

# Python + NEURON

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School of Brain Cells and Circuits  
Erice 2015

NINDS

# Installing ...

Recycle Bin

NEURON | for empirical

neuron.yale.edu/neuron

## NEURON

for empirically-based simulations of neurons and networks of neurons

Installers and source code

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[Documentation](#) | [Programmer's Reference](#) | [Forum](#) | [Resources](#) | [ModelDB](#)

Welcome to the community of NEURON users and developers!

This is the home page of the NEURON simulation environment, which is used in classrooms and world for building and models of neurons and

Search

Google™ Custom Search

Search

http://neuron.yale.edu/neuron/download

Search the web and Windows

6:56 AM 11/17/2015

Right Ctrl

# Installing on 64bit Windows 10 ...

Recycle Bin

Download and install | N

neuron.yale.edu/neuron/dow

## Download and install

If NEURON is already installed, uninstall it before installing a different version.

## The standard distribution

The current standard distribution is version 7.4. It is recommended for most users, especially for new projects.

## Precompiled installers:

OS X		<a href="#">64 bit .dmg</a>
MSWin	<a href="#">32 bit</a>	<a href="#">64 bit</a>
Linux	<a href="#">32 bit .deb</a>	<a href="#">64 bit .deb</a>
	<a href="#">32 bit .rpm</a>	<a href="#">64 bit .rpm</a>

## Installation hints

OS X Double click on the .dmg file, then

[http://www.neuron.yale.edu/ftp/neuron/versions/v7.4/nrn-7.4.x86\\_64-w64-mingw32-setup.exe](http://www.neuron.yale.edu/ftp/neuron/versions/v7.4/nrn-7.4.x86_64-w64-mingw32-setup.exe)

## Search

Google™ Custom Search

Search

## Navigation

- ▶ [Blogs](#)
- [Recent posts](#)

## Recent blog posts

- [Two important events at the 2015 SFN meeting](#)

6:59 AM 11/17/2015

Right Ctrl

# Run the downloaded file

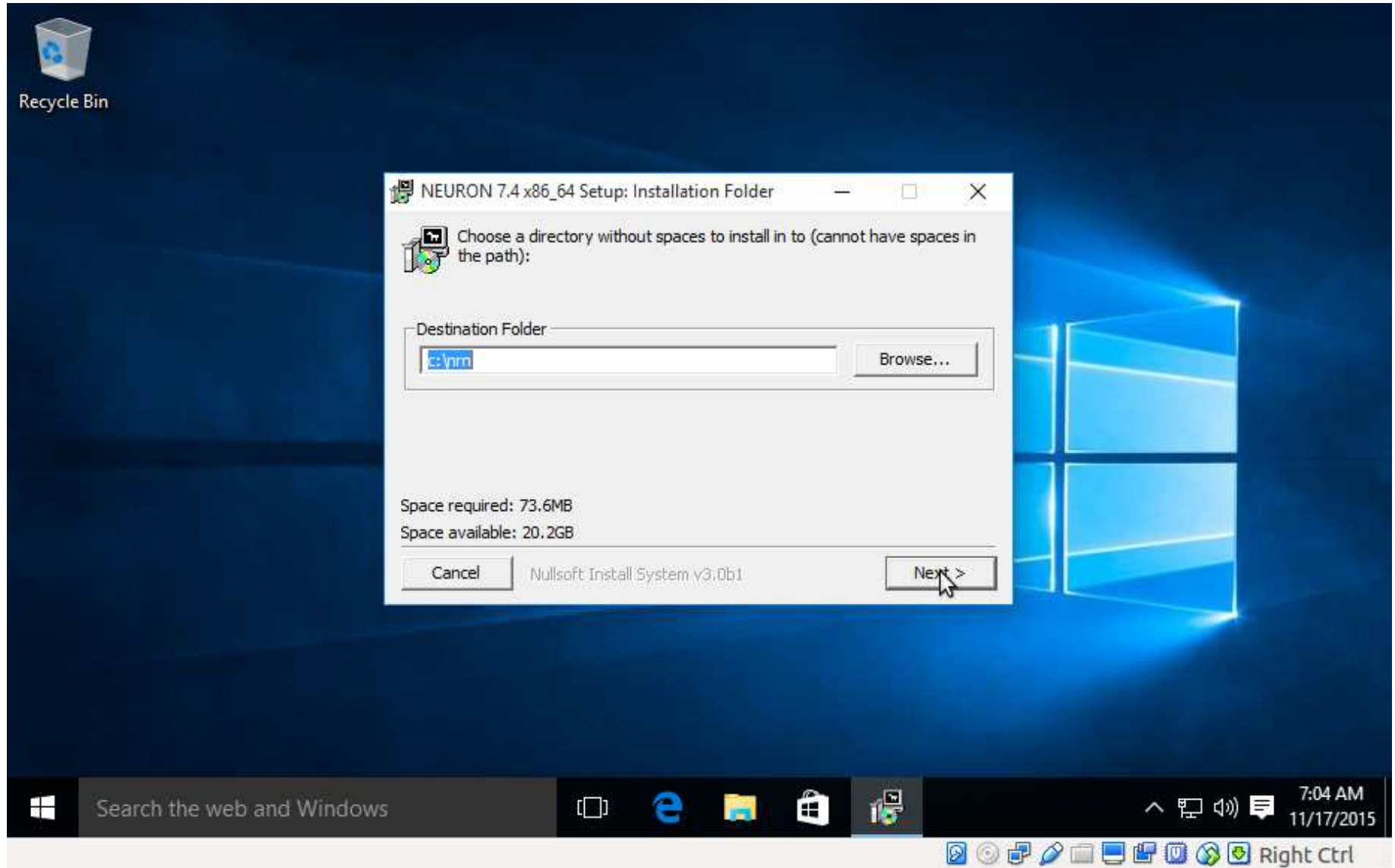
The screenshot shows a Windows desktop environment. In the top-left corner, there is a Recycle Bin icon. The main area is occupied by a web browser window titled "Download and install | N". The browser's address bar shows the URL "neuron.yale.edu/neuron/dow". The page content includes:

- Download and install**: A section with the text "If NEURON is already installed, uninstall it before installing a different version."
- The standard distribution**: A section with the text "The current standard distribution is version 7.4. It is recommended for most users, especially for new projects."
- Precompiled installers:** A table listing download links for different operating systems and architectures.
- Search**: A search bar with the text "Google™ Custom Search" and a "Search" button.
- Navigation**: A list of links including "Blogs" and "Recent posts".
- Recent blog posts**: A list of posts, with "Two important" being the first one.

