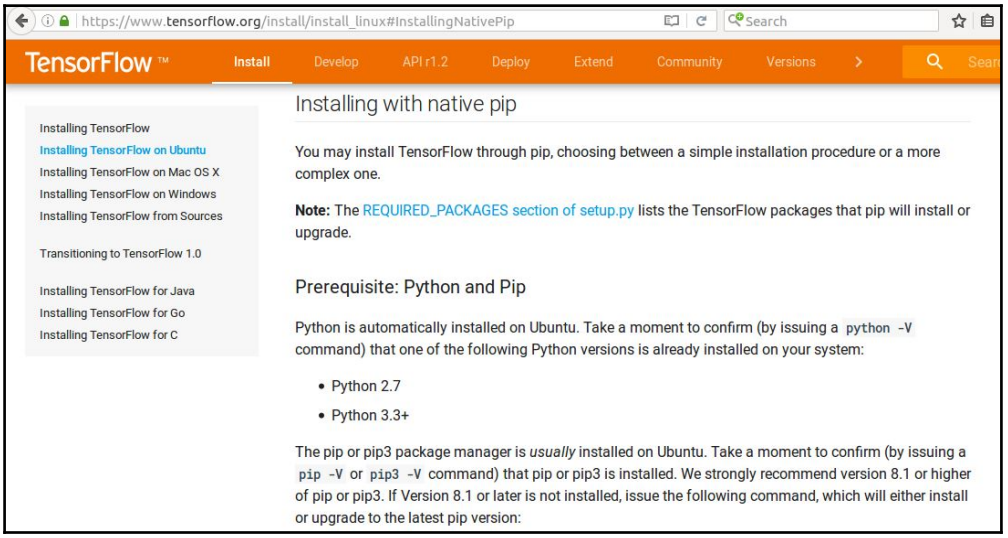
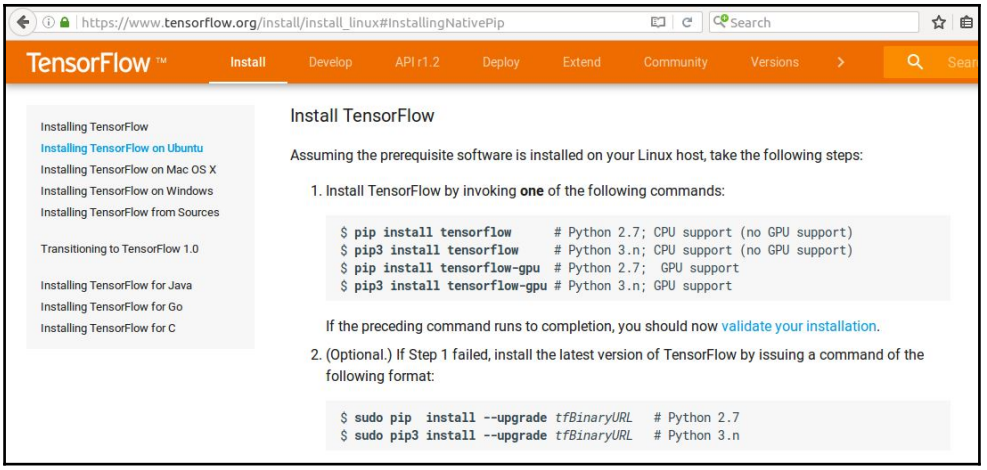
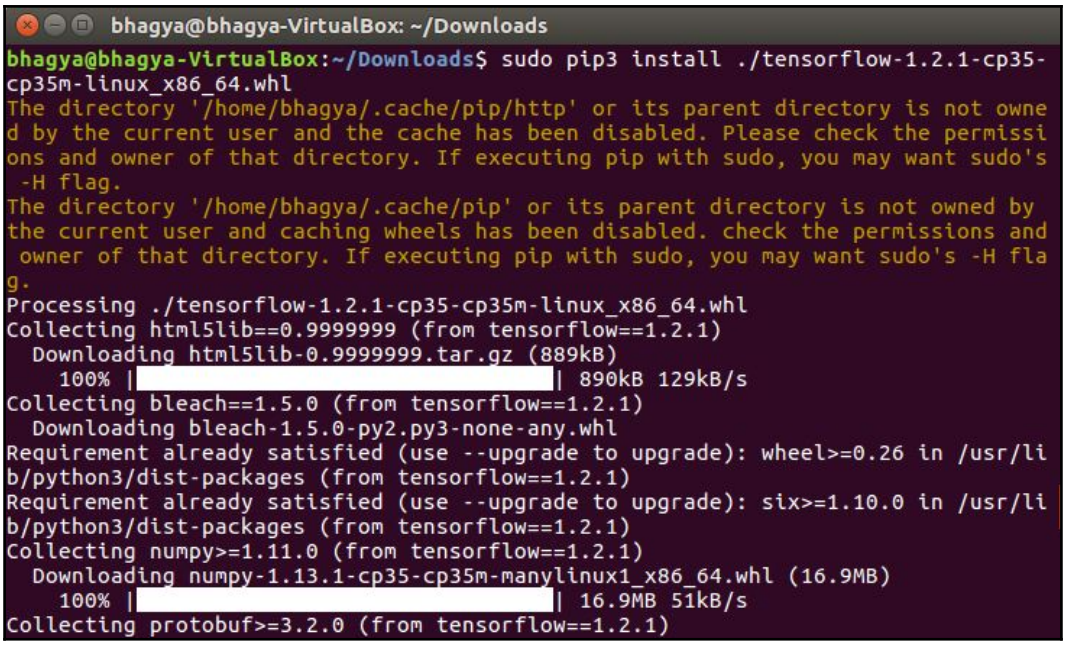
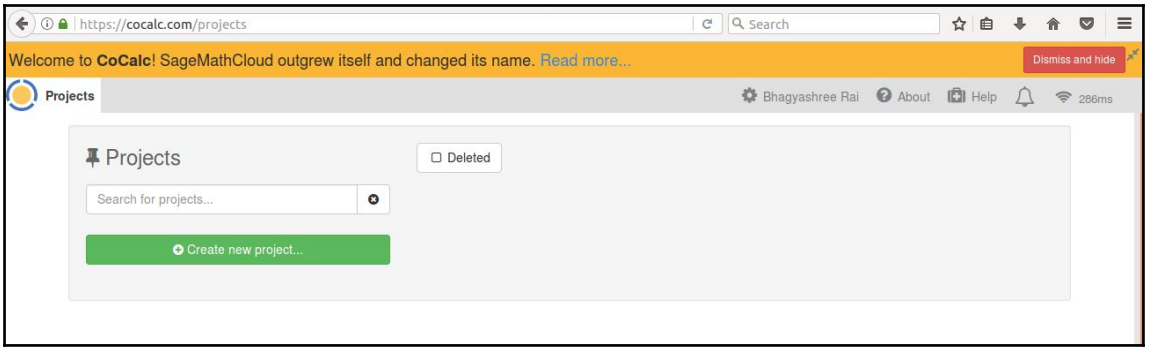
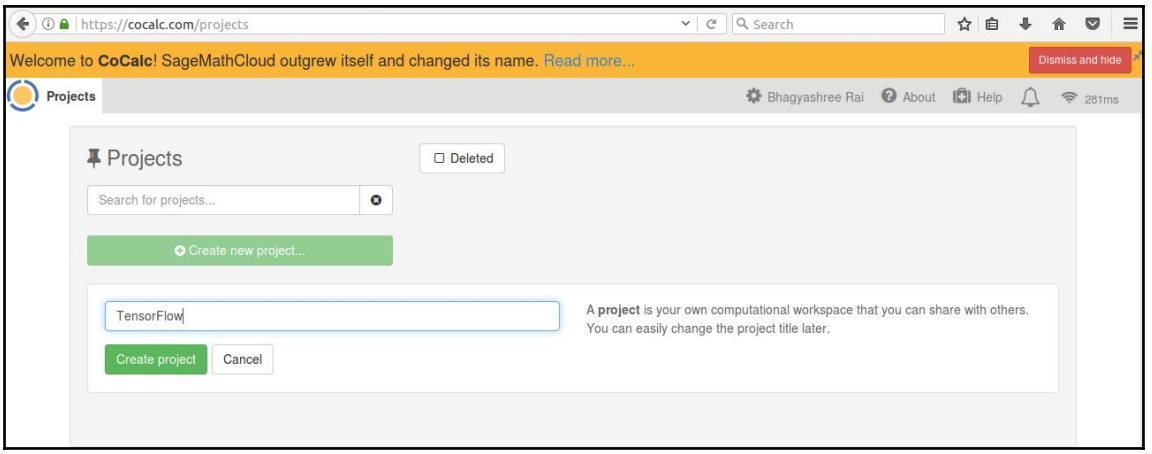
Chapter 1: Getting Started

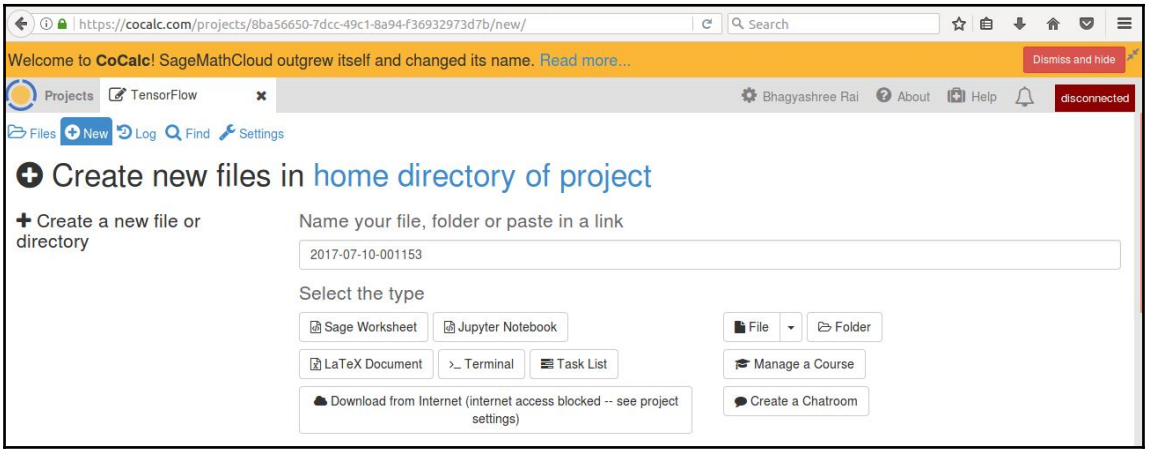


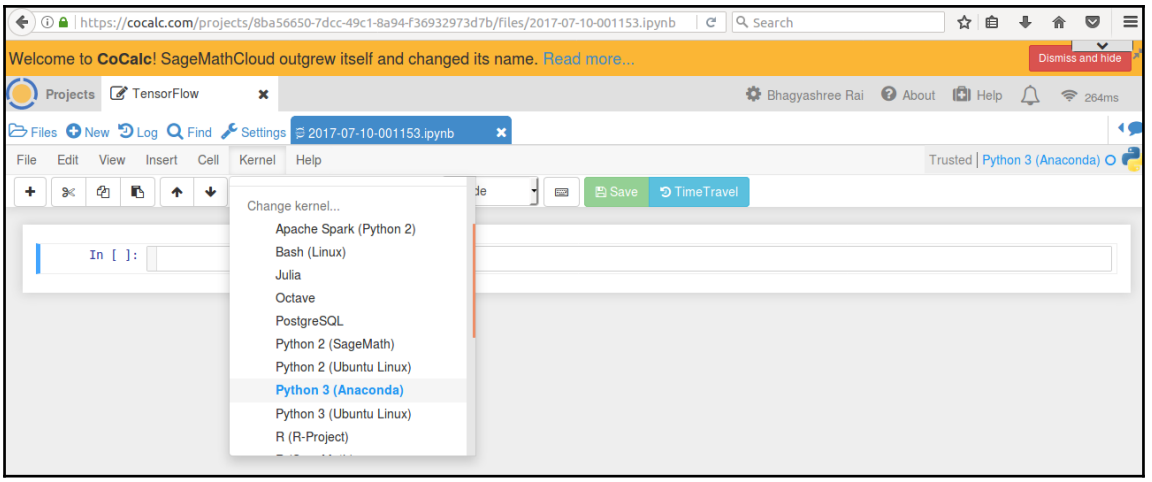


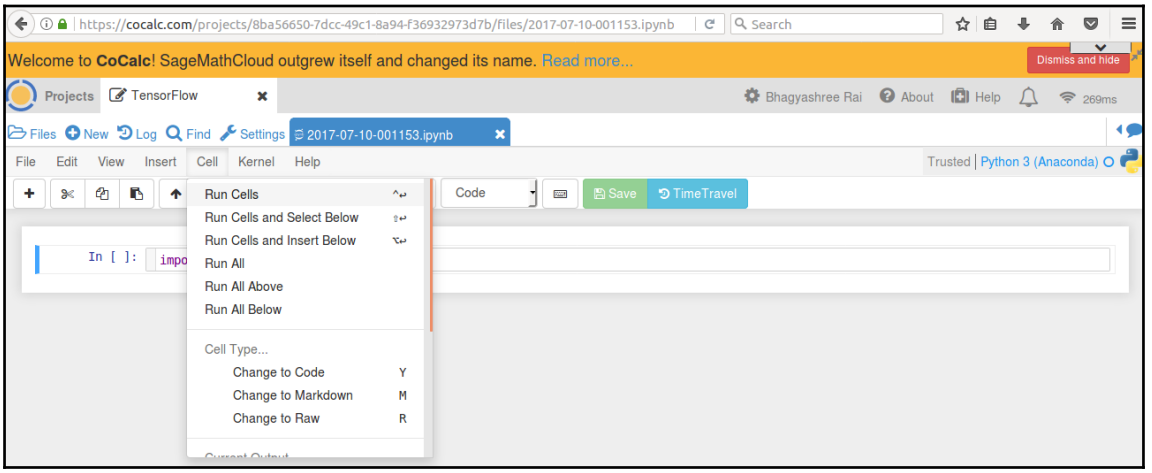

bhagya@bhagya-VirtualBox: ~/Downloads
bhagya@bhagya-VirtualBox:~/Downloads$ sudo pip3 install ./tensorflow-1.2.1-cp35-cp35m-linux_x86_64.whl
The directory '/home/bhagya/.cache/pip/http' or its parent directory is not owned by the current user and the cache has been disabled. Please check the permissions and owner of that directory. If executing pip with sudo, you may want sudo's -H flag.
The directory '/home/bhagya/.cache/pip' or its parent directory is not owned by the current user and caching wheels has been disabled. check the permissions and owner of that directory. If executing pip with sudo, you may want sudo's -H flag.
Processing ./tensorflow-1.2.1-cp35-cp35m-linux_x86_64.whl
Collecting html5lib==0.9999999 (from tensorflow==1.2.1)
Downloading html5lib-0.9999999.tar.gz (889kB)
100% | 890kB 129kB/s
Collecting bleach==1.5.0 (from tensorflow==1.2.1)
Downloading bleach-1.5.0-py2.py3-none-any.whl
Requirement already satisfied (use --upgrade to upgrade): wheel>=0.26 in /usr/lib/python3/dist-packages (from tensorflow==1.2.1)
Requirement already satisfied (use --upgrade to upgrade): six>=1.10.0 in /usr/lib/python3/dist-packages (from tensorflow==1.2.1)
Collecting numpy>=1.11.0 (from tensorflow==1.2.1)
Downloading numpy-1.13.1-cp35-cp35m-manylinux1_x86_64.whl (16.9MB)
100% | 16.9MB 51kB/s
Collecting protobuf>=3.2.0 (from tensorflow==1.2.1)

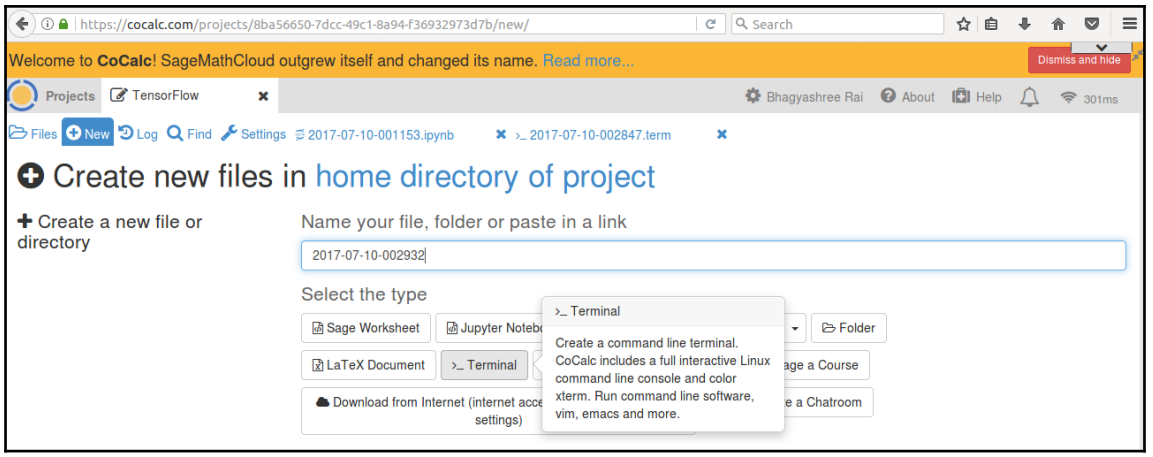

https://cocalc.com/projects
Search
Welcome to CoCalc! SageMathCloud outgrew itself and changed its name. Read more...
Dismiss and hide
Projects
Bhagyashree Rai
About
Help
286ms
Projects
Deleted
Search for projects...
Create new project...

