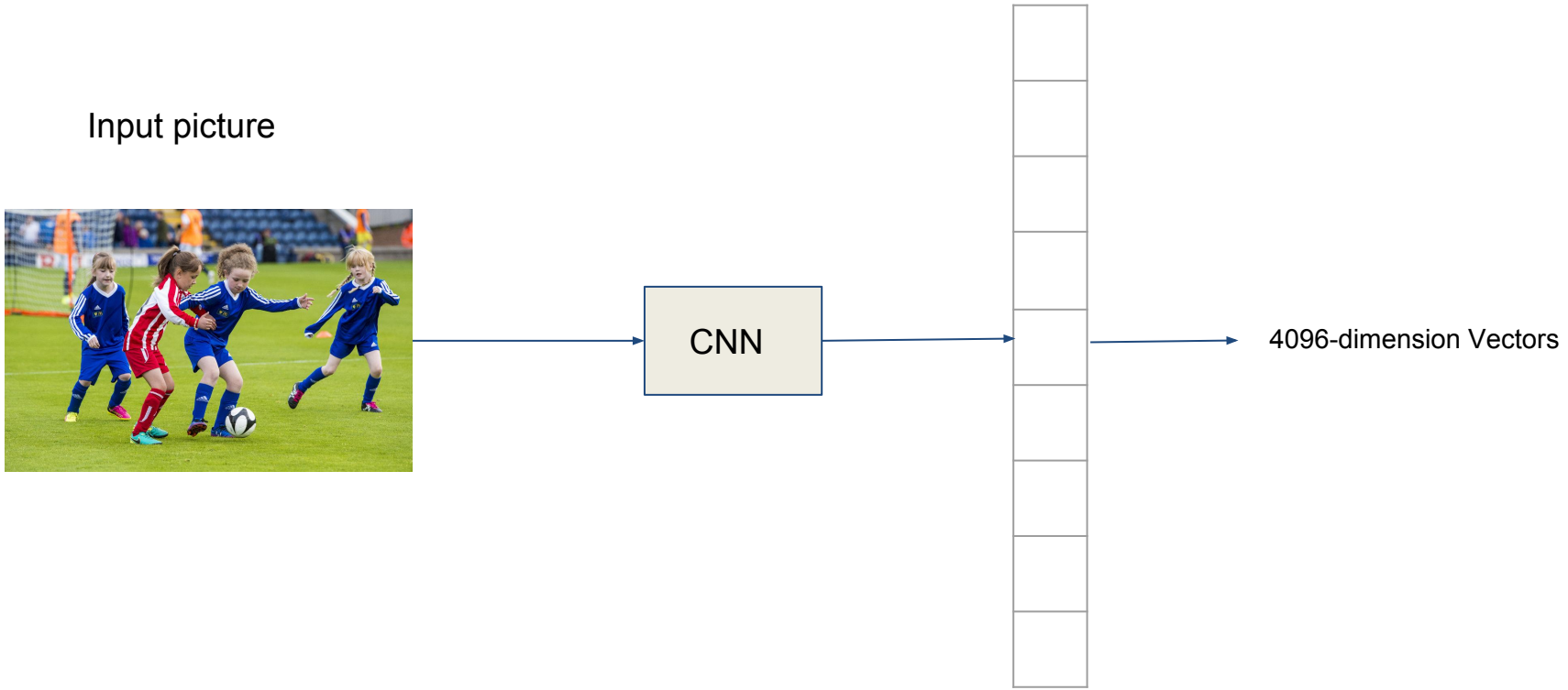
- Flatten Pictures



VQA Model

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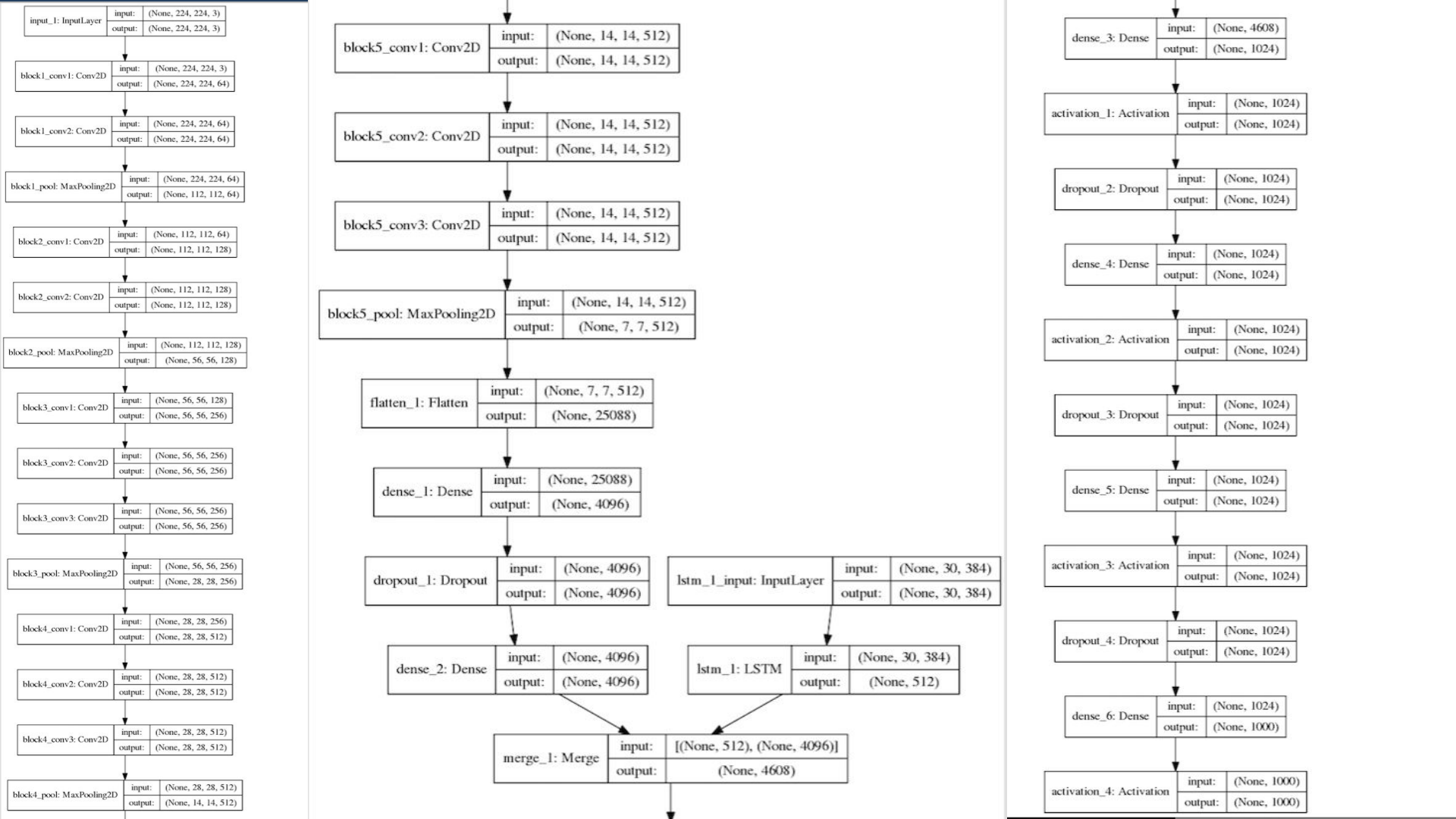
VGG 16

```
def VGG_16(weights_path=None):
    model = Sequential()
    model.add(ZeroPadding2D((1,1),input_shape=(3,224,224)))
    model.add(Convolution2D(64, 3, 3, activation='relu'))
    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(64, 3, 3, activation='relu'))
    model.add(MaxPooling2D((2,2), strides=(2,2)))

    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(128, 3, 3, activation='relu'))
    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(128, 3, 3, activation='relu'))
    model.add(MaxPooling2D((2,2), strides=(2,2)))

    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(256, 3, 3, activation='relu'))
    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(256, 3, 3, activation='relu'))
    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(256, 3, 3, activation='relu'))
    model.add(MaxPooling2D((2,2), strides=(2,2)))

    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(512, 3, 3, activation='relu'))
    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(512, 3, 3, activation='relu'))
    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(512, 3, 3, activation='relu'))
    model.add(MaxPooling2D((2,2), strides=(2,2)))

    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(512, 3, 3, activation='relu'))
    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(512, 3, 3, activation='relu'))
    model.add(ZeroPadding2D((1,1)))
    model.add(Convolution2D(512, 3, 3, activation='relu'))
    model.add(MaxPooling2D((2,2), strides=(2,2)))

    model.add(Flatten())
    model.add(Dense(4096, activation='relu'))
    model.add(Dropout(0.5))
    model.add(Dense(4096, activation='relu'))
    model.add(Dropout(0.5))
    model.add(Dense(1000, activation='softmax'))

    if weights_path:
        model.load_weights(weights_path)

    return model
```