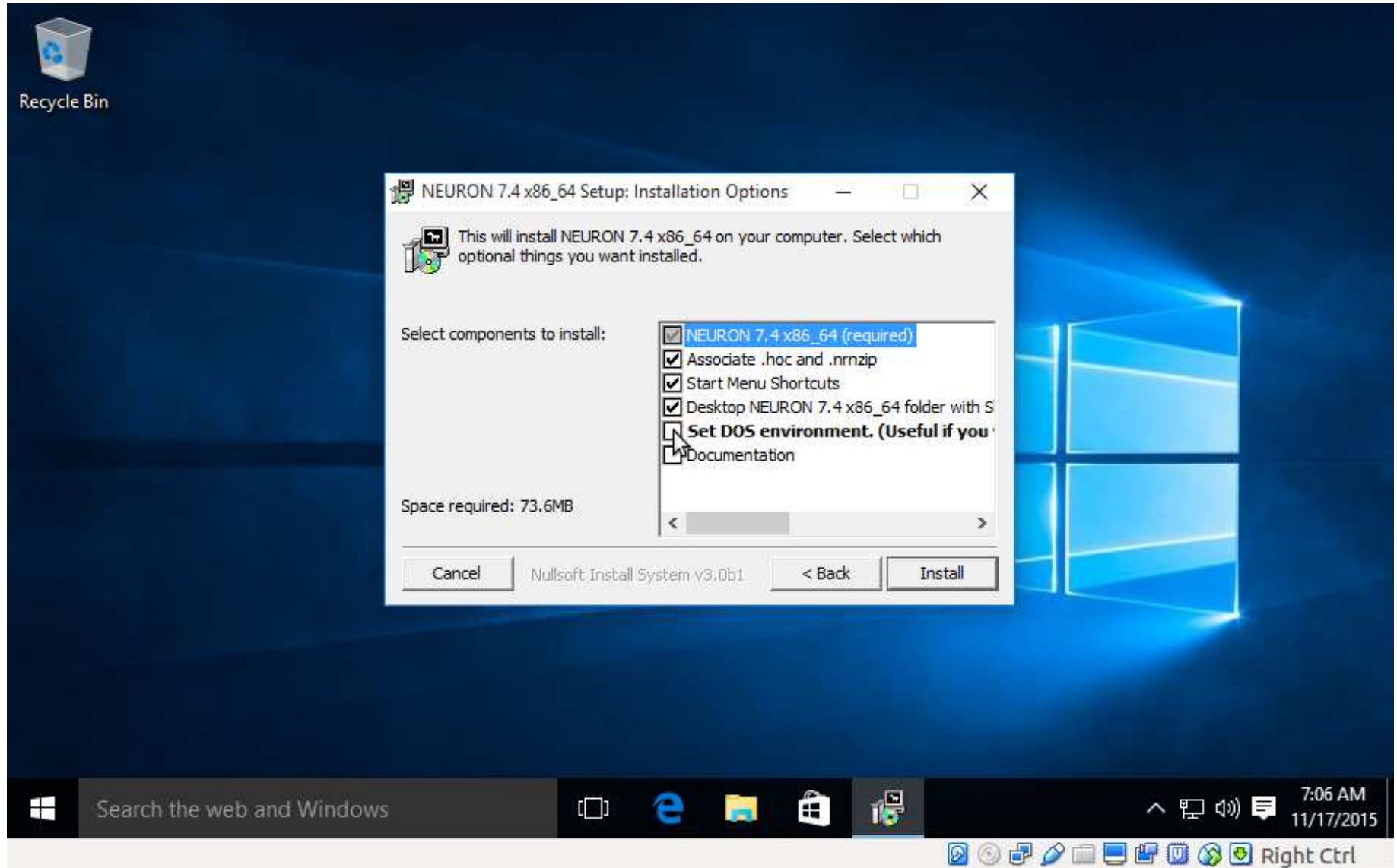
At the bottom of the browser window, a notification box is visible with the text "nrn-7.4.x86\_64-w64-mingw32-setup (1).exe finished downloading." and two buttons: "Run" and "View downloads". A mouse cursor is hovering over the "Run" button.

The Windows taskbar at the bottom shows the Start button, a search bar with the text "Search the web and Windows", and several application icons. The system tray on the right shows the time "7:03 AM" and the date "11/17/2015", along with icons for network, volume, and notifications. A "Right Ctrl" label is also present in the bottom right corner.

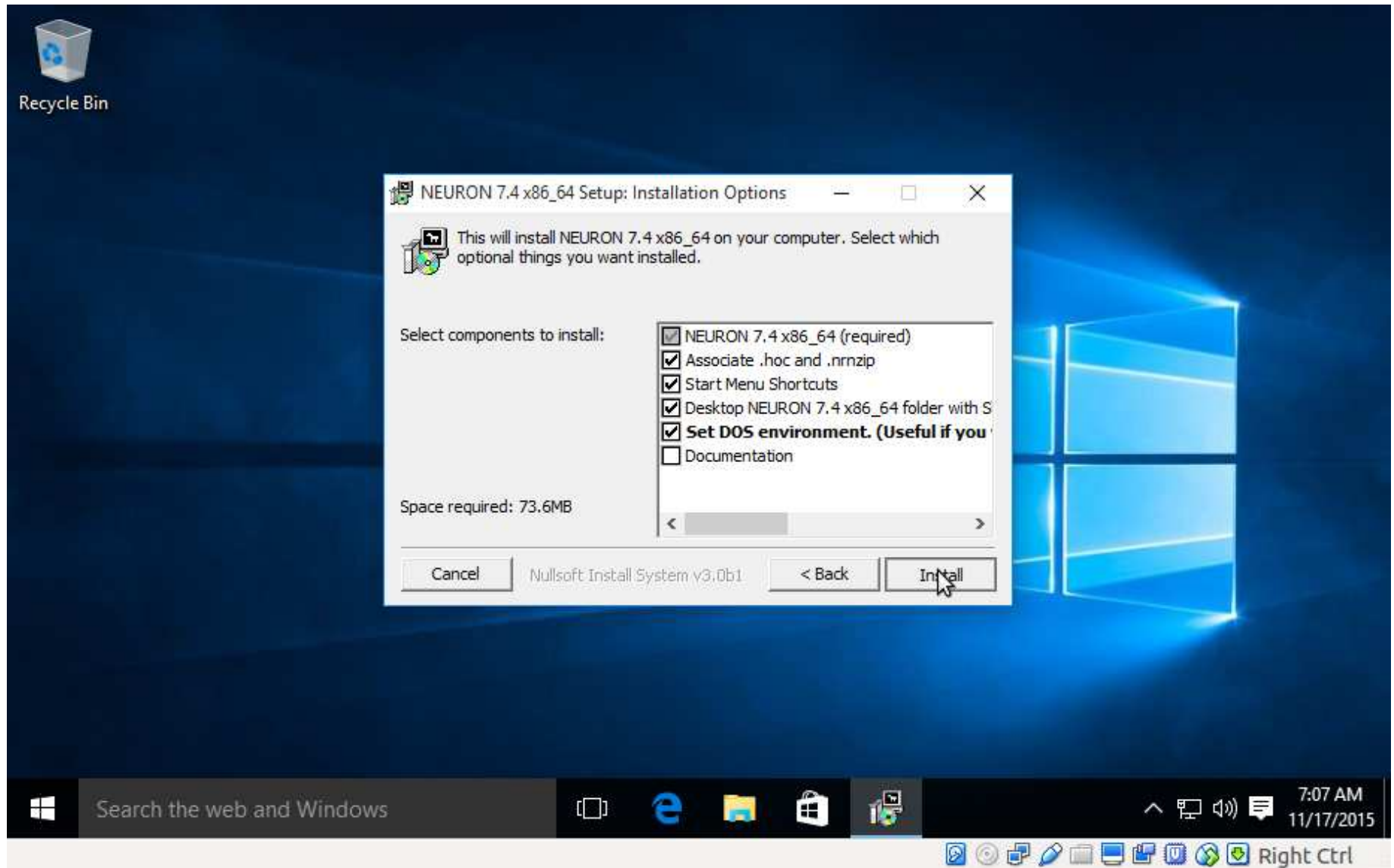
# Install into selected destination folder