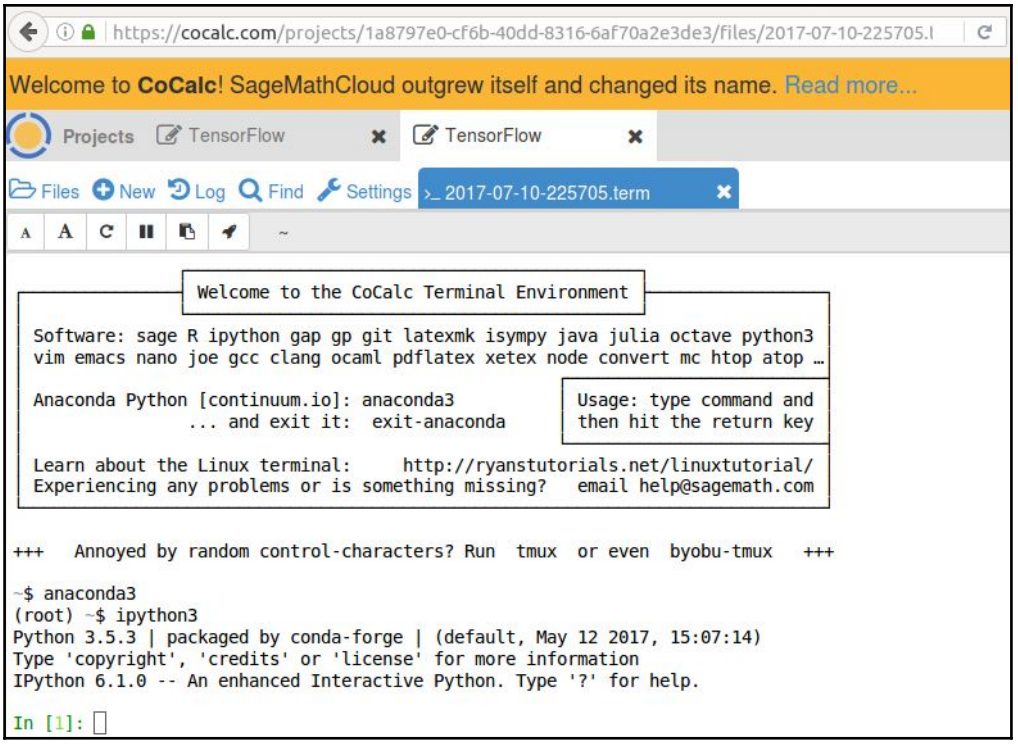

https://cocalc.com/projects
Search
Welcome to CoCalc! SageMathCloud outgrew itself and changed its name. Read more...
Dismiss and hide
Projects
Bhagyashree Rai
About
Help
281ms
Projects
Deleted
Search for projects...
Create new project...
TensorFlow
A project is your own computational workspace that you can share with others.
You can easily change the project title later.
Create project
Cancel


https://cocalc.com/projects/8ba56650-7dcc-49c1-8a94-f36932973d7b/new/
Search
Welcome to CoCalc! SageMathCloud outgrew itself and changed its name. Read more...
Dismiss and hide
Projects
TensorFlow
Bhagyashree Rai
About
Help
disconnected
Files
New
Log
Find
Settings
Create new files in home directory of project
Create a new file or directory
Name your file, folder or paste in a link
2017-07-10-001153
Select the type
Sage Worksheet
Jupyter Notebook
File
Folder
LaTeX Document
Terminal
Task List
Manage a Course
Download from Internet (internet access blocked -- see project settings)
Create a Chatroom


https://cocalc.com/projects/8ba56650-7dcc-49c1-8a94-f36932973d7b/files/2017-07-10-001153.ipynb
Search
Welcome to CoCalc! SageMathCloud outgrew itself and changed its name. Read more...
Dismiss and hide
Projects
TensorFlow
Bhagyashree Rai
About
Help
264ms
Files
New
Log
Find
Settings
2017-07-10-001153.ipynb
File
Edit
View
Insert
Cell
Kernel
Help
Trusted
Python 3 (Anaconda)
Save
TimeTravel
In [ ]:
Change kernel...
Apache Spark (Python 2)
Bash (Linux)
Julia
Octave
PostgreSQL
Python 2 (SageMath)
Python 2 (Ubuntu Linux)
Python 3 (Anaconda)
Python 3 (Ubuntu Linux)
R (R-Project)


https://cocalc.com/projects/8ba56650-7dcc-49c1-8a94-f36932973d7b/files/2017-07-10-001153.ipynb
Search
Welcome to CoCalc! SageMathCloud outgrew itself and changed its name. Read more...
Dismiss and hide
Projects
TensorFlow
Bhagyashree Rai
About
Help
269ms
Files
New
Log
Find
Settings
2017-07-10-001153.ipynb
File
Edit
View
Insert
Cell
Kernel
Help
Trusted
Python 3 (Anaconda)
Code
Save
TimeTravel
In [ ]:
Run Cells
Run Cells and Select Below
Run Cells and Insert Below
Run All
Run All Above
Run All Below
Cell Type...
Change to Code Y
Change to Markdown M
Change to Raw R


https://cocalc.com/projects/8ba56650-7dcc-49c1-8a94-f36932973d7b/new/
Search
Welcome to CoCalc! SageMathCloud outgrew itself and changed its name. Read more...
Dismiss and hide
Projects
TensorFlow
Bhagyashree Rai
About
Help
301ms
Files
New
Log
Find
Settings
2017-07-10-001153.ipynb
>_ 2017-07-10-002847.term
Create new files in home directory of project
Create a new file or directory
Name your file, folder or paste in a link
2017-07-10-002932
Select the type
Sage Worksheet
Jupyter Notebook
Folder
LaTeX Document
>_ Terminal
Download from Internet (internet access settings)
>_ Terminal
Create a command line terminal. CoCalc includes a full interactive Linux command line console and color xterm. Run command line software, vim, emacs and more.


https://cocalc.com/projects/1a8797e0-cf6b-40dd-8316-6af70a2e3de3/files/2017-07-10-225705.t
Welcome to CoCalc! SageMathCloud outgrew itself and changed its name. Read more...
Projects
TensorFlow
TensorFlow
Files
New
Log
Find
Settings
>_ 2017-07-10-225705.term
~
Welcome to the CoCalc Terminal Environment
Software: sage R ipython gap gp git latexmk isympy java julia octave python3
vim emacs nano joe gcc clang ocaml pdflatex xetex node convert mc htop atop …
Anaconda Python [continuum.io]: anaconda3
... and exit it: exit-anaconda
Usage: type command and then hit the return key
Learn about the Linux terminal: http://ryanstutorials.net/linuxtutorial/
Experiencing any problems or is something missing? email help@sagemath.com
+++ Annoyed by random control-characters? Run tmux or even byobu-tmux +++
~$ anaconda3
(root) ~$ ipython3
Python 3.5.3 | packaged by conda-forge | (default, May 12 2017, 15:07:14)
Type 'copyright', 'credits' or 'license' for more information
IPython 6.1.0 -- An enhanced Interactive Python. Type '?' for help.
In [1]:

```
In [16]: print("NN is:")
NN is:

In [17]: print(output)
[[  7.  10.]
 [ 15.  22.]]

In [18]:
```

```
In [26]: print("W is:")
W is:

In [27]: print(W.eval())
0
```

```
In [28]: W += a

In [29]: print("W after adding a:")
W after adding a:

In [30]: print(W.eval())
1
```

```
In [31]: W += a

In [32]: print("W after adding a again:")
W after adding a again:

In [33]: print(W.eval())
2

In [34]:
```

```
In [37]: print("E and d:")
E and d:

In [38]: print(sess.run([E,d]))
[4, 2]
```

```
In [39]: print("E with custom d=4:")
E with custom d=4:

In [40]: print(sess.run(E, feed_dict = {d:4.}))
6

In [41]:
```

```
In [8]: print(train[0])
[[ 0.  0.  0. ...,  0.  0.  0.]
 [ 0.  0.  0. ...,  0.  0.  0.]
 [ 0.  0.  0. ...,  0.  0.  0.]
 ...,
 [ 0.  0.  0. ...,  0.  0.  0.]
 [ 0.  0.  0. ...,  0.  0.  0.]
 [ 0.  0.  0. ...,  0.  0.  0.]]

In [9]: print(labels[0])
0

In [10]:
```

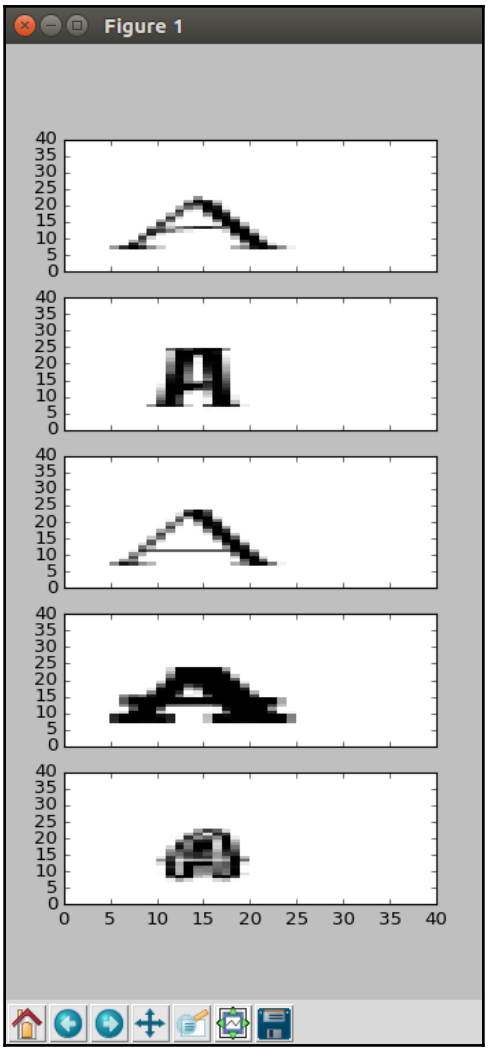
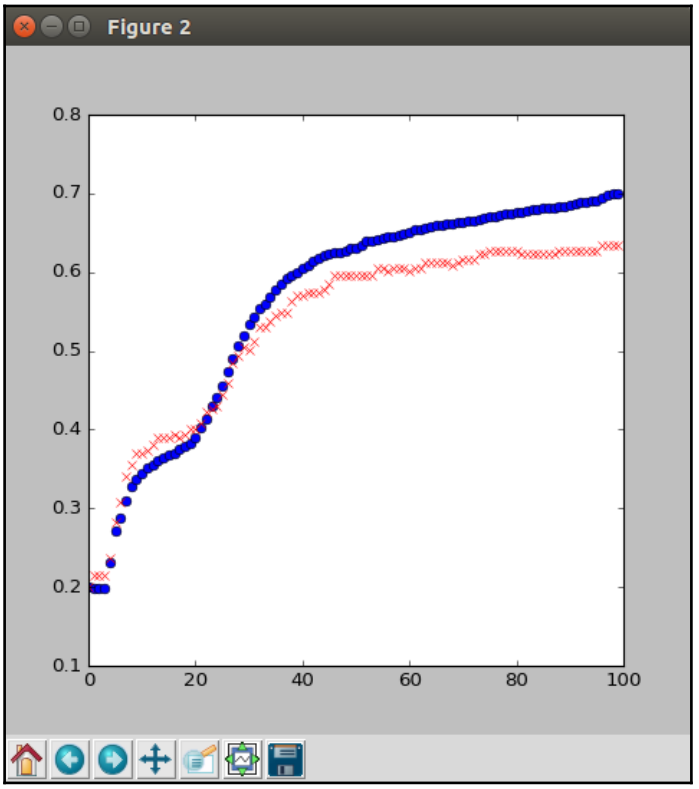


Figure 1
40
35
30
25
20
15
10
5
0
0 5 10 15 20 25 30 35 40

$$Pr(Y_i = c) = \frac{\beta_c X_i}{\sum_h \beta_h X_i}$$



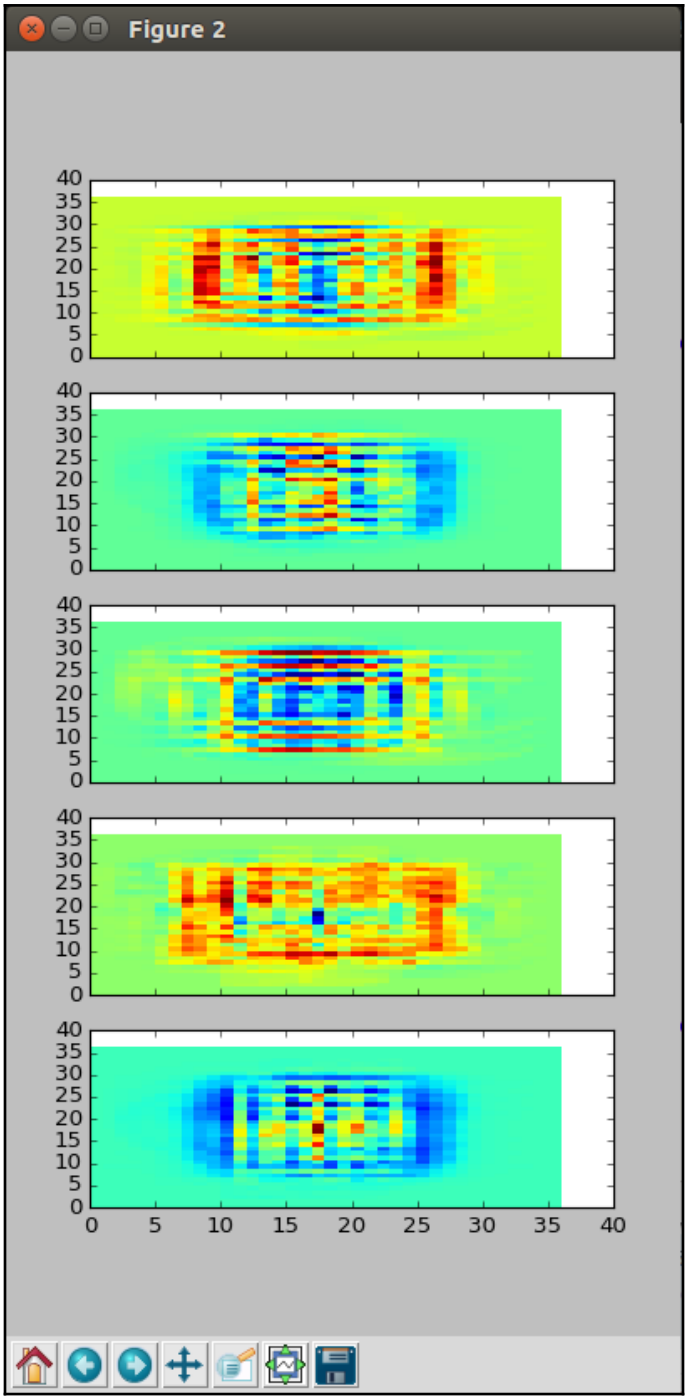


Figure 2
40
35
30
25
20
15
10
5
0
0
5
10
15
20
25
30
35
40

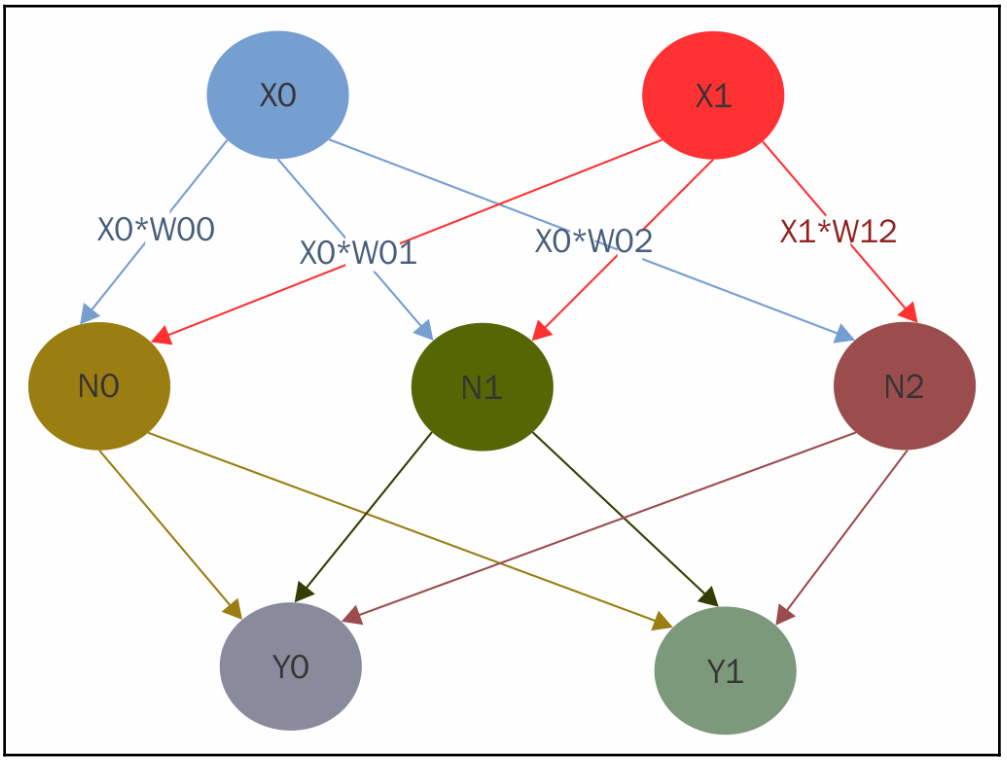
Chapter 2: Deep Neural Networks

```
In [11]: print(x2.eval())
[-1.59633303 -1.39370716 -1.11756158 -0.93147004 -1.30868506]

In [12]: print(sqx2.eval())
[ 2.54827905  1.94241965  1.24894392  0.86763644  1.71265662]

In [13]:
```

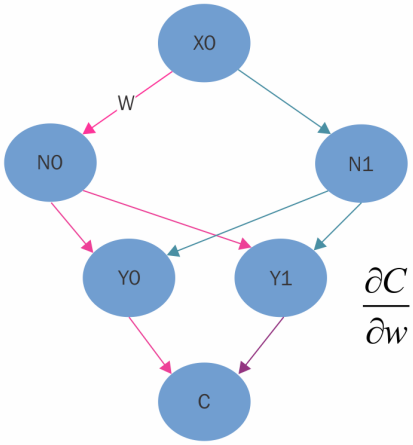
```
In [14]: print(x1.eval())
[ 3.2928977   3.11865115  2.75602937  2.55065155  2.60228252]

In [15]: print(logx1.eval())
[ 1.19176793  1.13740063  1.01379097  0.9363488   0.95638895]

In [16]:
```

```
In [17]: print(x3.eval())
[-0.24215472 -0.26575294 -0.30768225  0.0072251  -0.1542311 ]

In [18]: print(sigx3.eval())
[ 0.43975541  0.43395001  0.4236806   0.50180626  0.4615185 ]

In [19]:
```

```
In [24]: print((w1*x1).eval())
[ 0.25280735  0.23198548  0.32570502  0.32763374  0.29772624]

In [25]: print((w2*x2).eval())
[-0.16239884 -0.26094452 -0.24706605 -0.228054   -0.14377597]

In [26]: print(n1.eval())
[ 0.52258676  0.49276075  0.51964962  0.52487439  0.53841174]

In [27]:
```



```
In [23]: num_hidden = 128

In [24]: W1 = tf.Variable(tf.truncated_normal([1296, num_hidden],
   ....:                                       stddev=1./math.sqrt(1296)))

In [25]: b1 = tf.Variable(tf.constant(0.1,shape=[num_hidden]))

In [26]: h1 = tf.sigmoid(tf.matmul(x,W1) + b1)

In [27]:
```



$$\frac{\partial C}{\partial w} = \left(\frac{\partial C}{\partial Y_0}\right) \cdot \left(\frac{\partial Y_0}{\partial N_0}\right) \cdot \left(\frac{\partial N_0}{\partial w}\right) + \left(\frac{\partial C}{\partial Y_1}\right) \cdot \left(\frac{\partial Y_1}{\partial N_0}\right) \cdot \left(\frac{\partial N_0}{\partial w}\right)$$

```
In [42]: epochs = 5000

In [43]: train_acc = np.zeros(epochs//10)

In [44]: test_acc = np.zeros(epochs//10)

In [45]: for i in tqdm(range(epochs), ascii = True):
    ....:     # Record summary data, and the accuracy
    ....:     if i % 10 == 0:
    ....:         # Check accuracy on train set
    ....:         A = accuracy.eval(feed_dict={
    ....:             x: train.reshape([-1,1296]),
    ....:             y_: onehot_train})
    ....:         train_acc[i//10] = A
    ....:         # And now the validation set
    ....:         A = accuracy.eval(feed_dict={
    ....:             x: test.reshape([-1,1296]),
    ....:             y_: onehot_test})
    ....:         test_acc[i//10] = A
    ....:     train_step.run(feed_dict={
    ....:         x: train.reshape([-1,1296]),
    ....:         y_: onehot_train})
    ....:
```

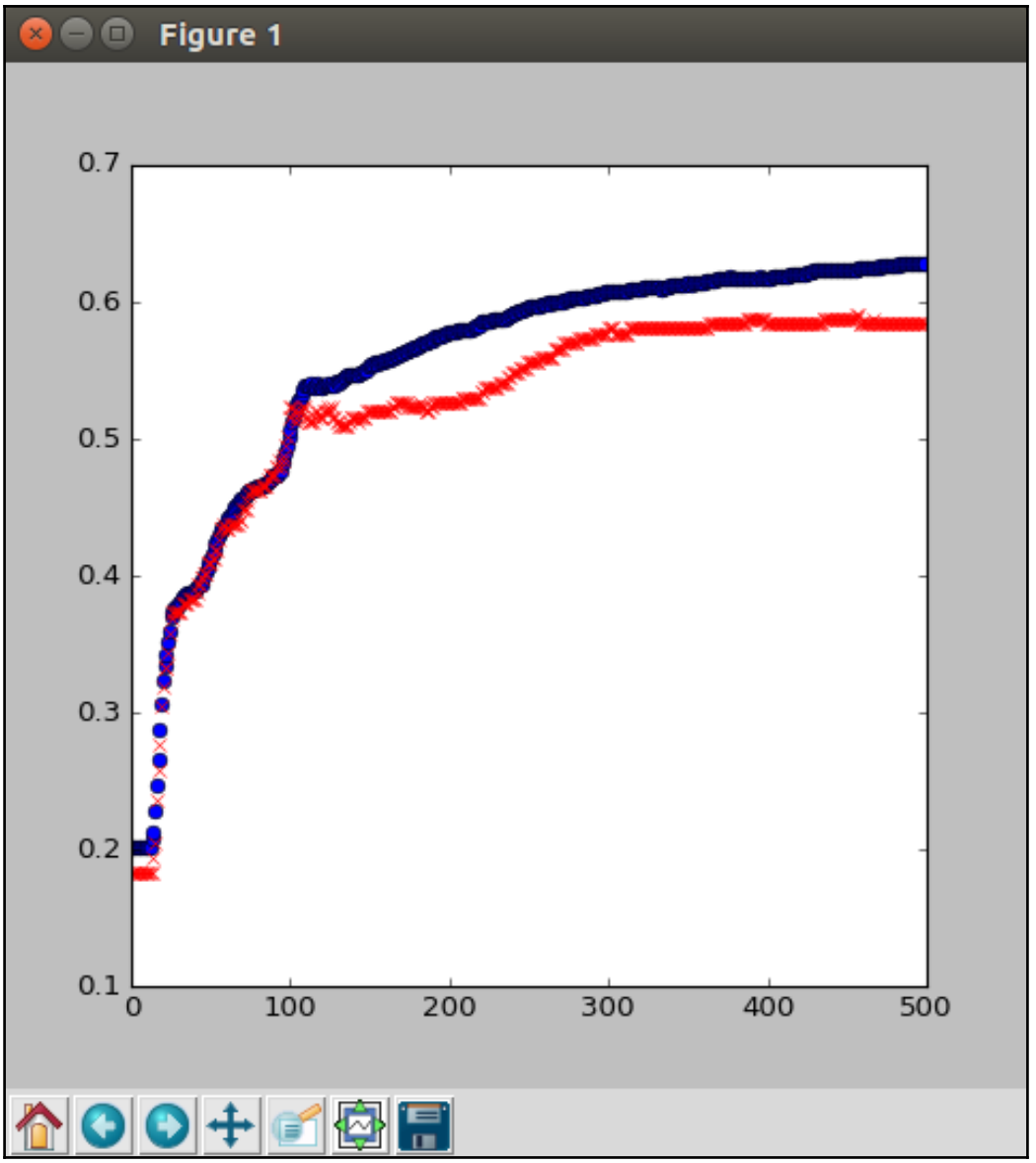


Figure 1
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
100
200
300
400
500