input_1: InputLayer | input: (None, 224, 224, 3) | output: (None, 224, 224, 3)
block1_conv1: Conv2D | input: (None, 224, 224, 3) | output: (None, 224, 224, 64)
block1_conv2: Conv2D | input: (None, 224, 224, 64) | output: (None, 224, 224, 64)
block1_pool: MaxPooling2D | input: (None, 224, 224, 64) | output: (None, 112, 112, 64)
block2_conv1: Conv2D | input: (None, 112, 112, 64) | output: (None, 112, 112, 128)
block2_conv2: Conv2D | input: (None, 112, 112, 128) | output: (None, 112, 112, 128)
block2_pool: MaxPooling2D | input: (None, 112, 112, 128) | output: (None, 56, 56, 128)
block3_conv1: Conv2D | input: (None, 56, 56, 128) | output: (None, 56, 56, 256)
block3_conv2: Conv2D | input: (None, 56, 56, 256) | output: (None, 56, 56, 256)
block3_conv3: Conv2D | input: (None, 56, 56, 256) | output: (None, 56, 56, 256)
block3_pool: MaxPooling2D | input: (None, 56, 56, 256) | output: (None, 28, 28, 256)
block4_conv1: Conv2D | input: (None, 28, 28, 256) | output: (None, 28, 28, 512)
block4_conv2: Conv2D | input: (None, 28, 28, 512) | output: (None, 28, 28, 512)
block4_conv3: Conv2D | input: (None, 28, 28, 512) | output: (None, 28, 28, 512)
block4_pool: MaxPooling2D | input: (None, 28, 28, 512) | output: (None, 14, 14, 512)
block5_conv1: Conv2D | input: (None, 14, 14, 512) | output: (None, 14, 14, 512)
block5_conv2: Conv2D | input: (None, 14, 14, 512) | output: (None, 14, 14, 512)
block5_conv3: Conv2D | input: (None, 14, 14, 512) | output: (None, 14, 14, 512)
block5_pool: MaxPooling2D | input: (None, 14, 14, 512) | output: (None, 7, 7, 512)
flatten_1: Flatten | input: (None, 7, 7, 512) | output: (None, 25088)
dense_1: Dense | input: (None, 25088) | output: (None, 4096)
dropout_1: Dropout | input: (None, 4096) | output: (None, 4096)
dense_2: Dense | input: (None, 4096) | output: (None, 4096)
lstm_1_input: InputLayer | input: (None, 30, 384) | output: (None, 30, 384)
lstm_1: LSTM | input: (None, 30, 384) | output: (None, 512)
merge_1: Merge | input: [(None, 512), (None, 4096)] | output: (None, 4608)
dense_3: Dense | input: (None, 4608) | output: (None, 1024)
activation_1: Activation | input: (None, 1024) | output: (None, 1024)
dropout_2: Dropout | input: (None, 1024) | output: (None, 1024)
dense_4: Dense | input: (None, 1024) | output: (None, 1024)
activation_2: Activation | input: (None, 1024) | output: (None, 1024)
dropout_3: Dropout | input: (None, 1024) | output: (None, 1024)
dense_5: Dense | input: (None, 1024) | output: (None, 1024)
activation_3: Activation | input: (None, 1024) | output: (None, 1024)
dropout_4: Dropout | input: (None, 1024) | output: (None, 1024)
dense_6: Dense | input: (None, 1024) | output: (None, 1000)
activation_4: Activation | input: (None, 1000) | output: (None, 1000)