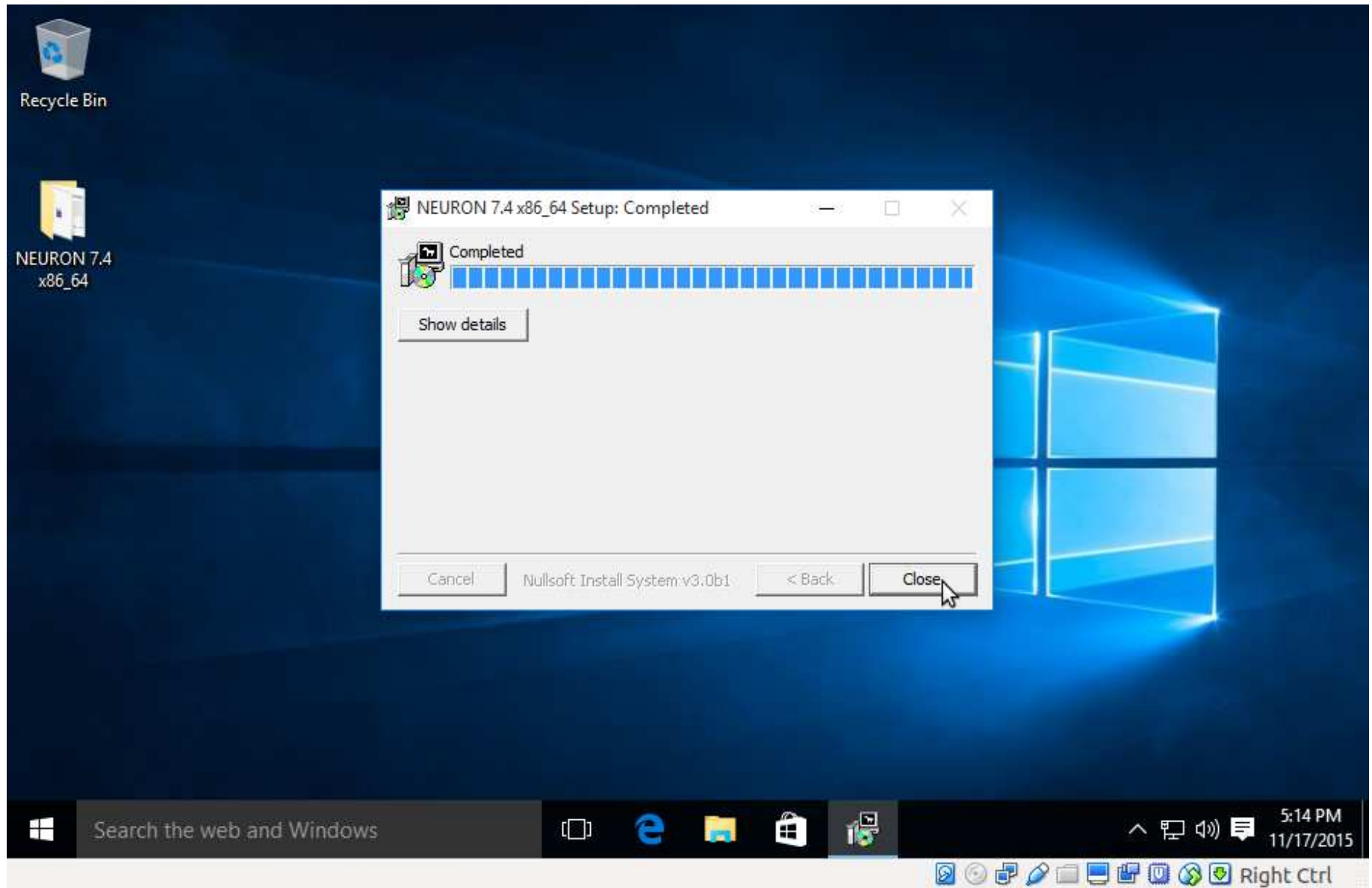
# Useful if launching IPython.



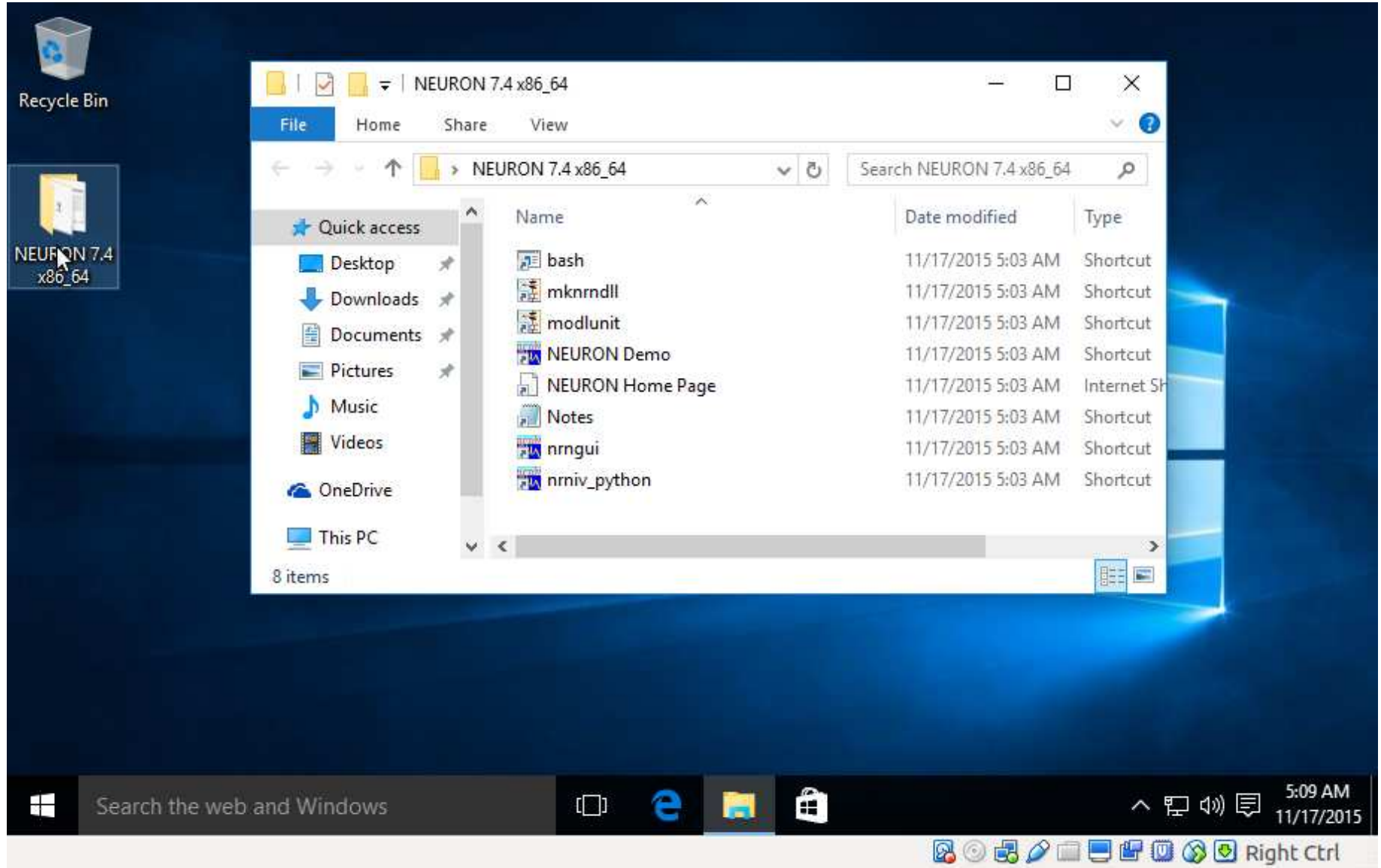
# Install NEURON



# NEURON installed



# Test by double clicking 'NEURON Demo'



# Selecting the 'Release' button starts a demo.

The screenshot displays the NEURON software interface on a Windows desktop. The desktop background is the standard Windows 7 blue theme. A taskbar at the bottom shows the Start button, search bar, and several application icons including Internet Explorer, File Explorer, and NEURON.