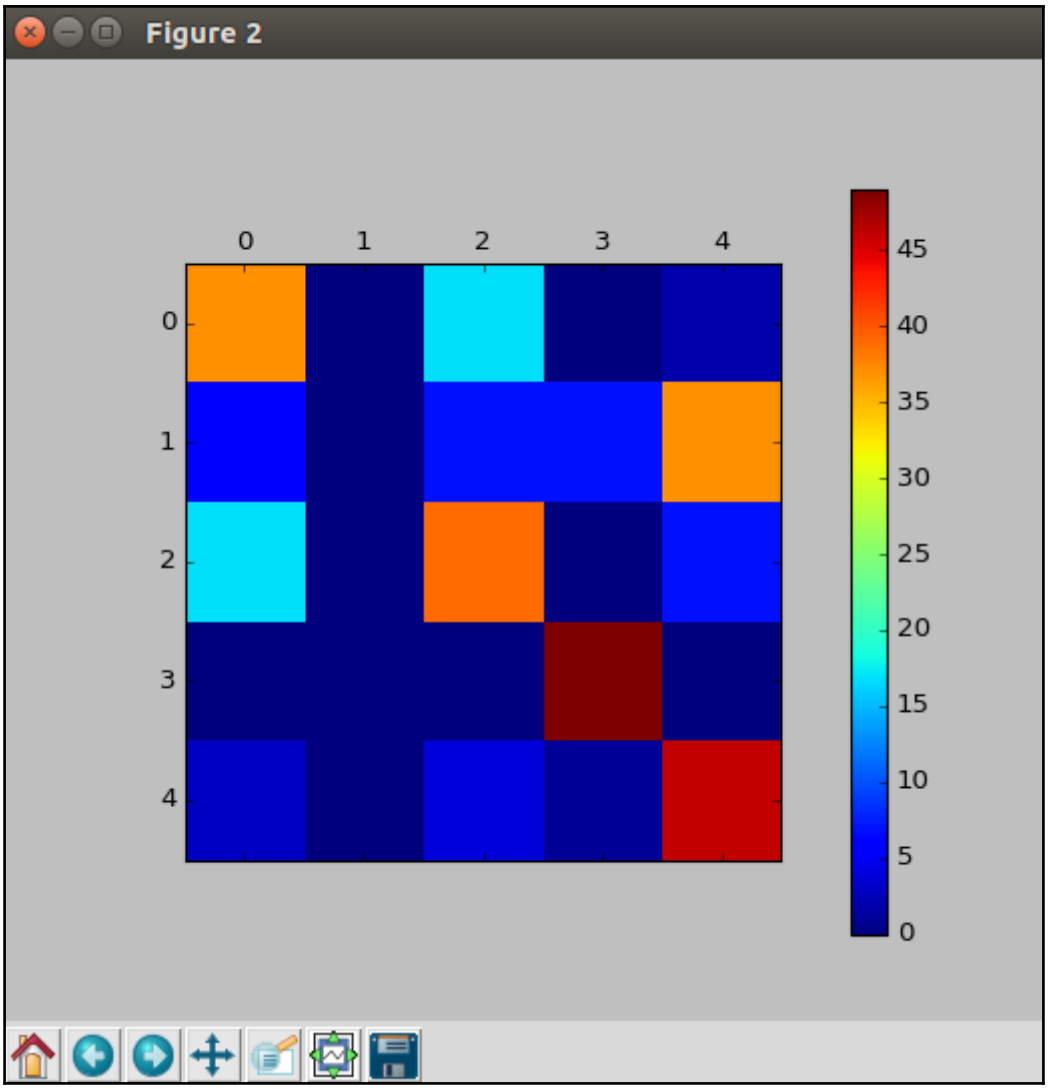


Figure 2
0
1
2
3
4
0
1
2
3
4
45
40
35
30
25
20
15
10
5
0

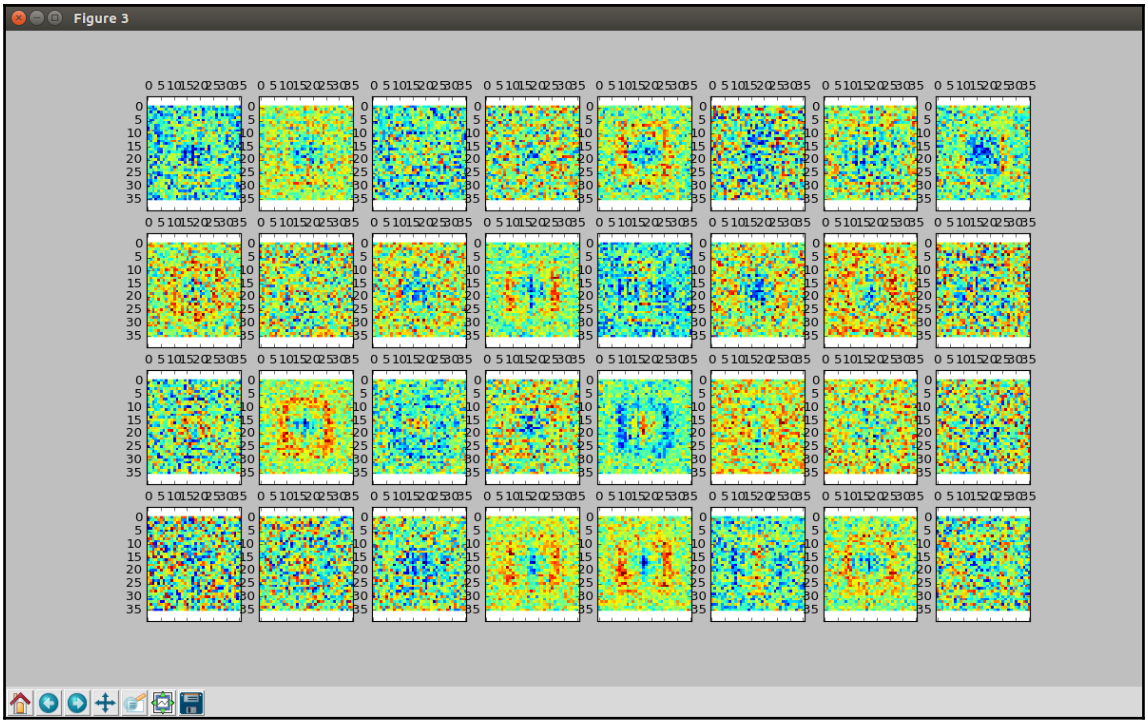


Figure 3

In [2]:

```
import tensorflow as tf
import numpy as np
import math
%autoindent
try:
    from tqdm import tqdm
except ImportError:
    def tqdm(x, *args, **kwargs):
        return x



# Load data
data = np.load('data_with_labels.npz')
train = data['arr_0']/255.
labels = data['arr_1']

# Look at some data
print(train[0])
print(labels[0])

# If you have matplotlib installed
import matplotlib.pyplot as plt
plt.ion()

def to_onehot(labels,nclasses = 5):
    '''
    Convert labels to "one-hot" format.

    >>> a = [0,1,2,3]
    >>> to_onehot(a,5)
    array([[ 1.,  0.,  0.,  0.,  0.],
           [ 0.,  1.,  0.,  0.,  0.],
           [ 0.,  0.,  1.,  0.,  0.],
           [ 0.,  0.,  0.,  1.,  0.]])
    '''
```

```
In [30]: W3 = tf.Variable(tf.truncated_normal([num_hidden2, 5],
   ....:                                       stddev=1./math.sqrt(5)))

In [31]: b3 = tf.Variable(tf.constant(0.1,shape=[5]))

In [32]: sess.run(tf.global_variables_initializer())

In [33]: y = tf.nn.softmax(tf.matmul(h2,W3) + b3)

In [34]:
```

```
In [38]: epochs = 25000

In [39]: train_acc = np.zeros(epochs//10)

In [40]: test_acc = np.zeros(epochs//10)

In [41]: for i in tqdm(range(epochs), ascii = True):
   ....:     # Record summary data, and the accuracy
   ....:     if i % 10 == 0:
   ....:         # Check accuracy on train set
   ....:         A = accuracy.eval(feed_dict={
   ....:             x: train.reshape([-1,1296]),
   ....:             y_: onehot_train})
   ....:         train_acc[i//10] = A
   ....:         # And now the validation set
   ....:         A = accuracy.eval(feed_dict={
   ....:             x: test.reshape([-1,1296]),
   ....:             y_: onehot_test})
   ....:         test_acc[i//10] = A
   ....:     train_step.run(feed_dict={
   ....:         x: train.reshape([-1,1296]),
   ....:         y_: onehot_train})
   ....:
```

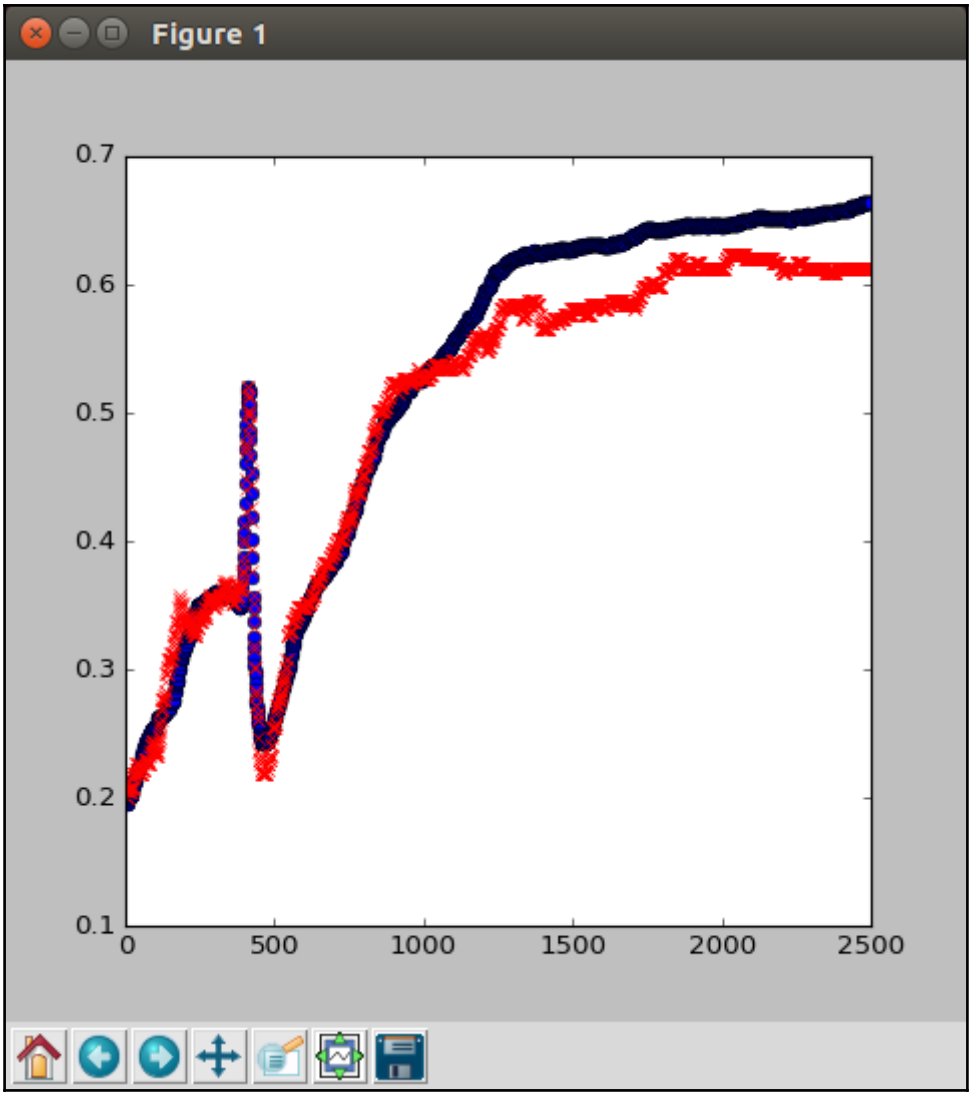


Figure 1
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
500
1000
1500
2000
2500