Neuraltalk2

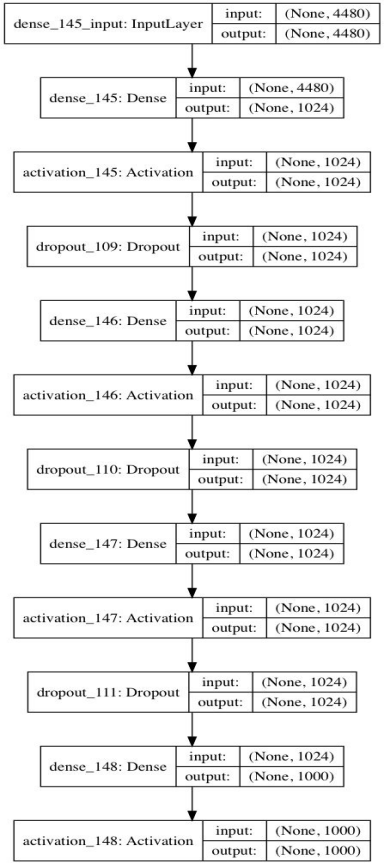
a man is playing tennis on a tennis court

a train is traveling down the tracks at a train station

a cake with a slice cut out of it

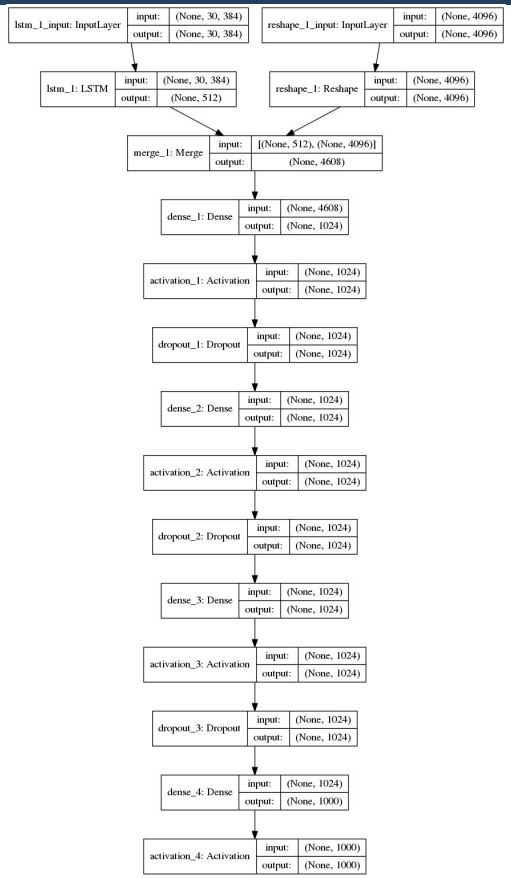
a bench sitting on a patch of grass next to a sidewalk

Model



- Multi-layer-Perceptron(MLP)

- Long-Short-Term-Memory(LSTM)



Training

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MLP

Epochs number	1	5	10	...	20
Time(min)	36.5	182.5	420	...	1680
Loss(lr = 0.01)	5.25	3.89	3.08	...	3.07

LSTM

Epochs Number	1	5	10	...	20
Time(min)	63	315	630	...	2520
Loss(lr = 0.01)	3.52	3.01	2.90	...	3.02

Accuracy

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Our MLP:24.0%

Our LSTM:36.5%

2017 challenge 1st: 69%

2017 challenge 27th: 37.3%

what color is that train?

```
Loaded
/Users/zack wang/a
  UserWarning)
42.28 %  blue
20.94 %  red
07.67 %  orange
07.64 %  silver
07.37 %  yellow
```

Problems & Future work

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- The VGG Model training implement was limited by the computational power.

- The loss of both MLP/LSTM model went smooth at around 3 after 10 epochs.