The main interface consists of several windows:

- NEURON Main Menu:** Located at the top left, it has a menu bar with 'File', 'Edit', 'Build', 'Tools', 'Graph', 'Vector', and 'Window'. Below the menu bar is an 'Iconify' button.
- NEU...:** A window titled 'NEU...' with 'Close' and 'Hide' buttons. It contains a list of demonstration options under the heading 'Choose one of the demonstrations':
  - Patch: HH
  - Stylized
  - Pyramidal
  - Release** (highlighted with a mouse cursor)
  - Synchronizing net (artificial cells)
  - LinearCircuit: Dynamic Clamp
  - Stochastic Single Channels: HH
  - No model
- Temp...:** A window titled 'Temp...' with 'Close' and 'Hide' buttons. It shows a temperature value of '16.3'.
- RunControl:** A window titled 'RunControl' with 'Close' and 'Hide' buttons. It contains several controls:
  - Init (mV):** A slider set to -65.
  - Init & Run:** A button.
  - Stop:** A button.
  - Continue til (ms):** A slider set to 5.
  - Continue for (ms):** A slider set to 1.
  - Single Step:** A button.
  - t (ms):** A text input field containing '0'.
  - Tstop (ms):** A slider set to 5.
  - dt (ms):** A slider set to 0.025.
- NEURON Demo:** A terminal window titled 'NEURON Demo' showing the following text:

```
NEURON -- Release 7.4 (1370:16a7055d4a86) 2
Duke, Yale, and the BlueBrain Project -- Co
See http://www.neuron.yale.edu/neuron/credi

loading membrane mechanisms from c:/nrn/dem
Additional mechanisms from files
  cabump.mod cachan1.mod camchan.mod capump
  han.mod mcna.mod nacaex.mod nachan.mod rele
oc>
```

The Windows taskbar at the bottom shows the search bar with the text 'Search the web and Windows', the system tray with the time '5:12 AM' and date '11/17/2015', and the 'Right Ctrl' button.

# 'Init&Run' button runs the simulation

The screenshot displays the NEURON software interface with several windows open. The 'RunControl' window is the central focus, showing the 'Init & Run' button being clicked by a mouse cursor. The 'Init (mV)' field is set to -65. Other parameters in the RunControl window include 'Continue til (ms)' at 5, 'Continue for (ms)' at 1, 'Single Step', 't (ms)' at 5, 'Tstop (ms)' at 5, and 'dt (ms)' at 0.025. The 'Ion Fluxes' window shows parameters for a pump model: kinetic pmp (mol/cm<sup>2</sup>) at 1e-013, beta at 100, kmp (uM) at 0.2, vmax (mA/cm<sup>2</sup>) at 0, pccbar (cm/s) at 2.5e-005, gnabar (mho/cm<sup>2</sup>) at 0.12, and gkbar (mho/cm<sup>2</sup>) at 0.036. The 'Synaptic release' window lists models like Patch: HH, Stylized, Pyramidal, and Release. The 'Graph[0]' window shows a plot of 'terminal.v( 0.5 )' with a peak around 1 ms. The 'Graph[1]' window shows a plot of 'ica\_3\_capump' (red), 'ica\_cachan' (green), and 'ica\_napax' (yellow) with peaks around 1-2 ms. The 'Graph[2]' window is partially visible at the bottom. The Windows taskbar at the bottom shows the search bar, system tray, and the time 5:14 AM on 11/17/2015.

# Exit by pressing 'NEURONMainMenu/File/Quit'

The screenshot displays the NEURON software interface with the 'NEURON Main Menu' window open. The 'File' menu is expanded, and the 'Quit' option is highlighted by the mouse cursor. Other visible windows include 'Ion Fluxes' with parameters like kinetic pmp (1e-013), beta (100), kmp (0.2), v<sub>max</sub> (0), p<sub>cbar</sub> (2.5e-005), g<sub>nbar</sub> (0.12), and g<sub>kbar</sub> (0.036); 'RunControl' with 'Init (mV)' set to -65 and 'dt (ms)' set to 0.025; and two graph windows. Graph[0] shows a plot of 'terminal.v( 0.5 )' with a peak around 1 ms. Graph[1] shows a plot of 'ica' components: 'ica\_nacax', 'ica\_mmp\_cadifpmp', 'ica\_3\_capump', and 'ica\_cachan' over time.

NEURON Main Menu

- Iconify
- File
- Edit
- Build
- Tools
- Graph
- Vector
- Window

load session  
load hoc  
load dll  
save session  
working dir  
recent dir  
Print  
Quit

Ion Fluxes

kinetic pmp (mol/cm<sup>2</sup>) 1e-013

beta 100

kmp (uM) 0.2

v<sub>max</sub> (mA/cm<sup>2</sup>) 0

p<sub>cbar</sub> (cm/s) 2.5e-005

g<sub>nbar</sub> (mho/cm<sup>2</sup>) 0.12

g<sub>kbar</sub> (mho/cm<sup>2</sup>) 0.036

RunControl

Init (mV) -65

Init & Run

Stop

Continue til (ms) 5

Continue for (ms) 1

Single Step

t (ms) 5

Tstop (ms) 5

dt (ms) 0.025

Graph[0] x -0.5 : 5.5 y -92 : 52

terminal.v( 0.5 )

Graph[1] x -0.5 : 5.5 y -0.046 : ...

ica

- ica\_nacax
- ica\_mmp\_cadifpmp
- ica\_3\_capump
- ica\_cachan

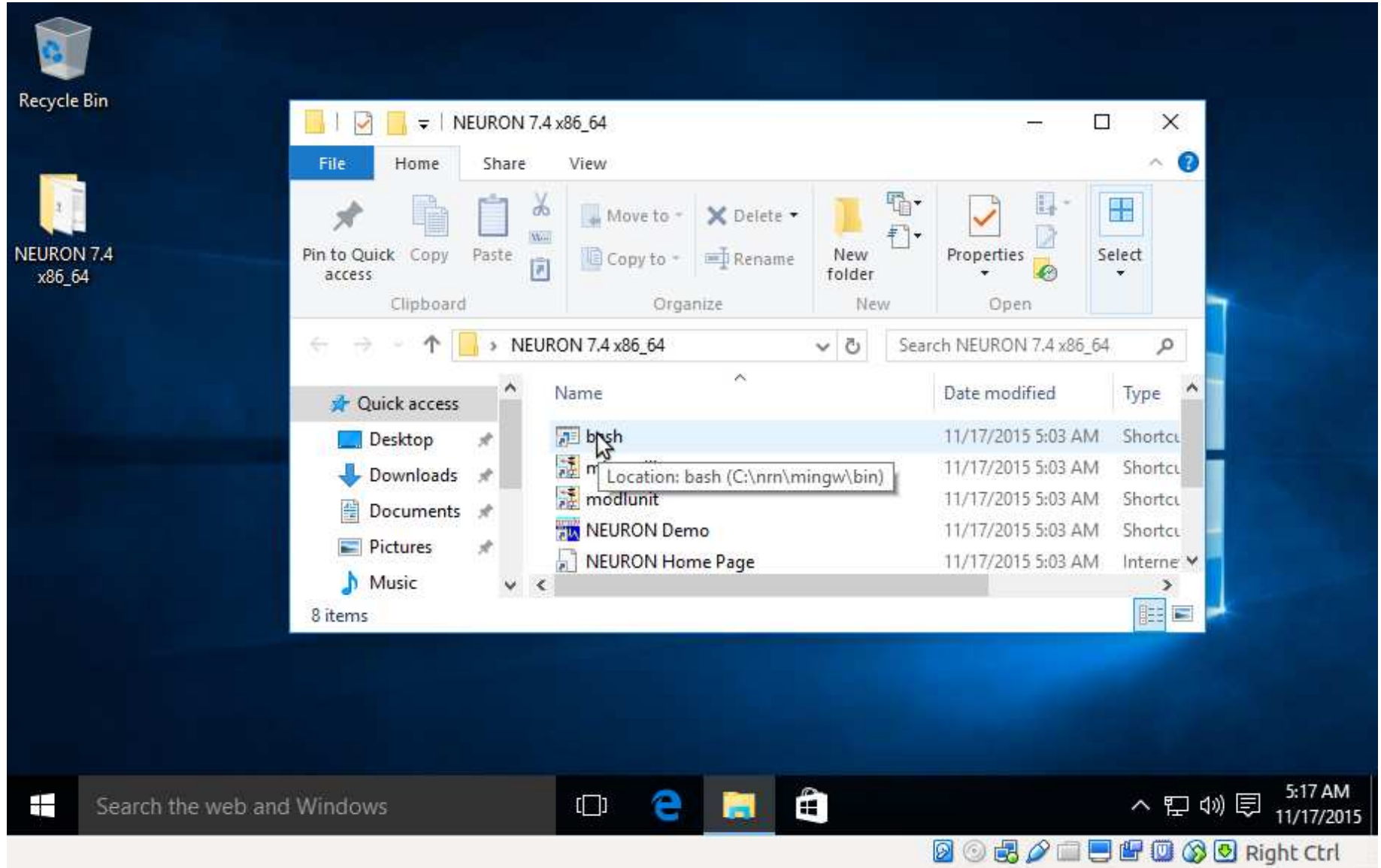
Graph[2] x -0.5 : 5.5 y -0.05 : 0...