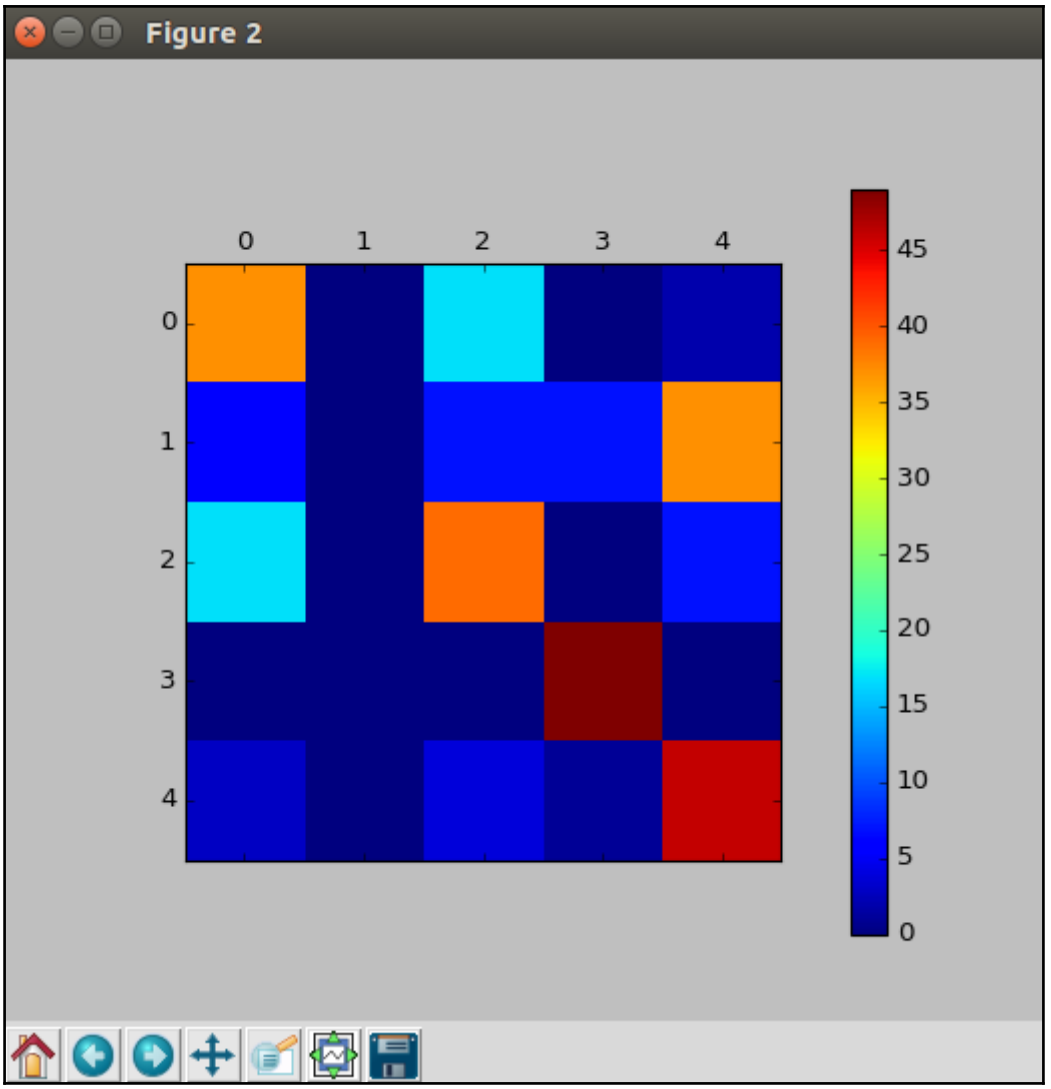


Figure 2
0
1
2
3
4
0
1
2
3
4
45
40
35
30
25
20
15
10
5
0

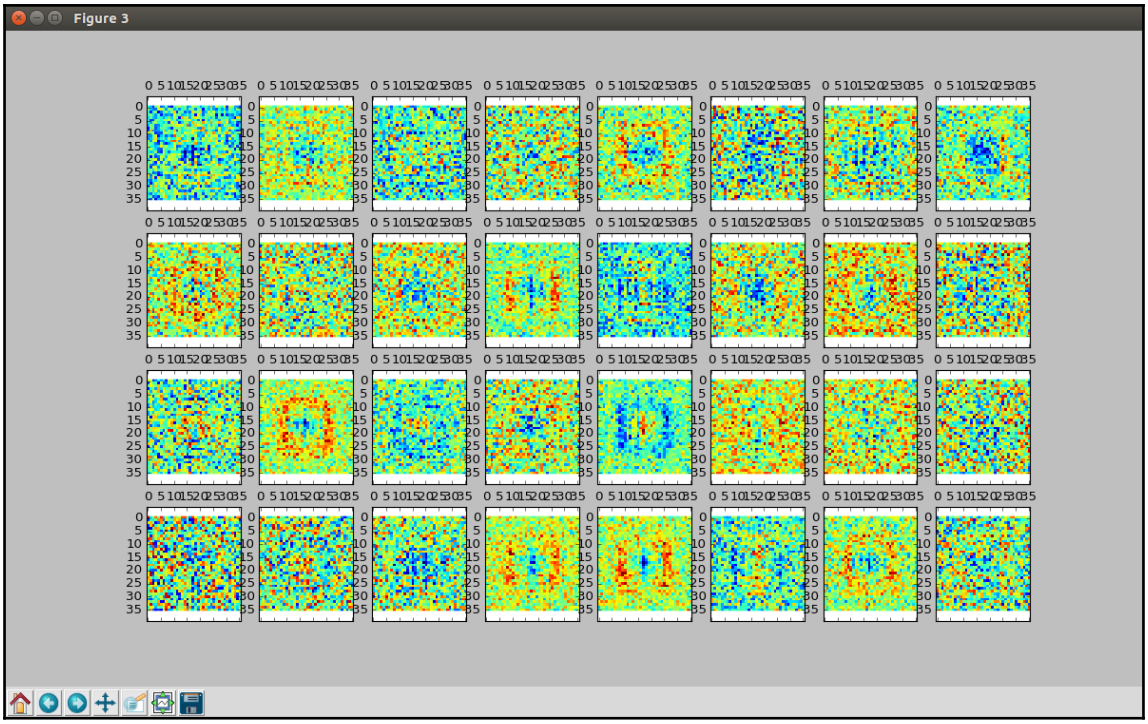


Figure 3

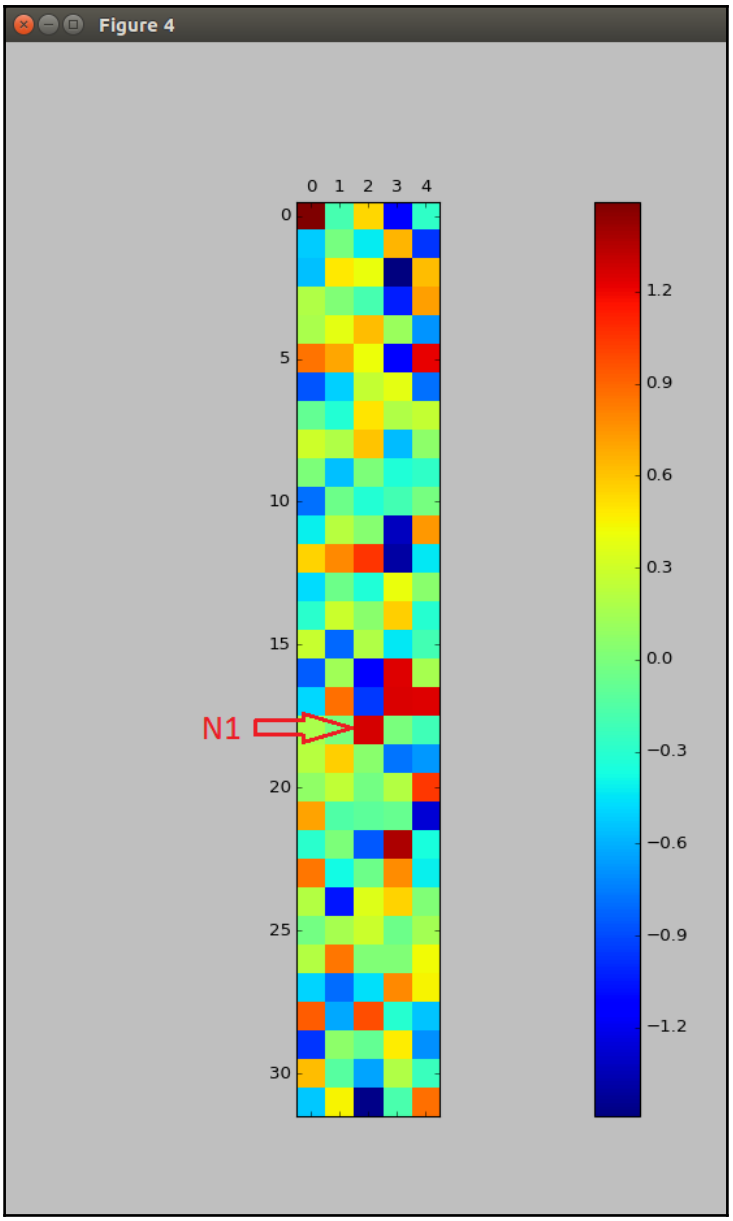
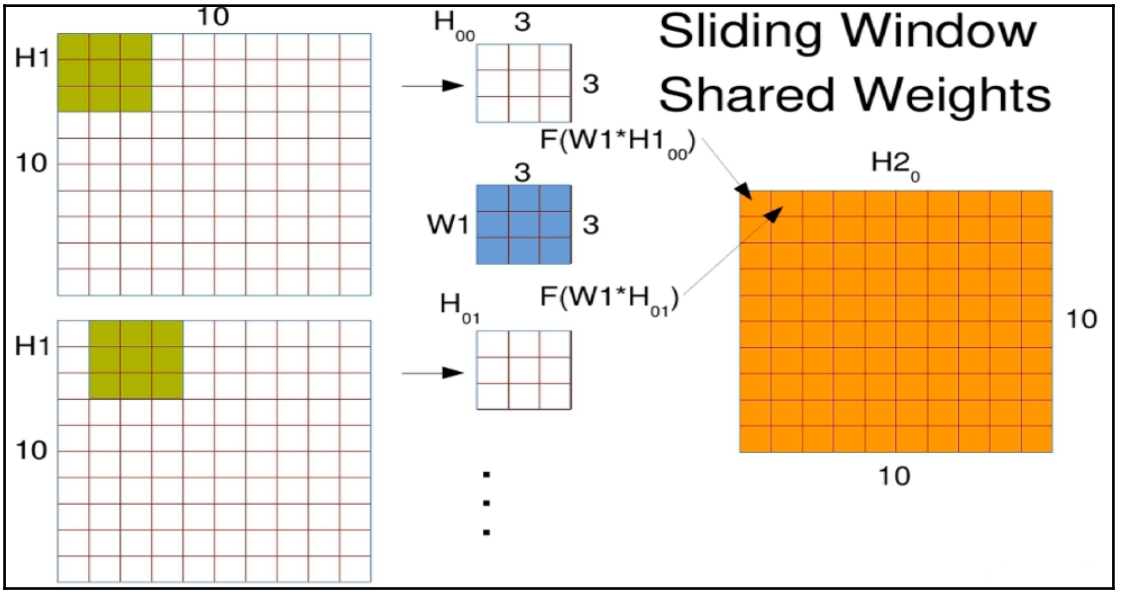
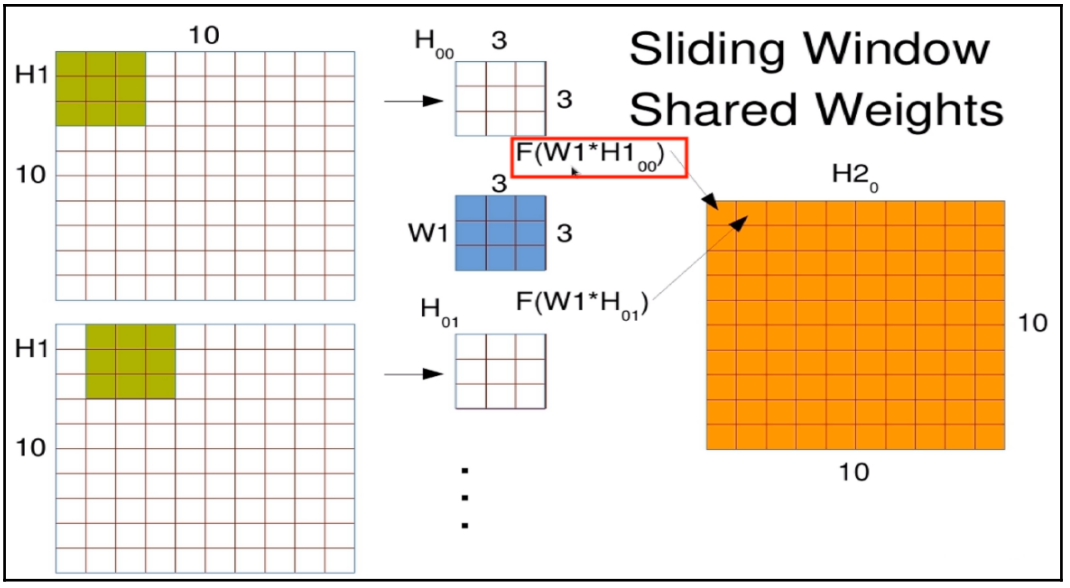
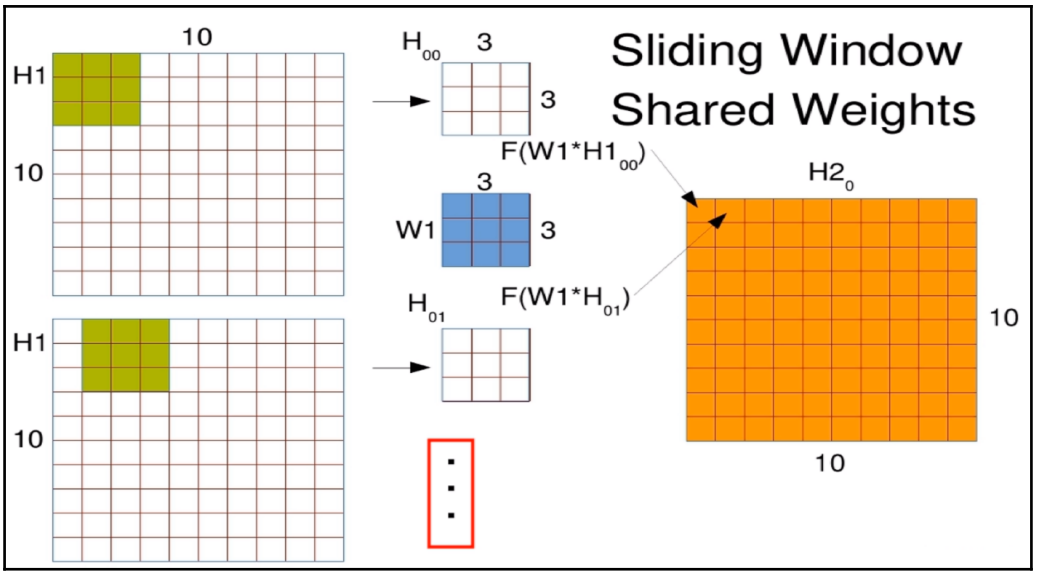


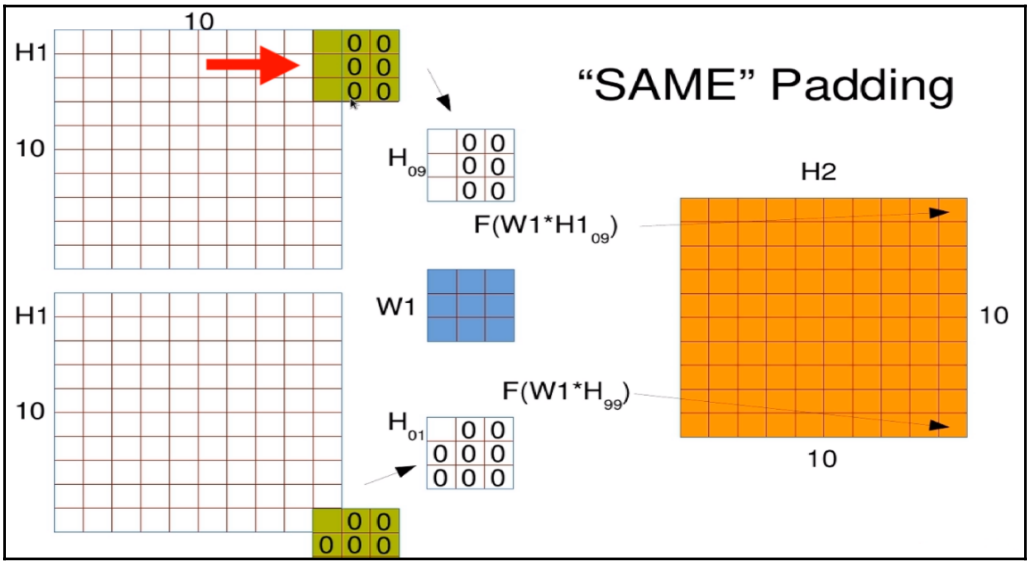
Figure 4
0 1 2 3 4
0
5
10
15
20
25
30
N1
1.2
0.9
0.6
0.3
0.0
−0.3
−0.6
−0.9
−1.2

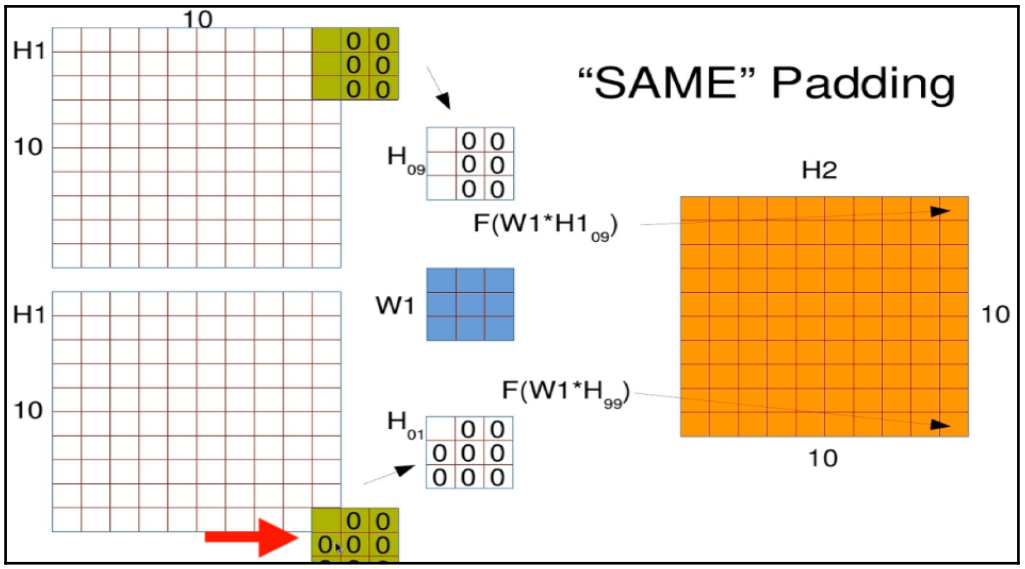
Chapter 3: Convolutional Neural Networks

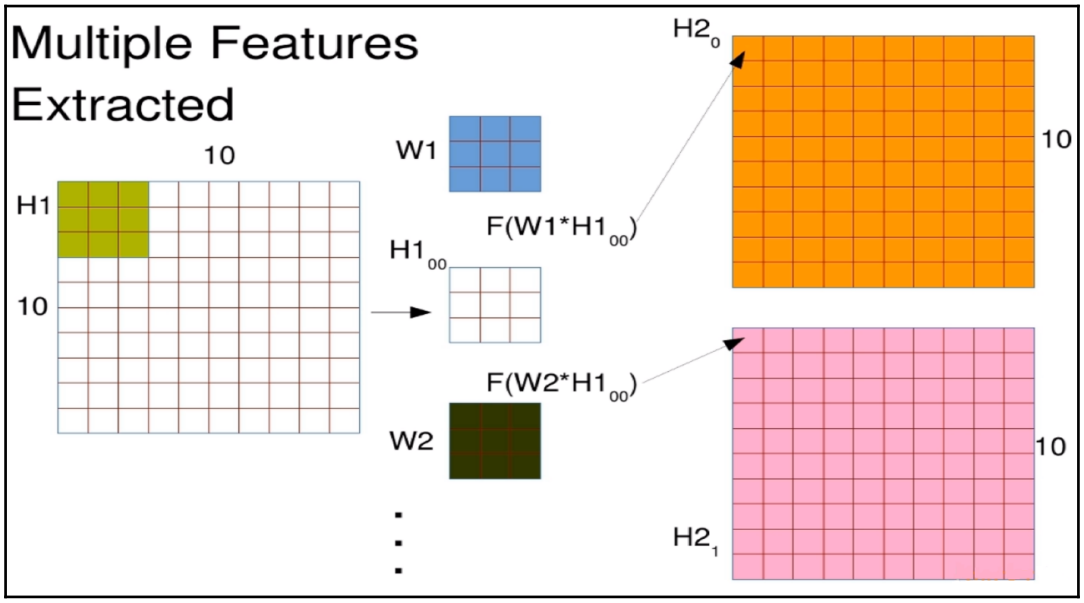


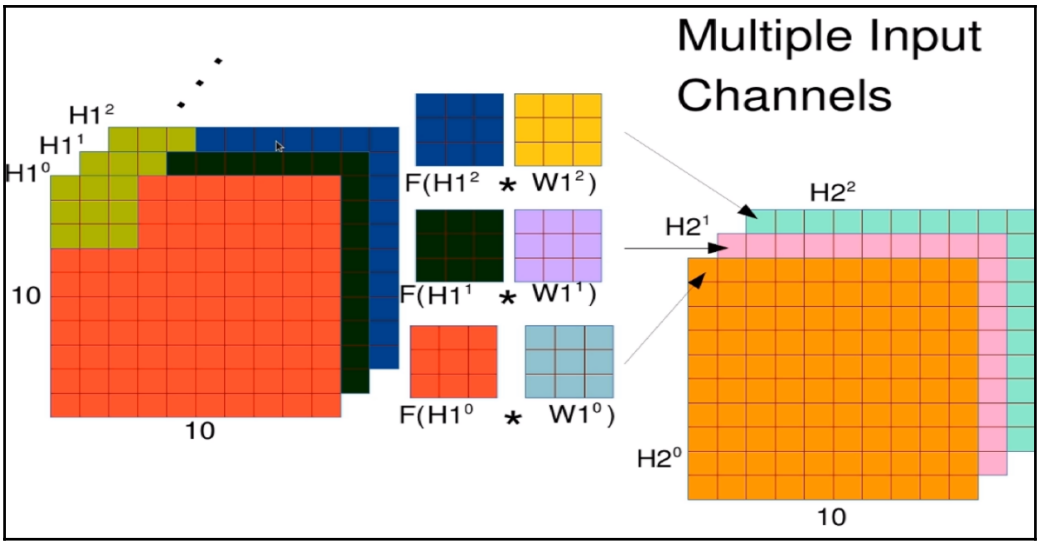



Sliding Window
Shared Weights
10
H1
10
H1
10
H00
3
3
F(W1*H100)
3
W1
3
F(W1*H01)
H01
H20
10
10


"SAME" Padding
10
H1
10
H1
10
0 0
0 0
0 0
H09
0 0
0 0
0 0
F(W1*H109)
W1
F(W1*H99)
H01
0 0
0 0 0
0 0 0
0 0
0 0 0
H2
10
10


10
H1
10
0 0
0 0
0 0
"SAME" Padding
H09
0 0
0 0
0 0
H2
F(W1*H109)
W1
H1
10
F(W1*H99)
10
H01
0 0
0 0 0
0 0 0
0 0
0 0


Multiple Features Extracted
10
H1
10
W1
H100
W2
F(W1*H100)
F(W2*H100)
H20
H21
10
10




```
In [1]:
```

```
import tensorflow as tf
import math
import numpy as np

sess = tf.InteractiveSession()

# Make some fake data, 1 data points
image = np.random.randint(10,size=[1,10,10]) + np.eye(10)*10

# TensorFlow placeholder
# None is for batch processing
# (-1 keeps same size)
# 10x10 is the shape
# 1 is the number of "channels"
# (like RGB colors or gray)
x = tf.placeholder("float", [None, 10, 10])
x_im = tf.reshape(x, [-1,10,10,1])

### Convolutional Layer

# Window size to use, 3x3 here
winx = 3
winy = 3

# How many features to compute on the window
num_filters = 2

# Weight shape should match window size
# The '1' represents the number of
# input "channels" (colors)
W1 = tf.Variable(tf.truncated_normal(
    [winx, winy,1, num_filters],
    stddev=1./math.sqrt(winx*winy)))
b1 = tf.Variable(tf.constant(
    0.1,shape=[num_filters]))
```

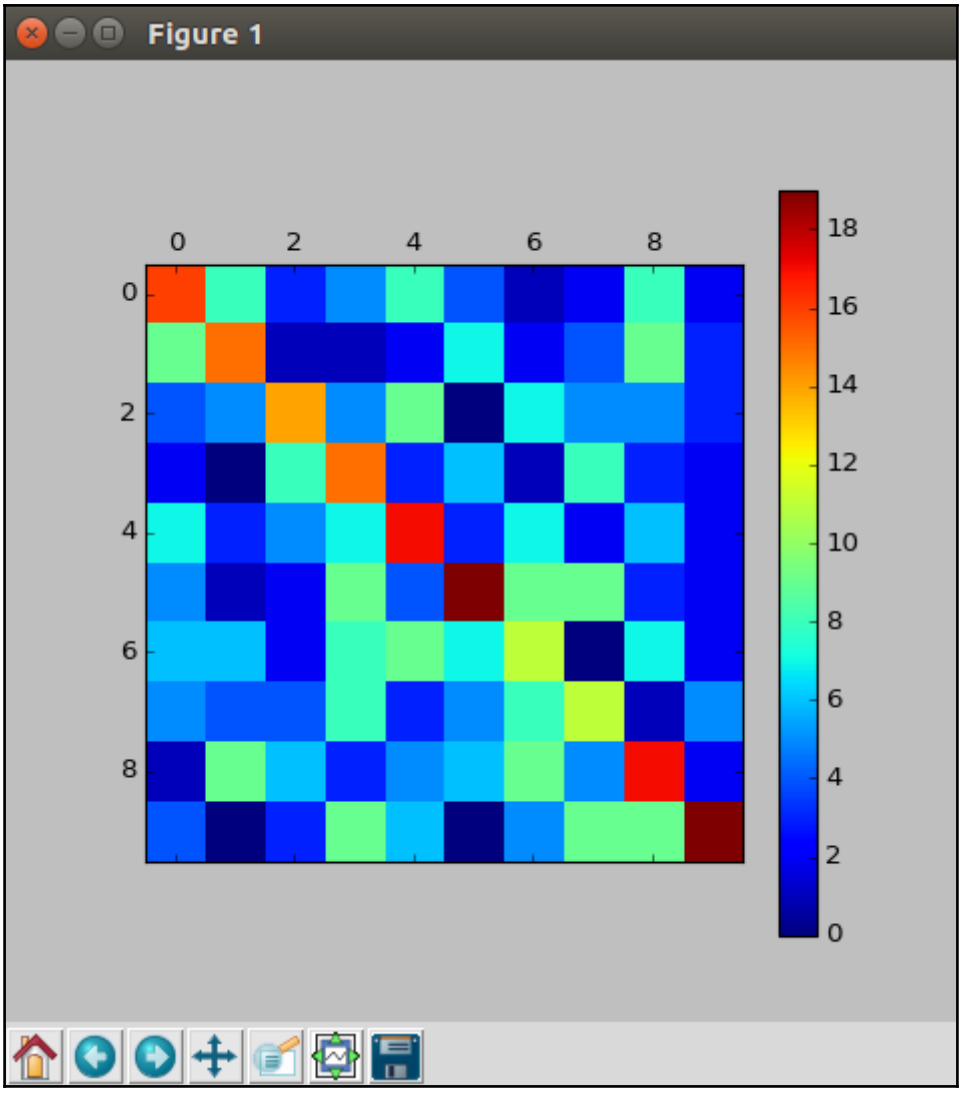


Figure 1
0
2
4
6
8
0
2
4
6
8
18
16
14
12
10
8
6
4
2
0

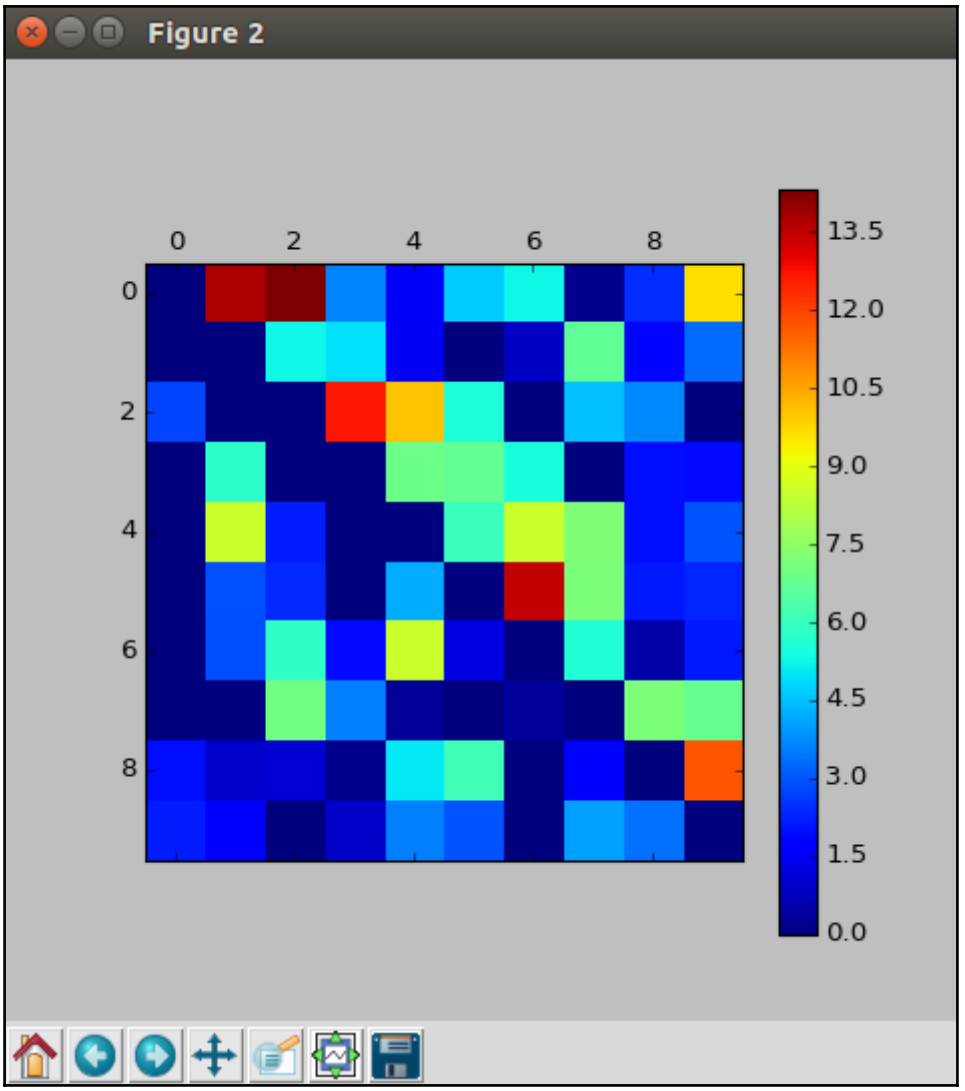


Figure 2
0
2
4
6
8
0
2
4
6
8
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0

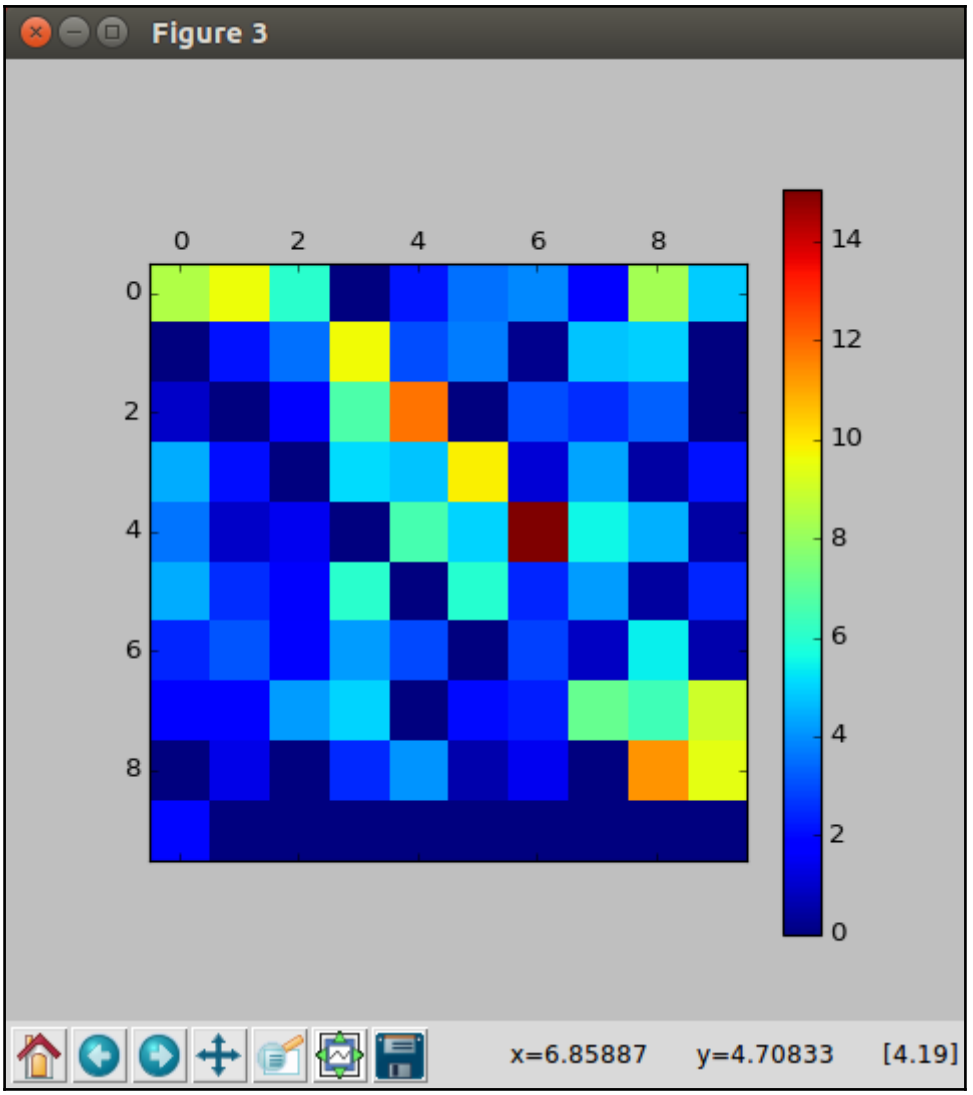
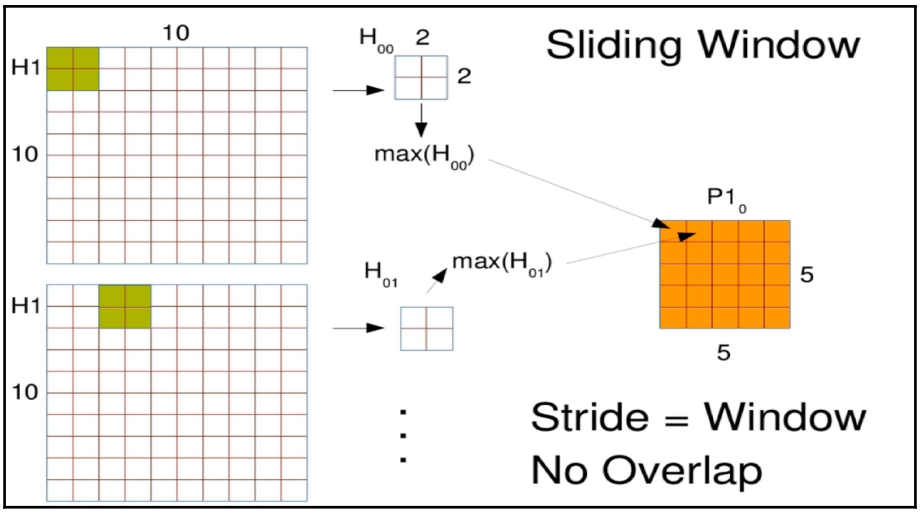
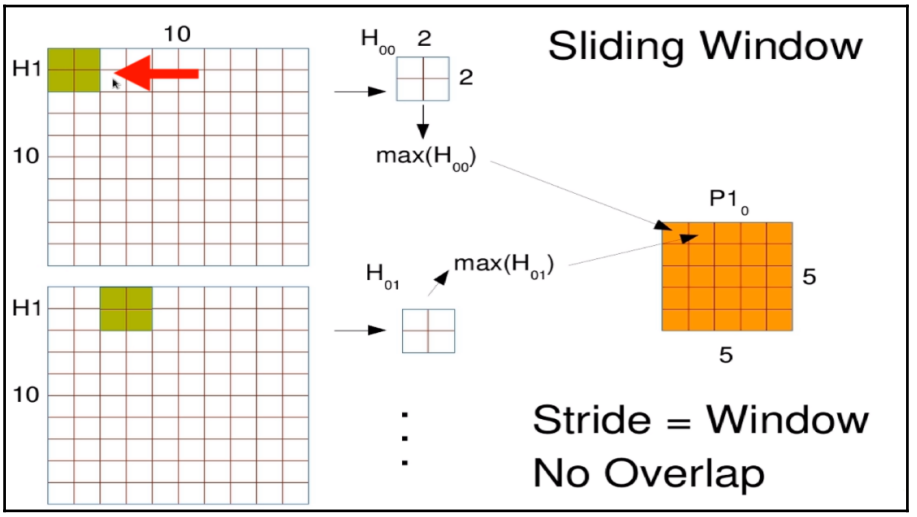
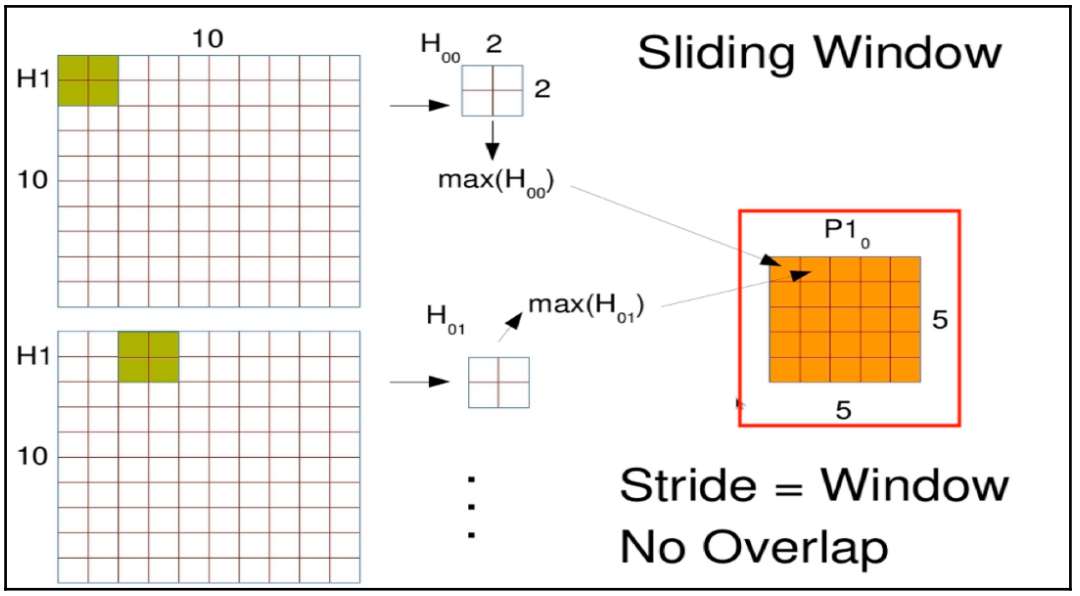
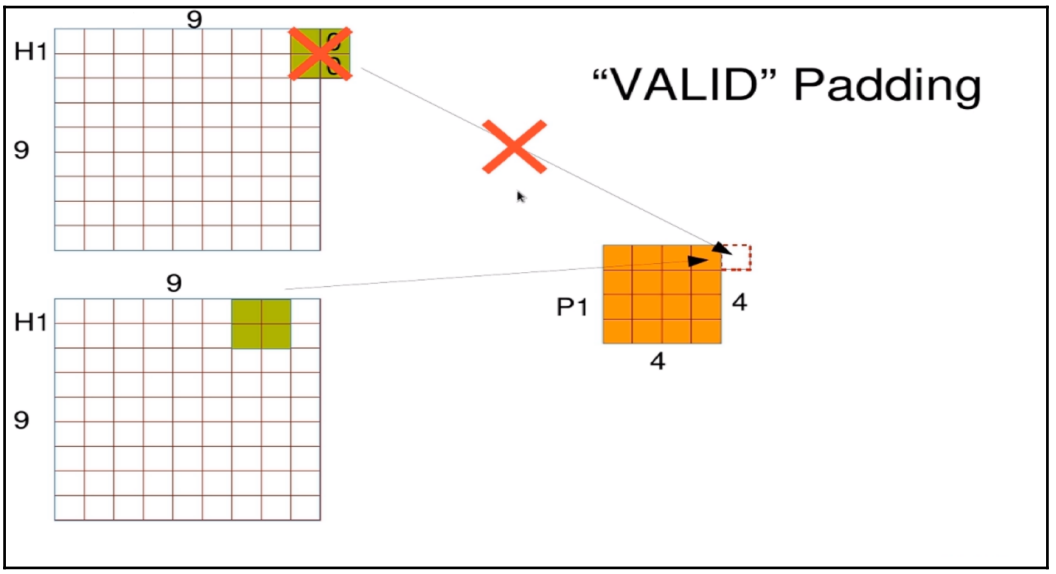


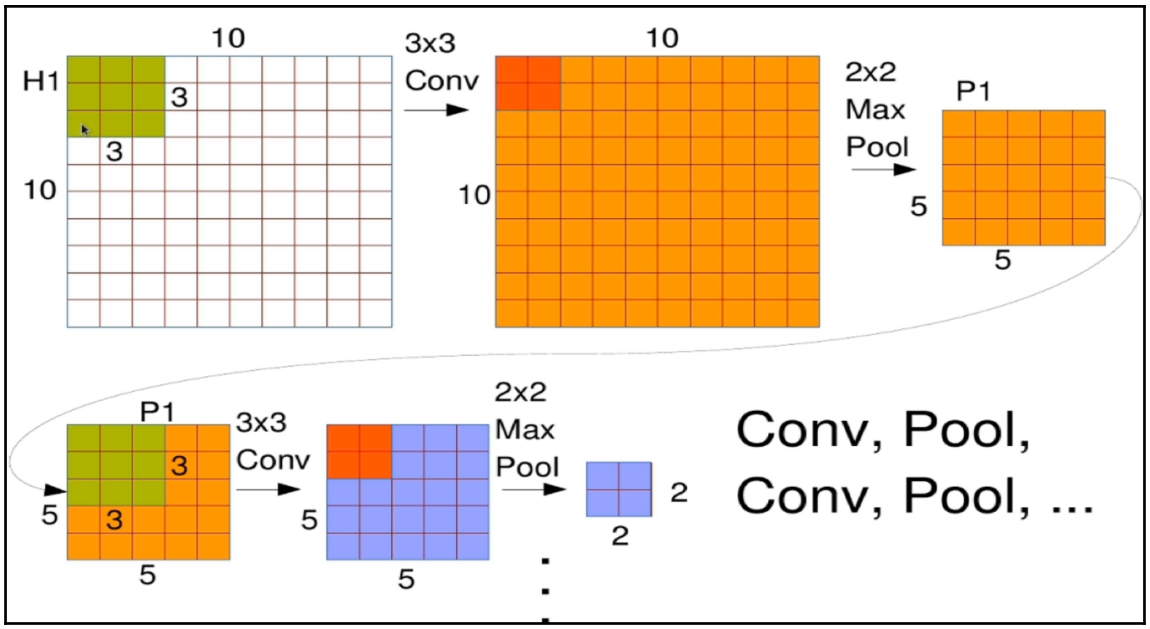
Figure 3
0
2
4
6
8
0
2
4
6
8
14
12
10
8
6
4
2
0
x=6.85887
y=4.70833
[4.19]


Sliding Window
10
H1
10
H1
10
H_{00} 2
2
$\max(H_{00})$
H_{01}
$\max(H_{01})$
$P1_0$
5
5
Stride = Window
No Overlap


Sliding Window
10
H1
10
H1
10
H_{00} 2
2
$\max(H_{00})$
H_{01}
$\max(H_{01})$
$P1_0$
5
5
Stride = Window
No Overlap


Sliding Window
10
H1
10
H1
10
H_{00}
2
2
$\max(H_{00})$
H_{01}
$\max(H_{01})$
$P1_0$
5
5
Stride = Window
No Overlap


9
H1
9
9
H1
9
"VALID" Padding
P1
4
4


H1
10
3
3
10
3x3
Conv
10
10
2x2
Max
Pool
P1
5
5
P1
5
3
3
5
3x3
Conv
5
5
2x2
Max
Pool
2
2
Conv, Pool,
Conv, Pool, ...