Search the web and Windows

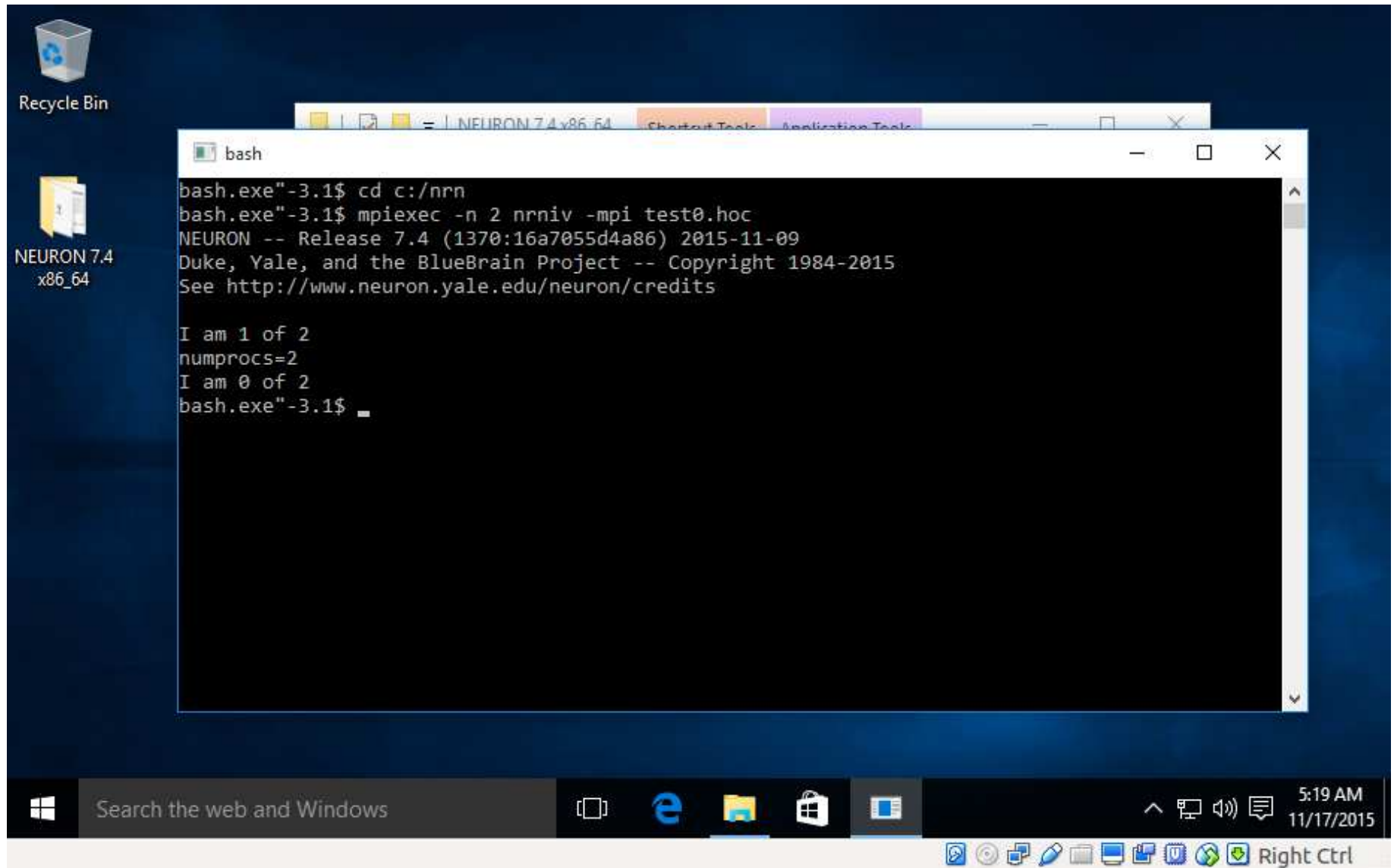
5:15 AM 11/17/2015

Right Ctrl

# Test MPI by starting the bash terminal



# MPI works? `mpiexec -n 2 nrniv -mpi test0.hoc`



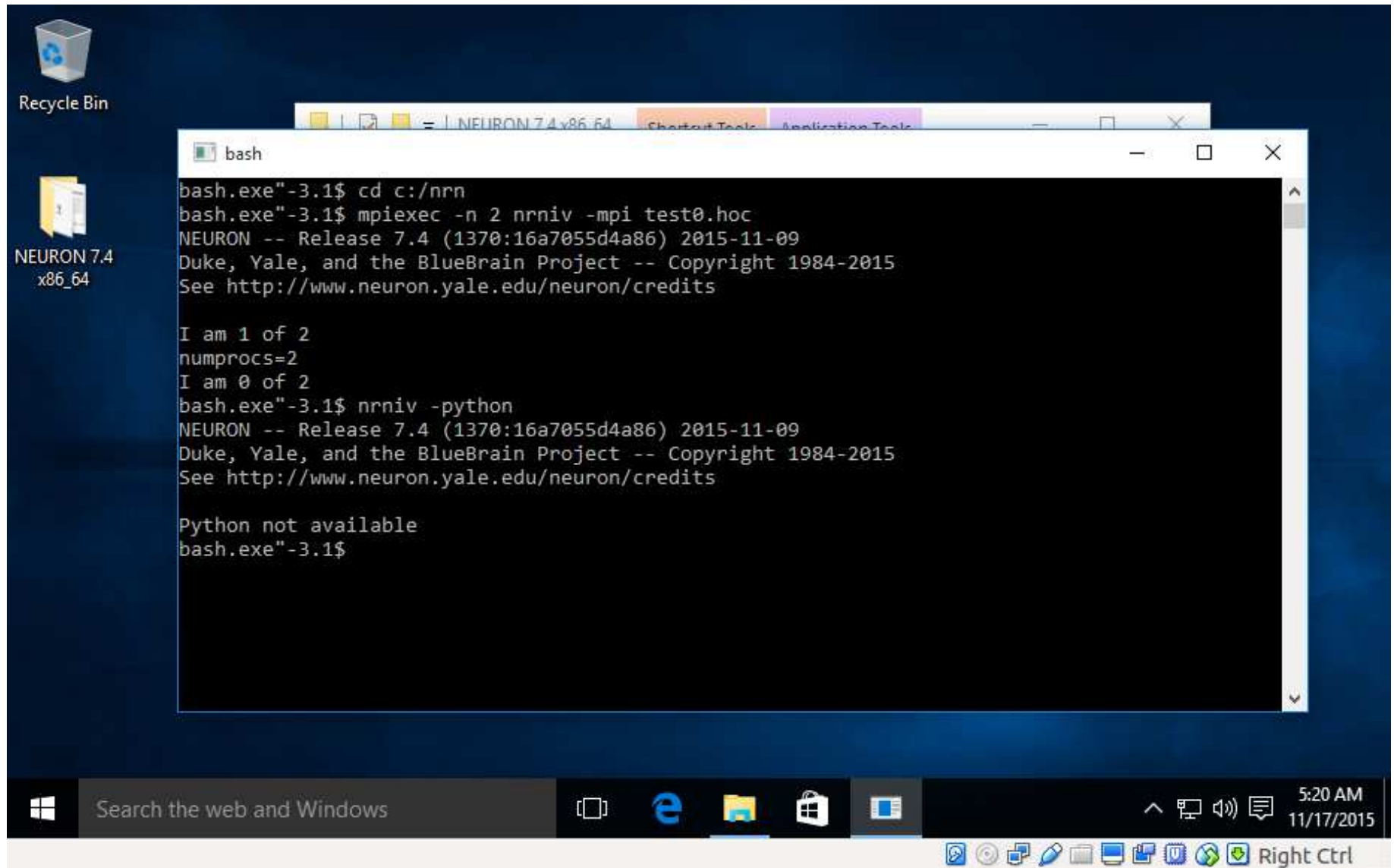
The screenshot shows a Windows desktop with a dark blue background. On the left side, there is a Recycle Bin icon and a folder icon labeled "NEURON 7.4 x86\_64". In the center, a terminal window titled "bash" is open, displaying the following text:

```
bash.exe"-3.1$ cd c:/nrn
bash.exe"-3.1$ mpiexec -n 2 nrniv -mpi test0.hoc
NEURON -- Release 7.4 (1370:16a7055d4a86) 2015-11-09
Duke, Yale, and the BlueBrain Project -- Copyright 1984-2015
See http://www.neuron.yale.edu/neuron/credits

I am 1 of 2
numprocs=2
I am 0 of 2
bash.exe"-3.1$ _
```

The taskbar at the bottom of the screen includes the Windows logo, a search bar with the text "Search the web and Windows", and several application icons. The system tray on the right shows the time "5:19 AM" and the date "11/17/2015", along with icons for network, volume, and notifications. A "Right Ctrl" button is visible in the bottom right corner.

# ... but Python not yet installed.



The screenshot shows a Windows desktop environment. In the background, there is a Recycle Bin icon and a folder named 'NEURON 7.4 x86\_64'. In the foreground, a terminal window titled 'bash' is open. The terminal displays the following text:

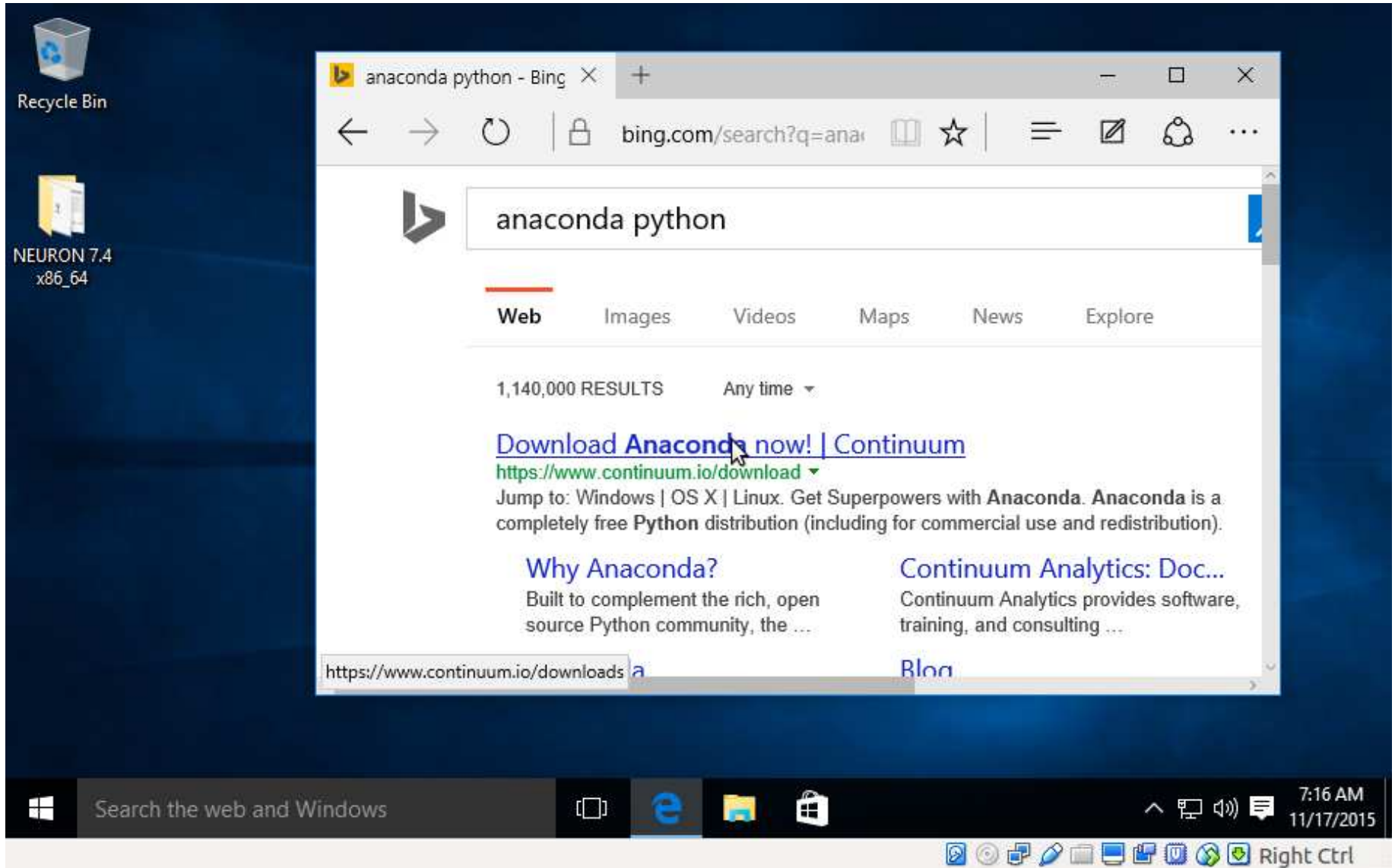
```
bash.exe"-3.1$ cd c:/nrn
bash.exe"-3.1$ mpiexec -n 2 nrniv -mpi test0.hoc
NEURON -- Release 7.4 (1370:16a7055d4a86) 2015-11-09
Duke, Yale, and the BlueBrain Project -- Copyright 1984-2015
See http://www.neuron.yale.edu/neuron/credits

I am 1 of 2
numprocs=2
I am 0 of 2
bash.exe"-3.1$ nrniv -python
NEURON -- Release 7.4 (1370:16a7055d4a86) 2015-11-09
Duke, Yale, and the BlueBrain Project -- Copyright 1984-2015
See http://www.neuron.yale.edu/neuron/credits

Python not available
bash.exe"-3.1$
```

The Windows taskbar at the bottom shows the Start button, a search bar with the text 'Search the web and Windows', and several application icons. The system tray on the right indicates the time is 5:20 AM on 11/17/2015.

# Anaconda is one of several excellent distributions.



The image shows a Windows desktop environment with a dark blue background. On the left side, there are icons for the Recycle Bin and a folder named 'NEURON 7.4 x86\_64'. A web browser window is open, displaying a Bing search for 'anaconda python'. The search results show 1,140,000 results. The top result is a link to 'Download Anaconda now! | Continuum' with the URL 'https://www.continuum.io/download'. Below this, there are two columns of text: 'Why Anaconda?' and 'Continuum Analytics: Doc...'. The Windows taskbar is visible at the bottom, showing the Start button, a search bar, and several application icons. The system tray on the right shows the time as 7:16 AM on 11/17/2015 and the 'Right Ctrl' key indicator.

anaconda python - Bing

bing.com/search?q=anaconda python

anaconda python

Web Images Videos Maps News Explore

1,140,000 RESULTS Any time

[Download Anaconda now! | Continuum](https://www.continuum.io/download)  
<https://www.continuum.io/download>

Jump to: Windows | OS X | Linux. Get Superpowers with **Anaconda**. **Anaconda** is a completely free **Python** distribution (including for commercial use and redistribution).