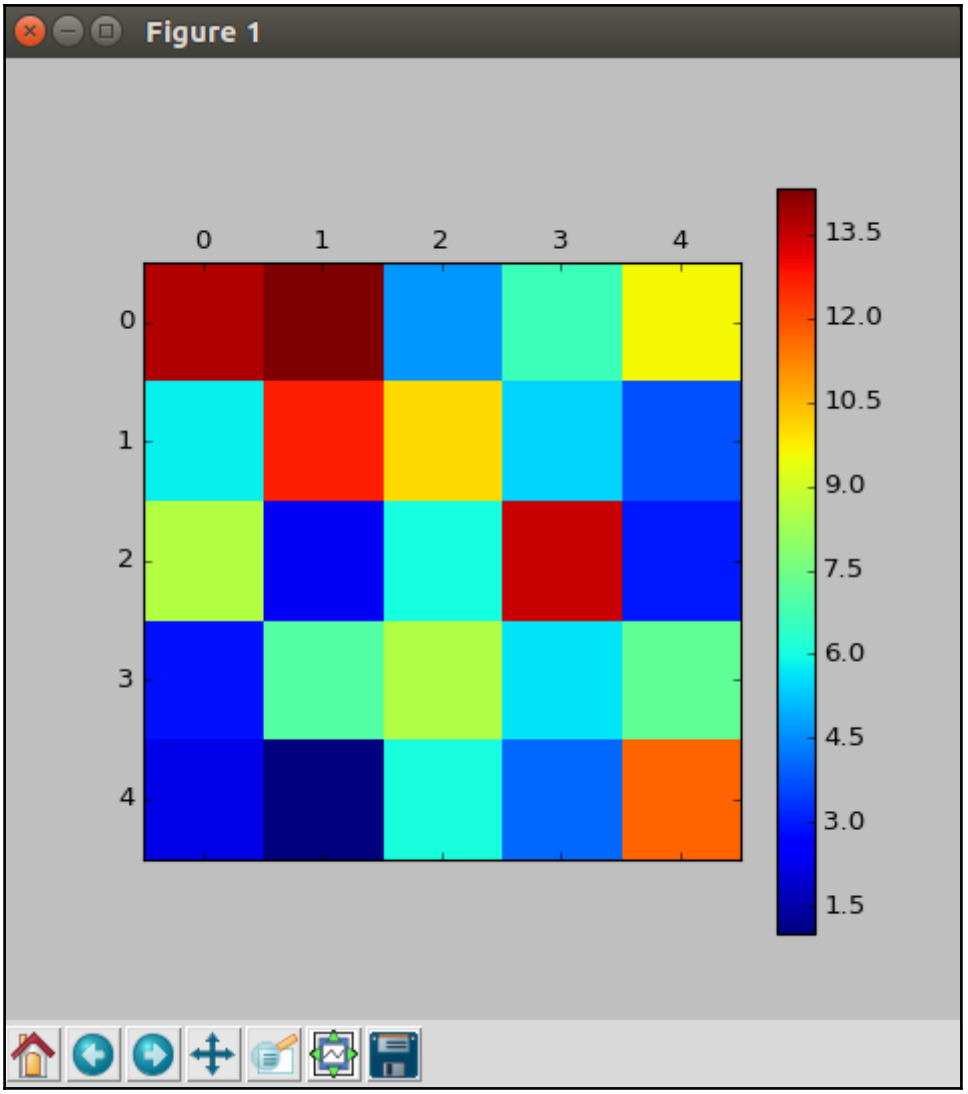
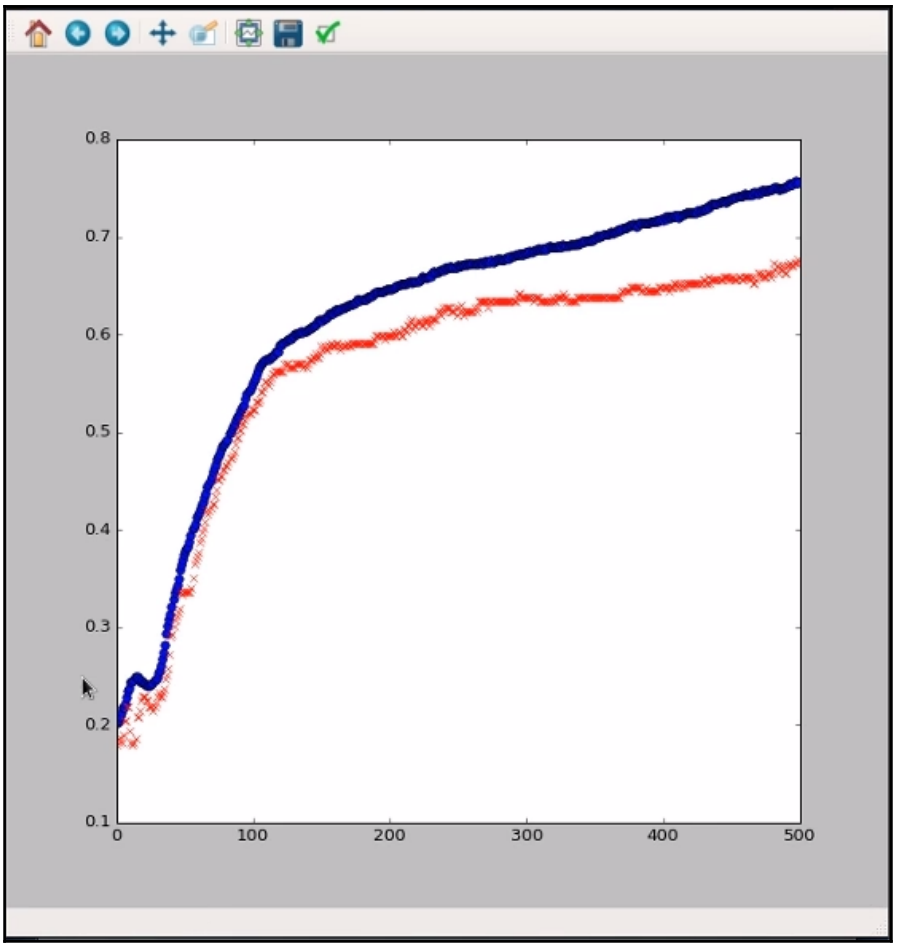
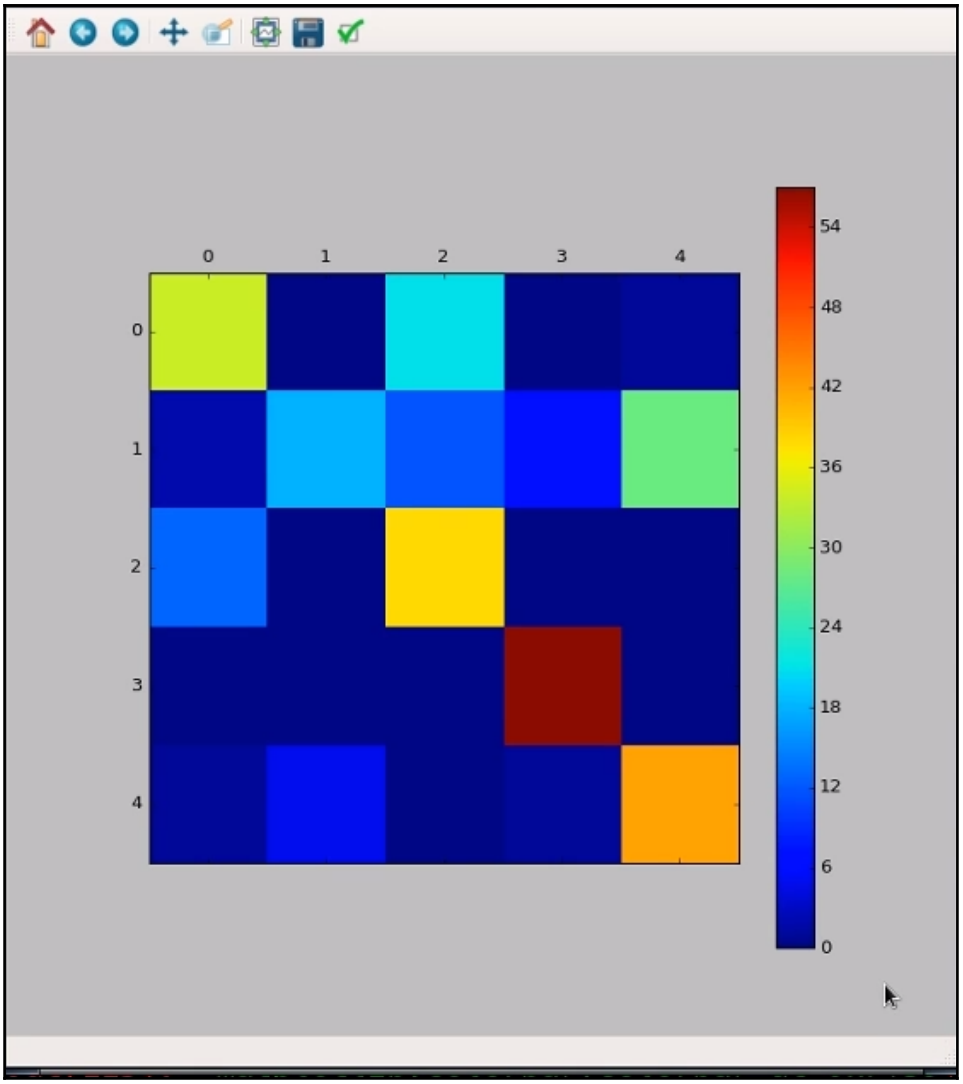
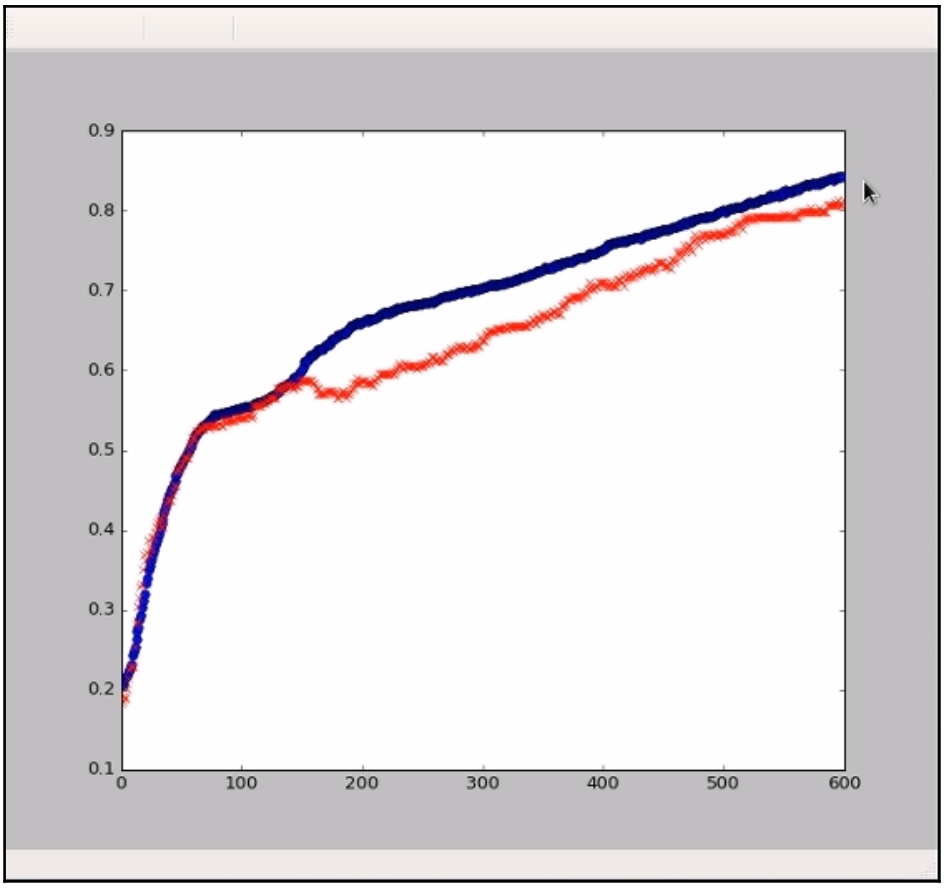
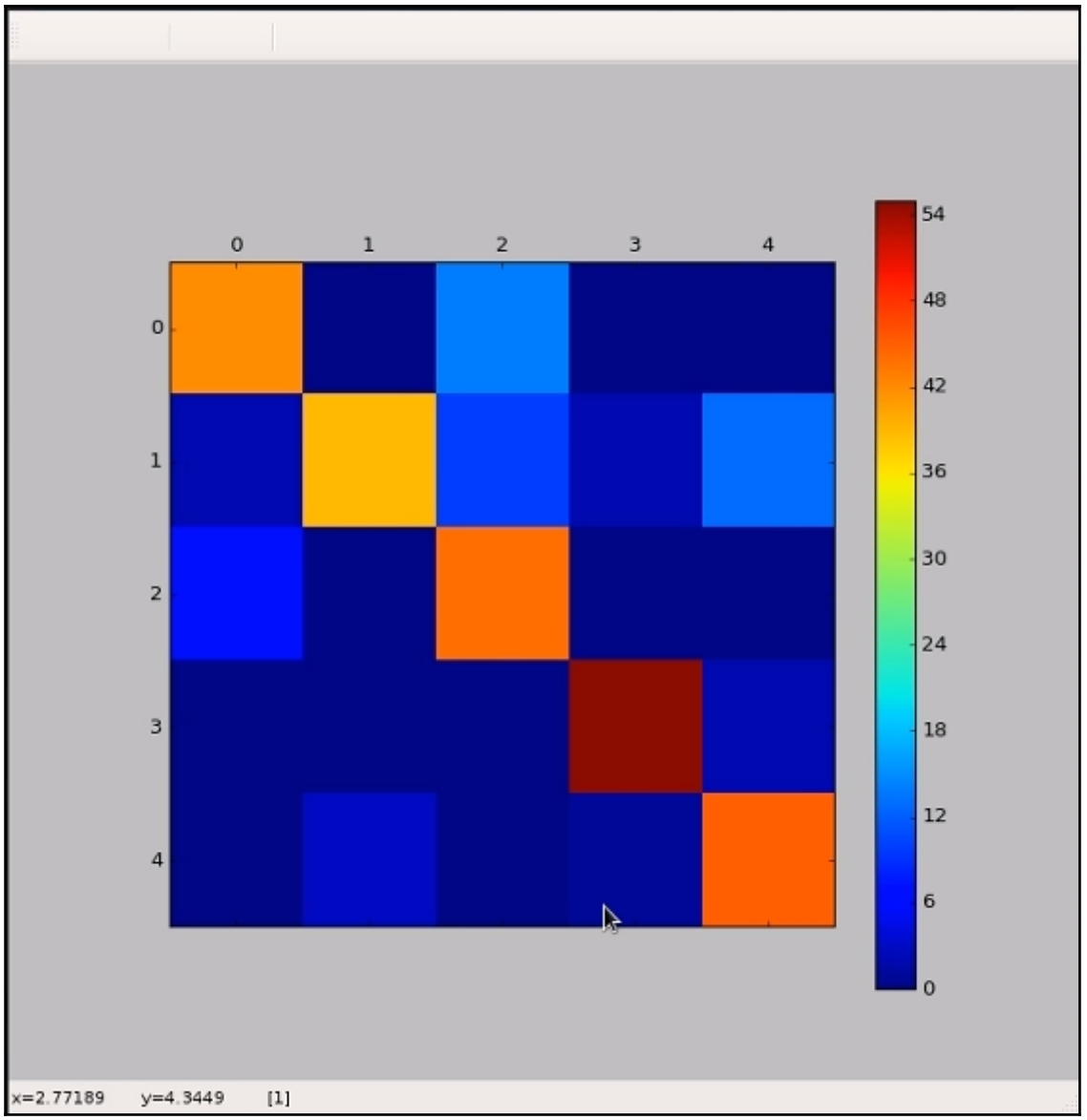


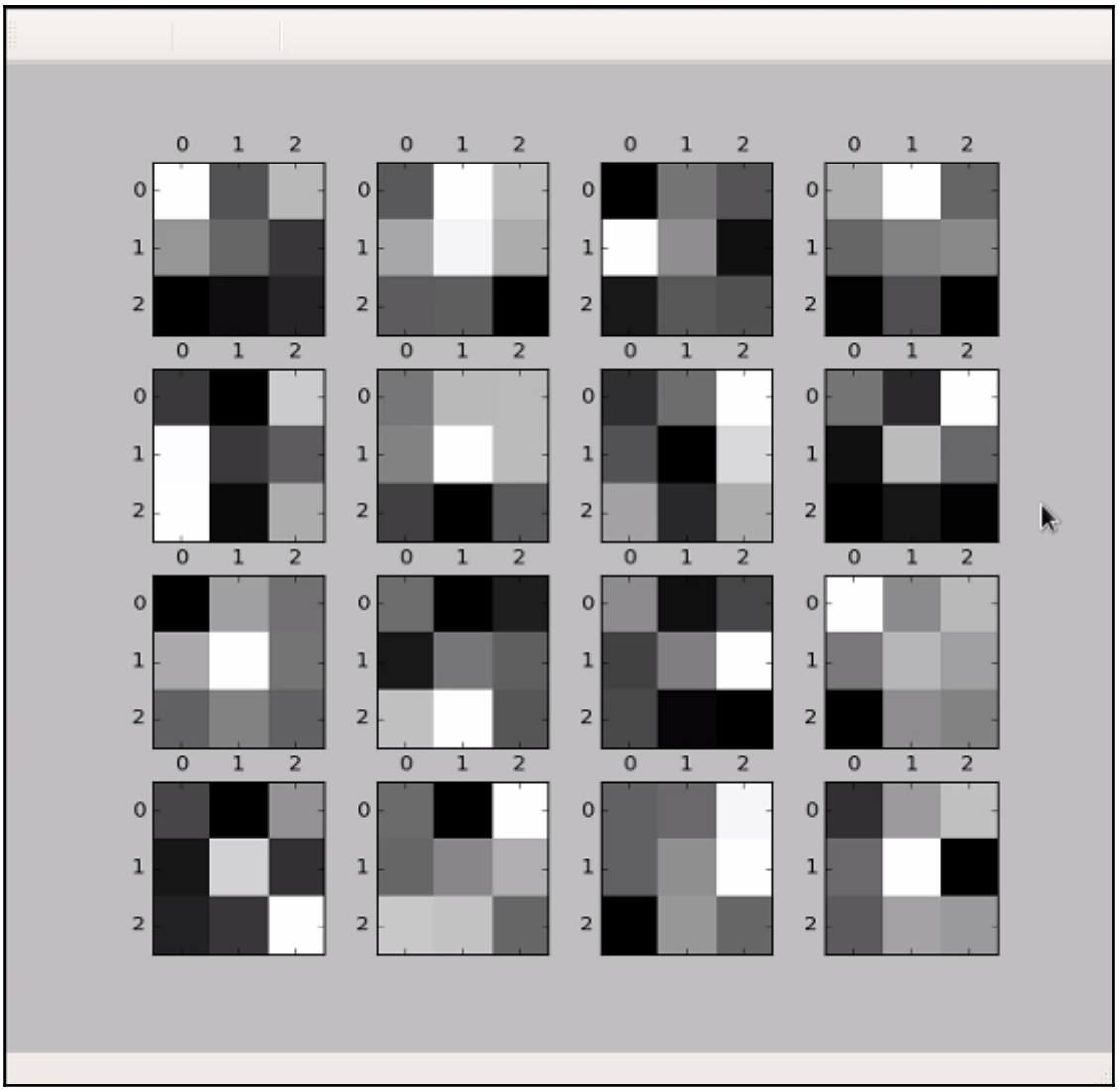
Figure 1
0
1
2
3
4
0
1
2
3
4
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5

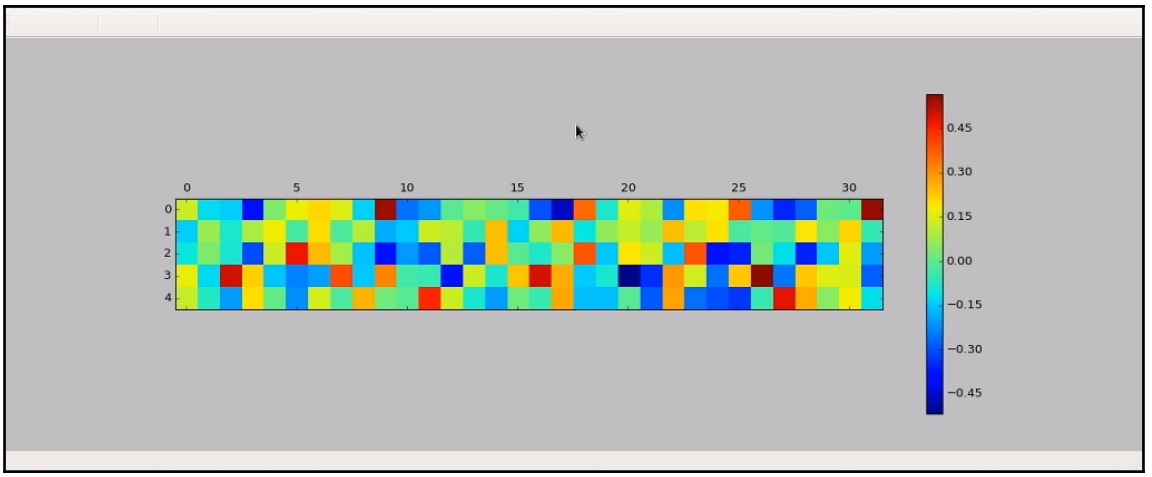

0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
100
200
300
400
500


0
1
2
3
4
0
1
2
3
4
54
48
42
36
30
24
18
12
6
0

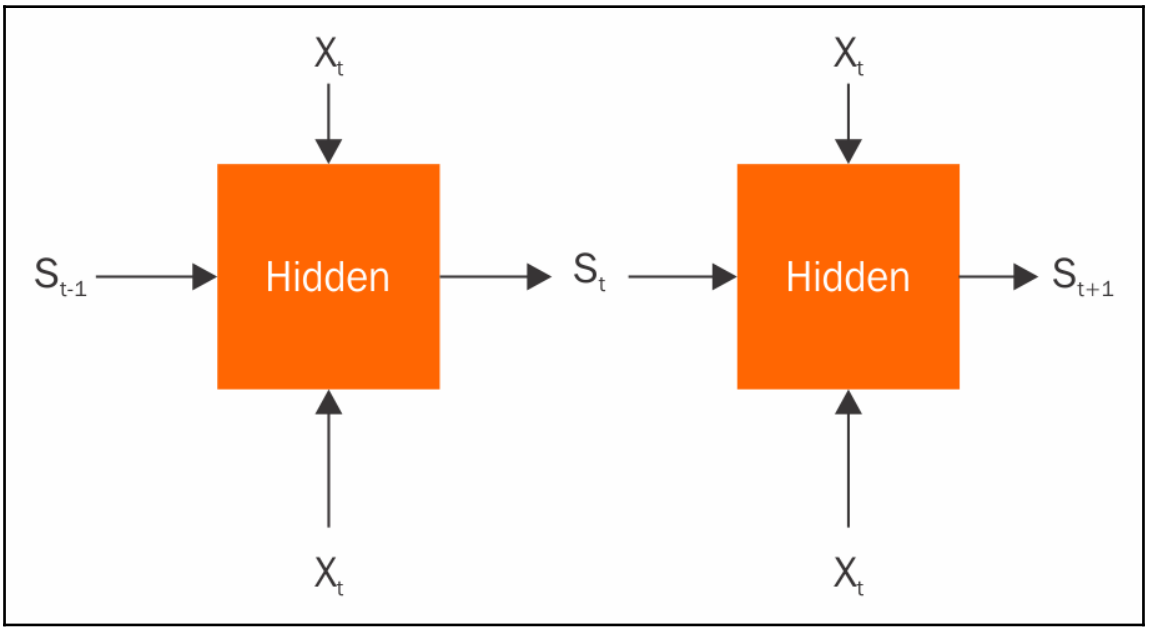

0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
100
200
300
400
500
600


0
1
2
3
4
0
1
2
3
4
54
48
42
36
30
24
18
12
6
0
x=2.77189
y=4.3449
[1]