**Why Anaconda?**  
Built to complement the rich, open source Python community, the ...

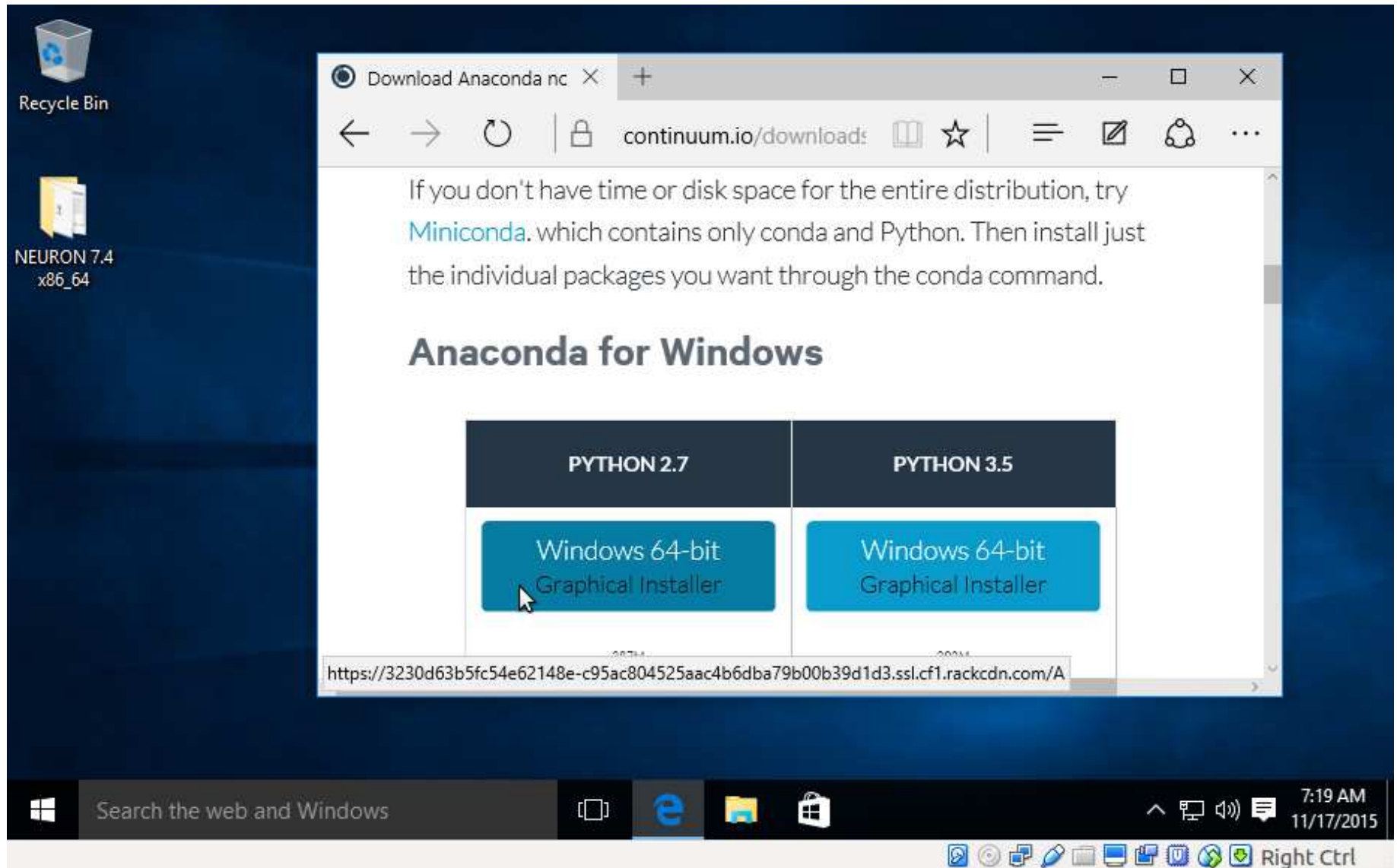
**Continuum Analytics: Doc...**  
Continuum Analytics provides software, training, and consulting ...

<https://www.continuum.io/downloads>

7:16 AM 11/17/2015

Right Ctrl

# NEURON assumes Python 2.7



Download Anaconda nc × +

continuum.io/download/

If you don't have time or disk space for the entire distribution, try [Miniconda](#), which contains only conda and Python. Then install just the individual packages you want through the conda command.

## Anaconda for Windows

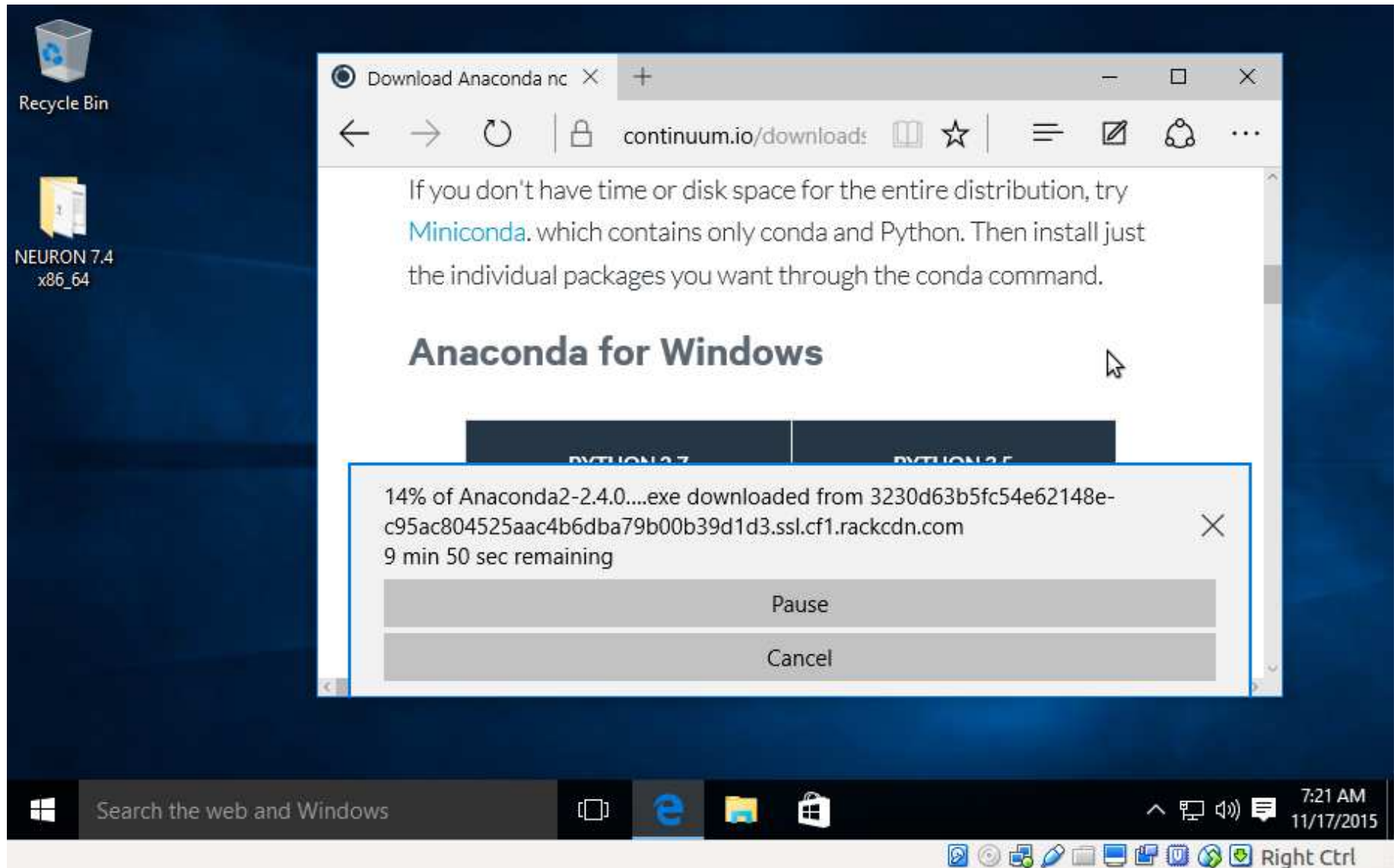
PYTHON 2.7	PYTHON 3.5
Windows 64-bit Graphical Installer	Windows 64-bit Graphical Installer