0 1 2
0
1
2


0
5
10
15
20
25
30
0
1
2
3
4
0.45
0.30
0.15
0.00
−0.15
−0.30
−0.45

Chapter 4: Introducing Recurrent Neural Networks



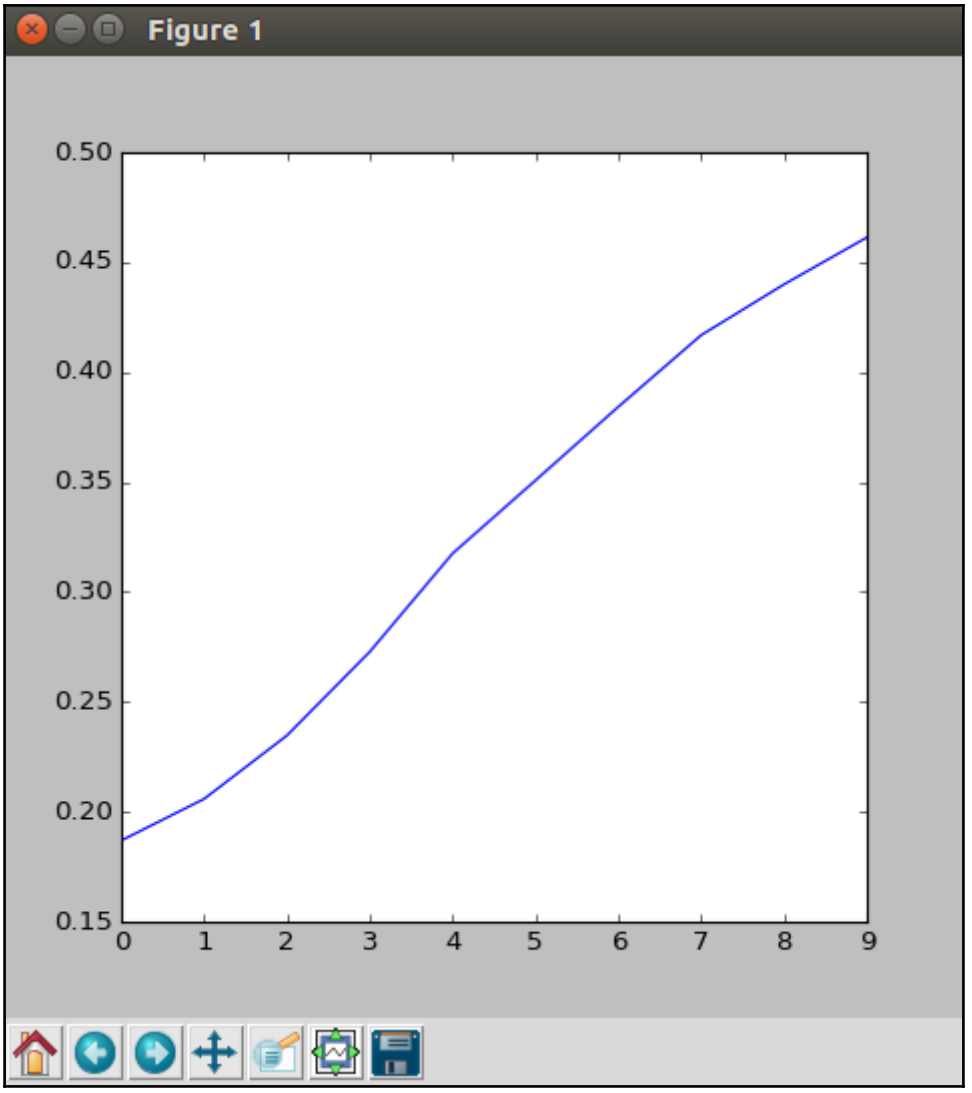
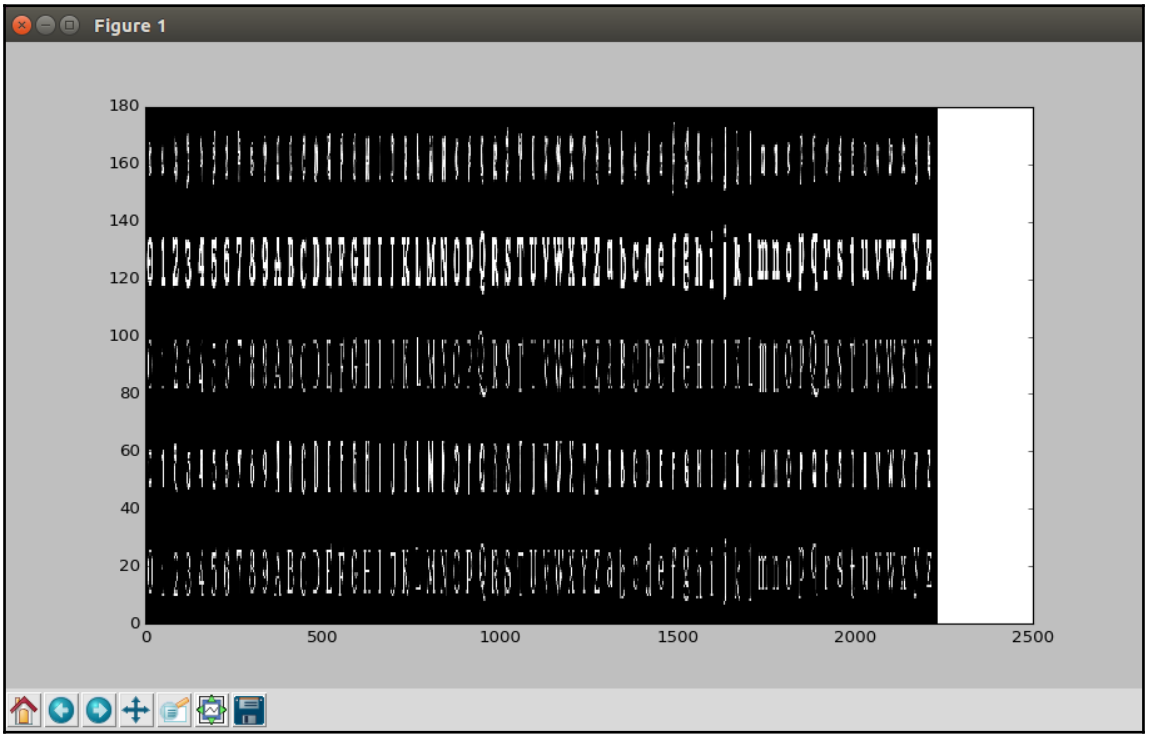
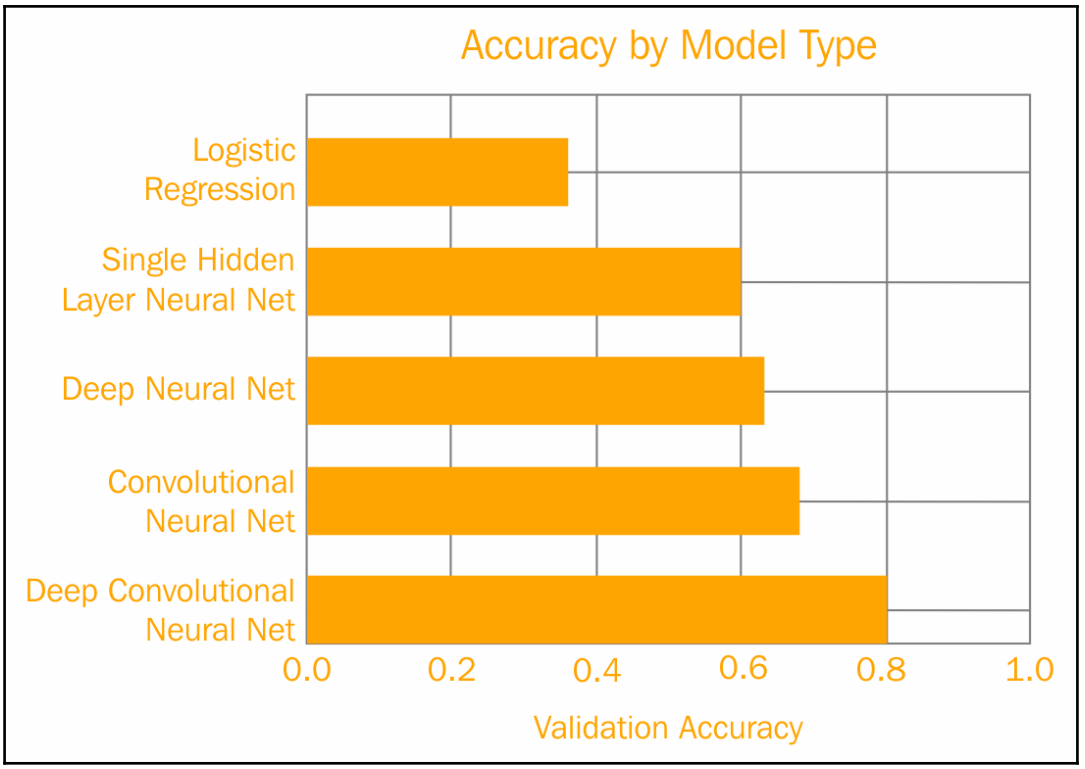
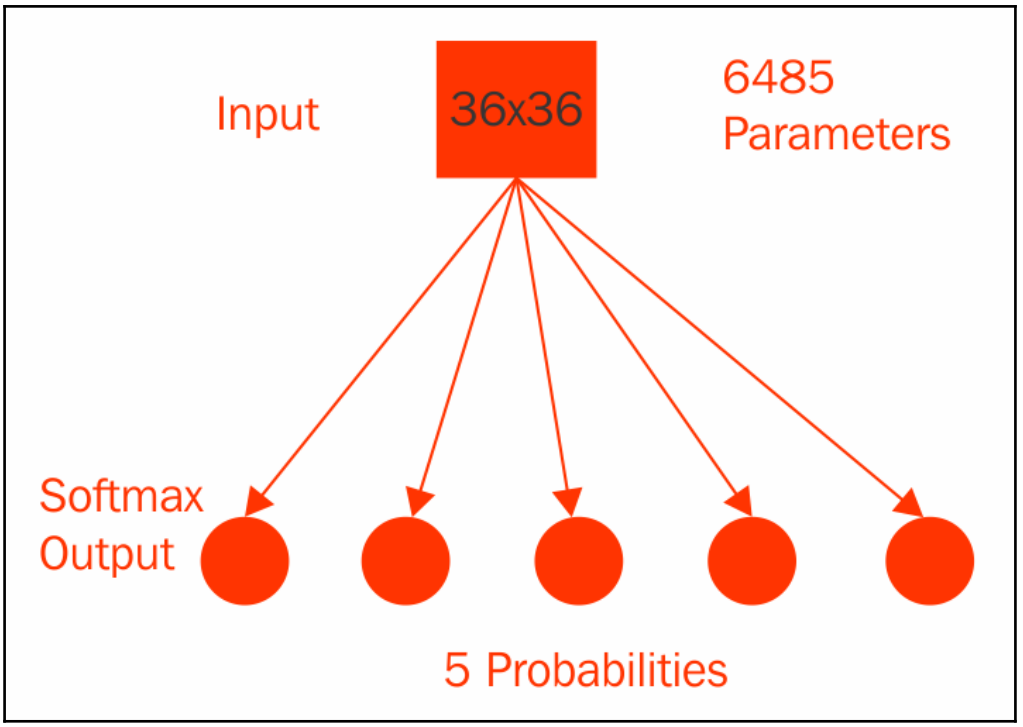


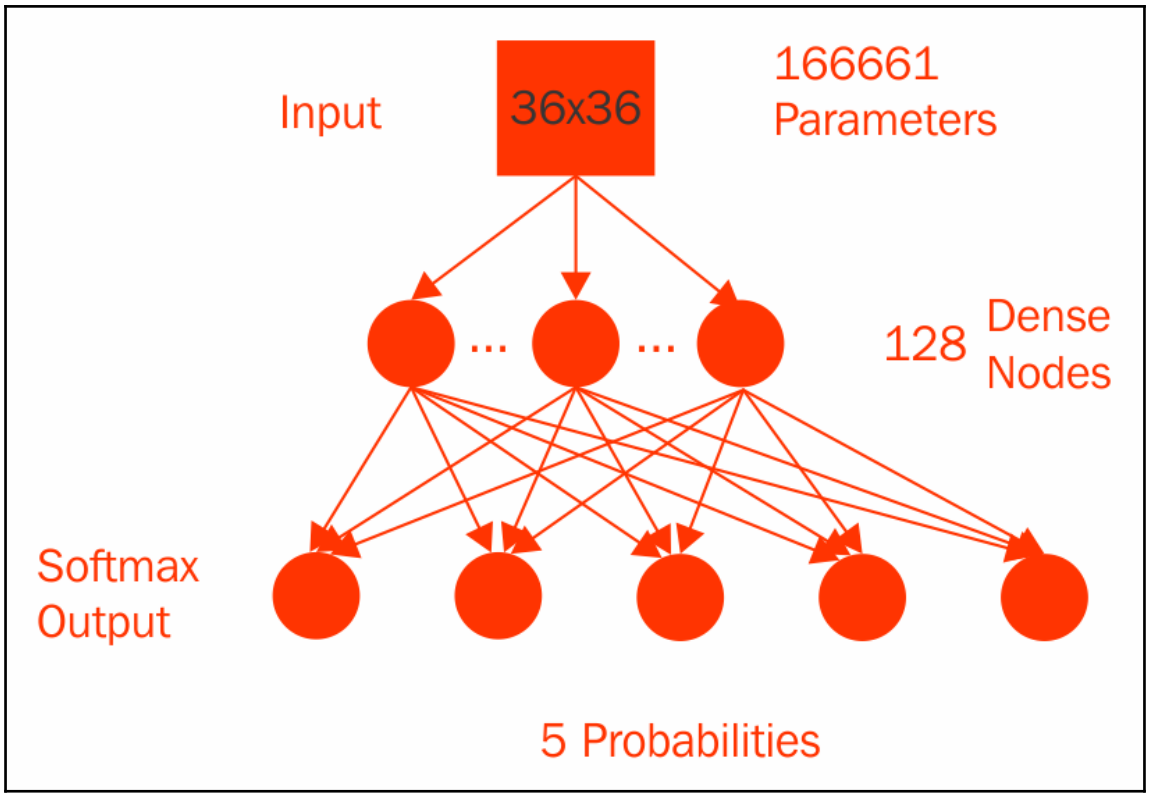
Figure 1
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0
1
2
3
4
5
6
7
8
9

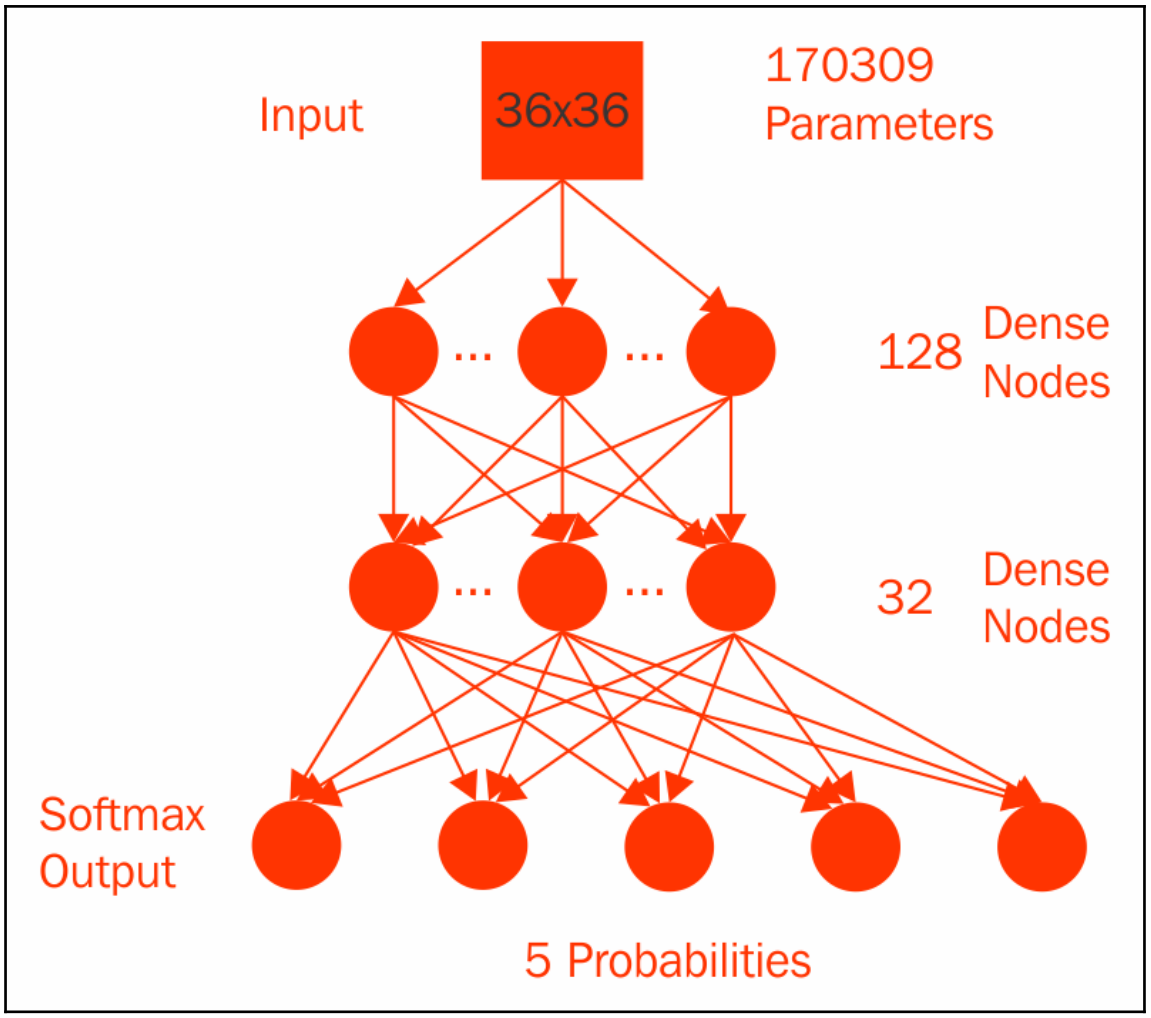
Chapter 5: Wrapping Up

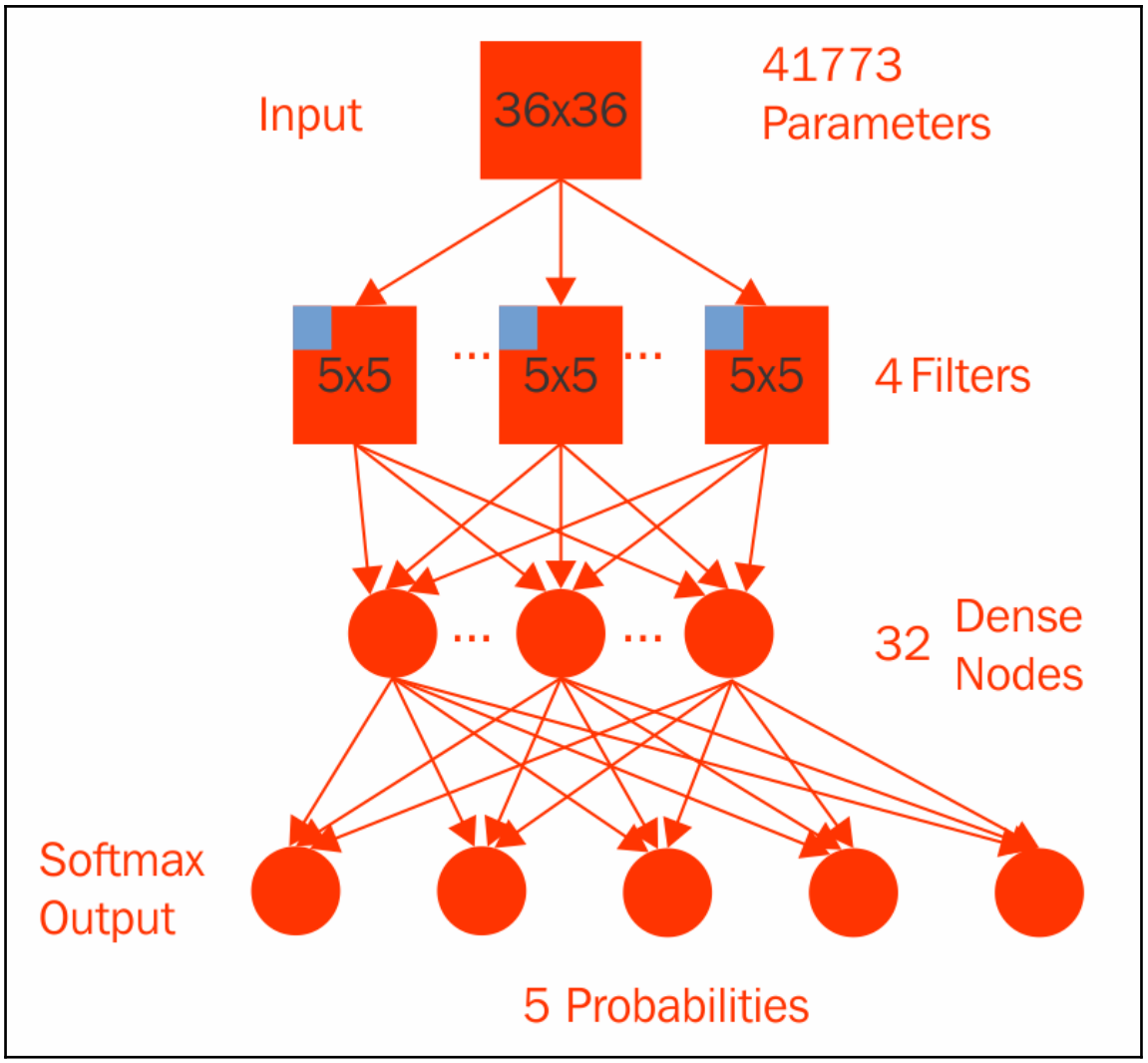


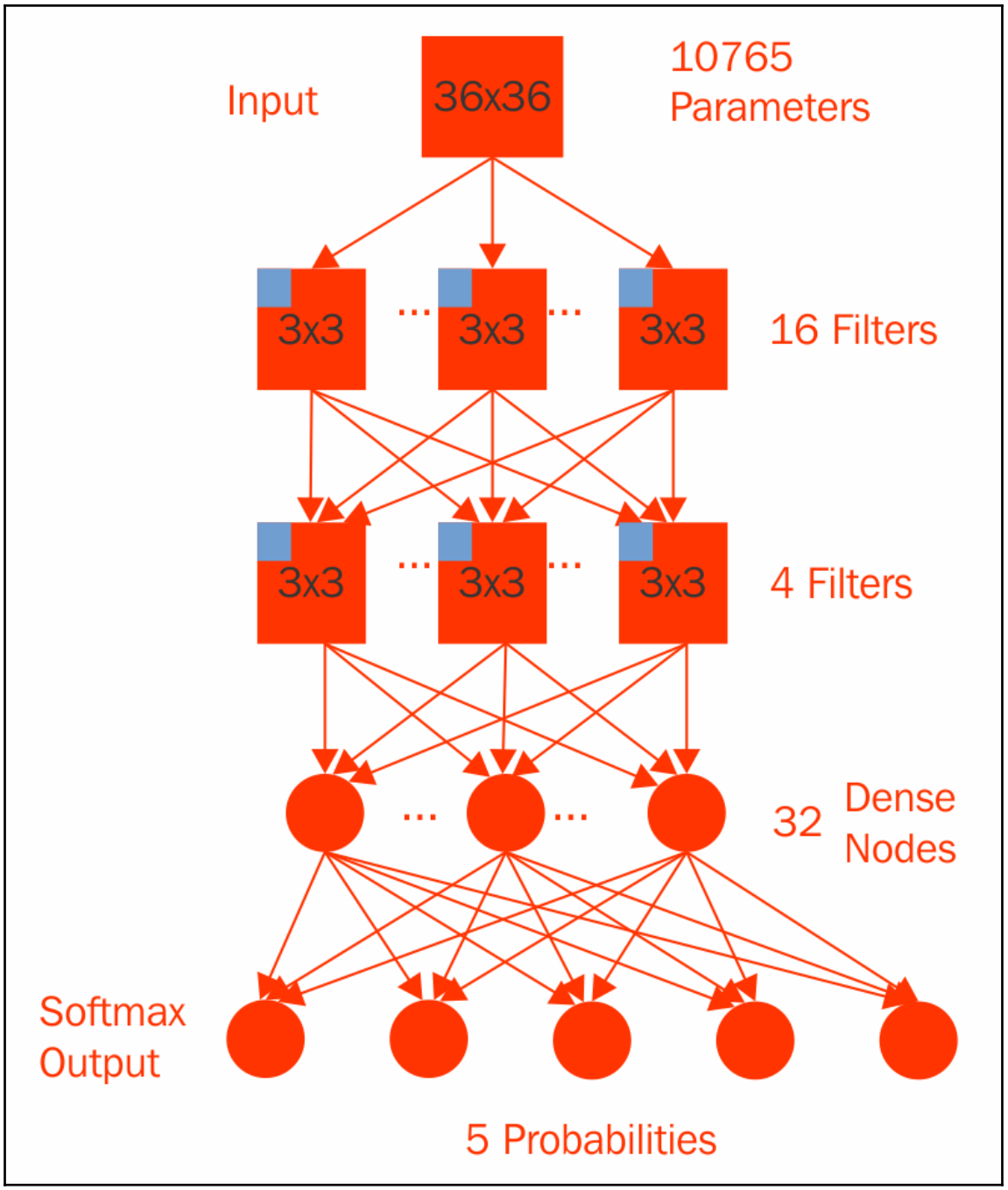

Accuracy by Model Type
Logistic Regression
Single Hidden Layer Neural Net
Deep Neural Net
Convolutional Neural Net
Deep Convolutional Neural Net
0.0
0.2
0.4
0.6
0.8
1.0
Validation Accuracy

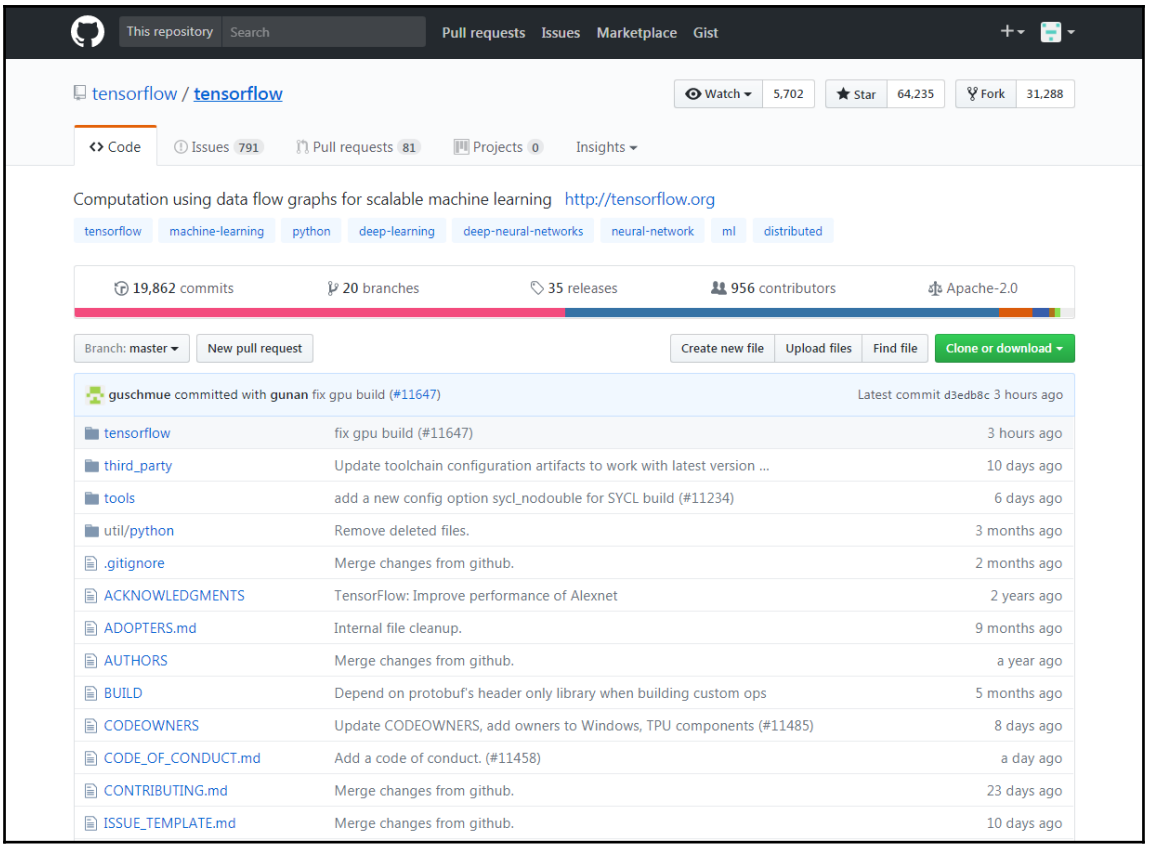

Input
36x36
6485
Parameters
Softmax
Output
5 Probabilities

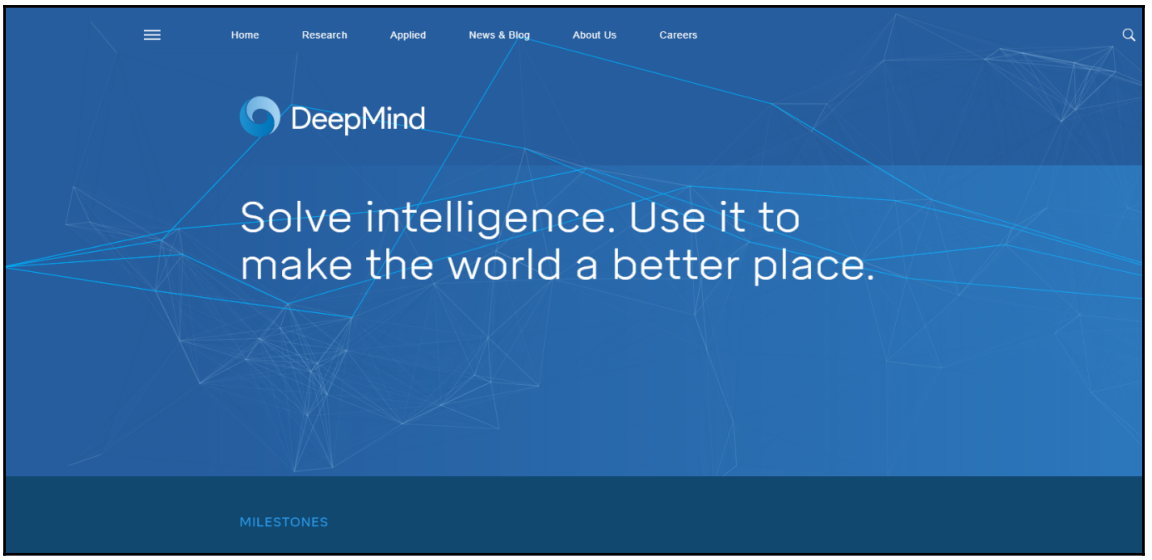

Input
36x36
166661
Parameters
128
Dense
Nodes
Softmax
Output
5 Probabilities

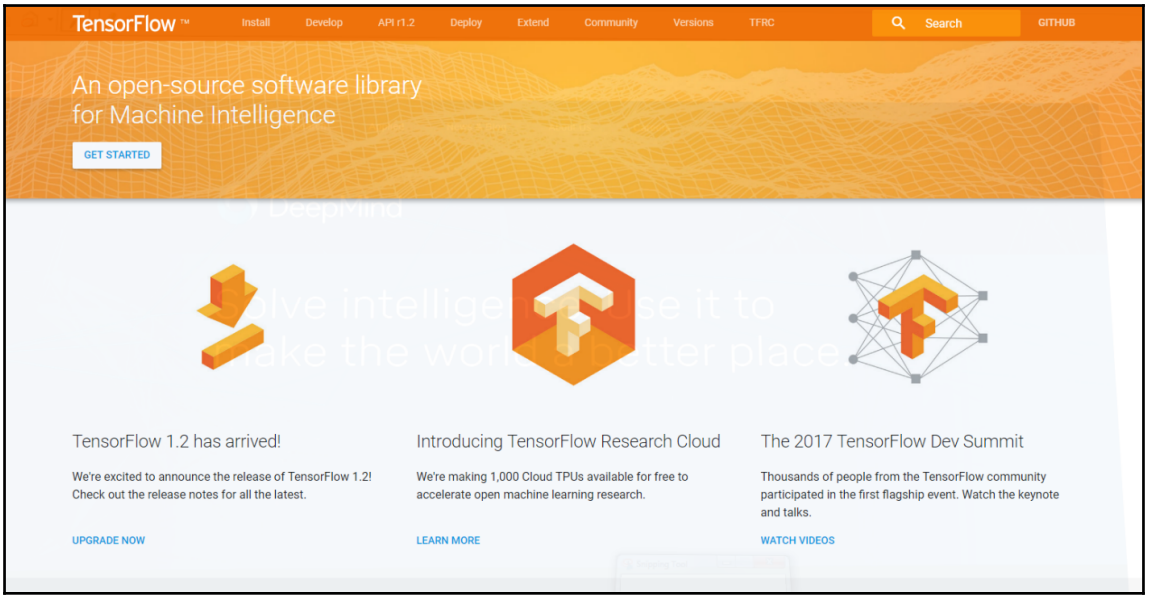

Input
36x36
170309
Parameters
128
Dense
Nodes
32
Dense
Nodes
Softmax
Output
5 Probabilities

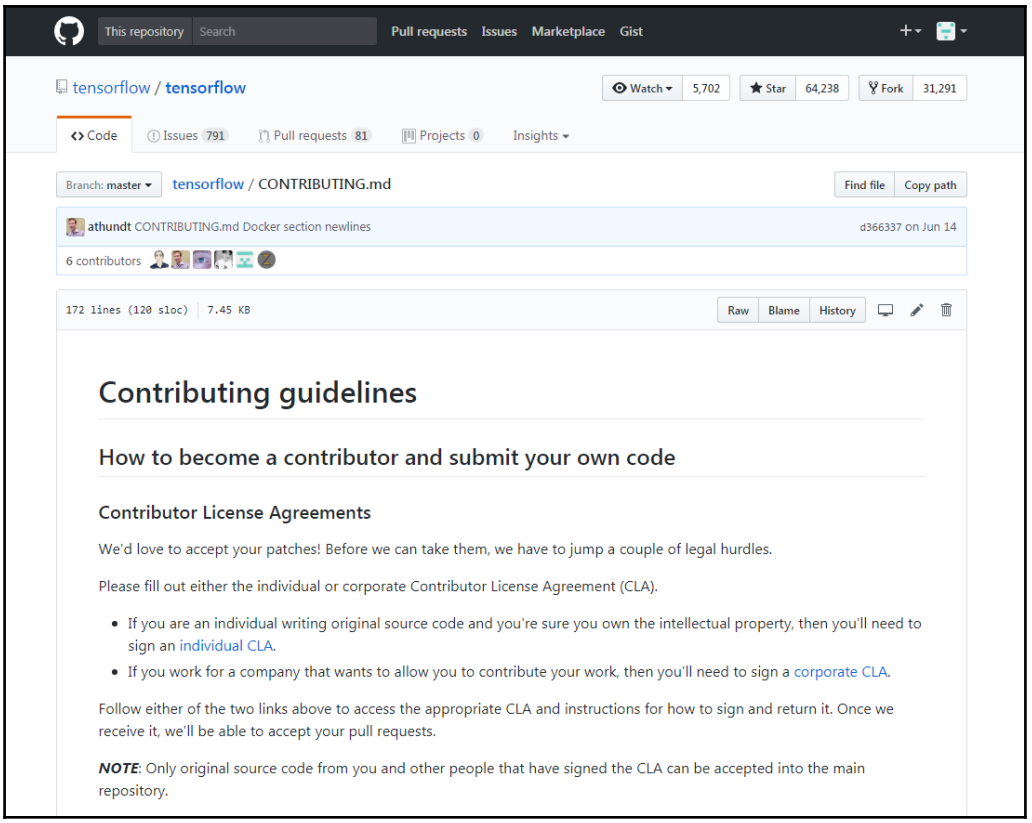

Input
36x36
41773
Parameters
5x5
5x5
5x5
4 Filters
32
Dense
Nodes
Softmax
Output
5 Probabilities


Input
36x36
10765
Parameters
3x3
3x3
3x3
16 Filters
3x3
3x3
3x3
4 Filters
32
Dense
Nodes
Softmax
Output
5 Probabilities


This repository
Search
Pull requests
Issues
Marketplace
Gist
tensorflow / tensorflow
Watch 5,702
Star 64,235
Fork 31,288
Code
Issues 791
Pull requests 81
Projects 0
Insights
Computation using data flow graphs for scalable machine learning http://tensorflow.org
tensorflow
machine-learning
python
deep-learning
deep-neural-networks
neural-network
ml
distributed
19,862 commits
20 branches
35 releases
956 contributors
Apache-2.0
Branch: master
New pull request
Create new file
Upload files
Find file
Clone or download
guschmue committed with gunan fix gpu build (#11647)
Latest commit d3edb8c 3 hours ago
tensorflow fix gpu build (#11647) 3 hours ago
third_party Update toolchain configuration artifacts to work with latest version ... 10 days ago
tools add a new config option sycl_nodouble for SYCL build (#11234) 6 days ago
util/python Remove deleted files. 3 months ago
.gitignore Merge changes from github. 2 months ago
ACKNOWLEDGMENTS TensorFlow: Improve performance of Alexnet 2 years ago
ADOPTERS.md Internal file cleanup. 9 months ago
AUTHORS Merge changes from github. a year ago
BUILD Depend on protobuf's header only library when building custom ops 5 months ago
CODEOWNERS Update CODEOWNERS, add owners to Windows, TPU components (#11485) 8 days ago
CODE_OF_CONDUCT.md Add a code of conduct. (#11458) a day ago
CONTRIBUTING.md Merge changes from github. 23 days ago
ISSUE_TEMPLATE.md Merge changes from github. 10 days ago


Home
Research
Applied
News & Blog
About Us
Careers
DeepMind
Solve intelligence. Use it to
make the world a better place.
MILESTONES


TensorFlow ™
Install
Develop
API r1.2
Deploy
Extend
Community
Versions
TFRC
Search
GITHUB
An open-source software library
for Machine Intelligence
GET STARTED
TensorFlow 1.2 has arrived!
We're excited to announce the release of TensorFlow 1.2!
Check out the release notes for all the latest.
UPGRADE NOW
Introducing TensorFlow Research Cloud
We're making 1,000 Cloud TPUs available for free to
accelerate open machine learning research.
LEARN MORE
The 2017 TensorFlow Dev Summit
Thousands of people from the TensorFlow community
participated in the first flagship event. Watch the keynote
and talks.
WATCH VIDEOS


This repository
Search
Pull requests
Issues
Marketplace
Gist
tensorflow / tensorflow
Watch 5,702
Star 64,238
Fork 31,291
Code
Issues 791
Pull requests 81
Projects 0
Insights
Branch: master
tensorflow / CONTRIBUTING.md
Find file
Copy path
athundt CONTRIBUTING.md Docker section newlines
d366337 on Jun 14
6 contributors
172 lines (120 sloc)
7.45 KB
Raw
Blame
History
Contributing guidelines
How to become a contributor and submit your own code
Contributor License Agreements
We'd love to accept your patches! Before we can take them, we have to jump a couple of legal hurdles.
Please fill out either the individual or corporate Contributor License Agreement (CLA).
If you are an individual writing original source code and you're sure you own the intellectual property, then you'll need to sign an individual CLA.
If you work for a company that wants to allow you to contribute your work, then you'll need to sign a corporate CLA.
Follow either of the two links above to access the appropriate CLA and instructions for how to sign and return it. Once we receive it, we'll be able to accept your pull requests.
NOTE: Only original source code from you and other people that have signed the CLA can be accepted into the main repository.