<https://3230d63b5fc54e62148e-c95ac804525aac4b6dba79b00b39d1d3.ssl.cf1.rackcdn.com/A>

7:19 AM 11/17/2015

Right Ctrl

# It is a large distribution



The screenshot shows a Windows desktop environment. In the background, there is a dark blue desktop with icons for the Recycle Bin and a folder named 'NEURON 7.4 x86\_64'. A web browser window is open, displaying the 'Download Anaconda' page from 'continuum.io'. The page content includes a paragraph: 'If you don't have time or disk space for the entire distribution, try [Miniconda](#). which contains only conda and Python. Then install just the individual packages you want through the conda command.' Below this is the heading 'Anaconda for Windows' and two buttons for 'PYTHON 2.7' and 'PYTHON 3.5'. A download progress dialog box is overlaid on the browser, showing '14% of Anaconda2-2.4.0....exe downloaded from 3230d63b5fc54e62148e-c95ac804525aac4b6dba79b00b39d1d3.ssl.cf1.rackcdn.com' with '9 min 50 sec remaining'. The dialog box has 'Pause' and 'Cancel' buttons. The Windows taskbar at the bottom shows the Start button, search bar, and several application icons. The system tray on the right shows the time '7:21 AM 11/17/2015' and a 'Right Ctrl' notification.

Download Anaconda nc

continuum.io/download/

If you don't have time or disk space for the entire distribution, try [Miniconda](#). which contains only conda and Python. Then install just the individual packages you want through the conda command.

## Anaconda for Windows

14% of Anaconda2-2.4.0....exe downloaded from 3230d63b5fc54e62148e-c95ac804525aac4b6dba79b00b39d1d3.ssl.cf1.rackcdn.com  
9 min 50 sec remaining

Pause

Cancel

7:21 AM 11/17/2015

Right Ctrl

# Run.. No need to View

The screenshot shows a Windows desktop environment. In the background, there is a dark blue desktop with icons for 'Recycle Bin' and 'NEURON 7.4 x86\_64'. A web browser window is open, displaying the 'Download Anaconda' page from 'continuum.io'. The page content includes a paragraph about 'Miniconda' and a section titled 'Anaconda for Windows' with two columns for 'PYTHON 2.7' and 'PYTHON 3.5', each containing a 'Windows 64-bit Graphical Installer' button. In the foreground, a download notification box is visible, stating 'Anaconda2-2.4.0-Windows-x86\_64.exe finished downloading.' and featuring 'Run' and 'View downloads' buttons. The Windows taskbar at the bottom shows the search bar, task view, and several application icons, along with the system tray displaying the time '7:37 AM' and date '11/17/2015'.

Download Anaconda nc × +

← → ↻ | 🔒 continuum.io/download: 📖 ☆ | ☰ ✍️ 🔔 ⋮

If you don't have time or disk space for the entire distribution, try [Miniconda](#), which contains only conda and Python. Then install just the individual packages you want through the conda command.

## Anaconda for Windows

PYTHON 2.7	PYTHON 3.5
Windows 64-bit Graphical Installer	Windows 64-bit Graphical Installer

Anaconda2-2.4.0-Windows-x86\_64.exe finished downloading. Run View downloads ×

Search the web and Windows

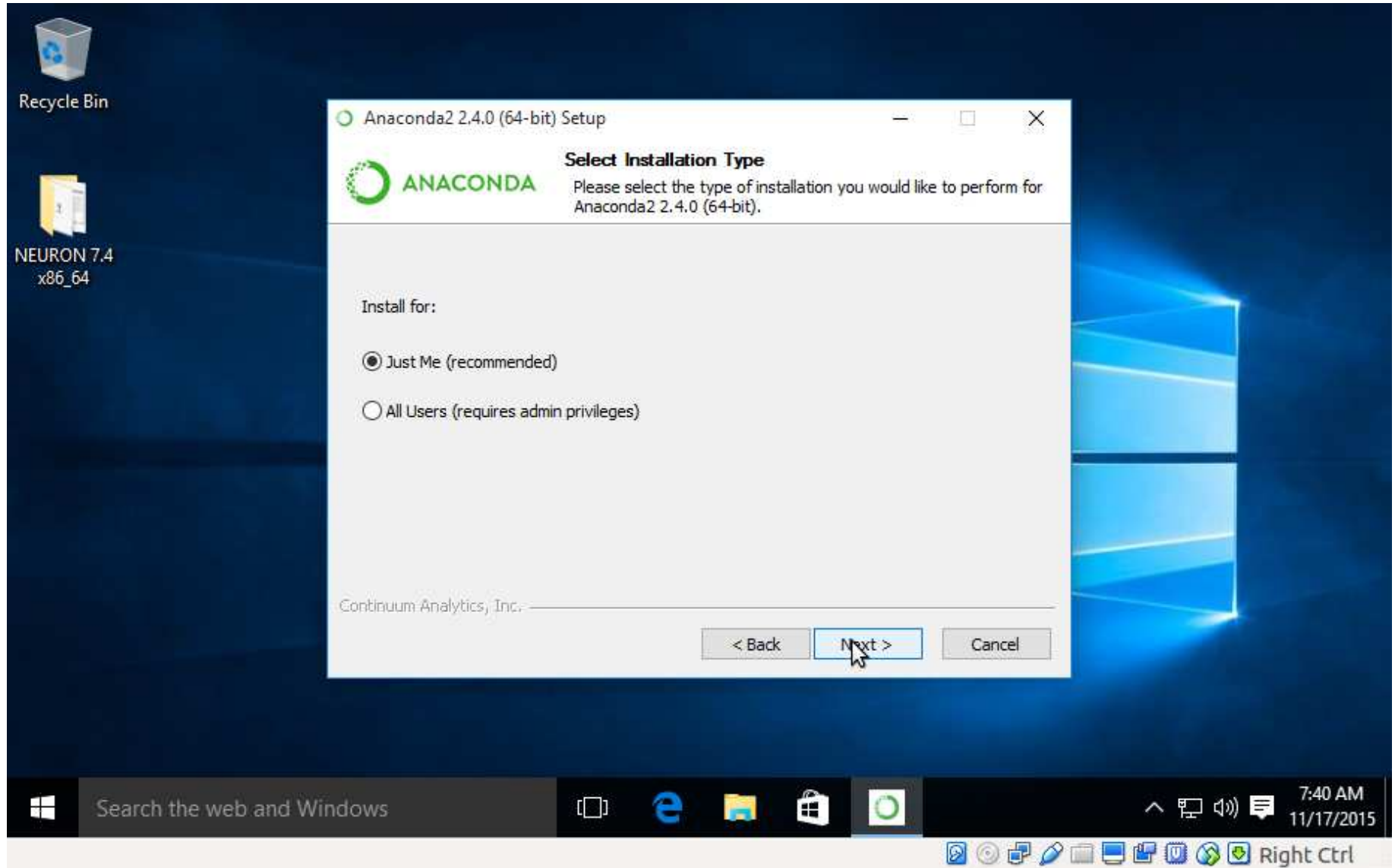
7:37 AM 11/17/2015

Right Ctrl

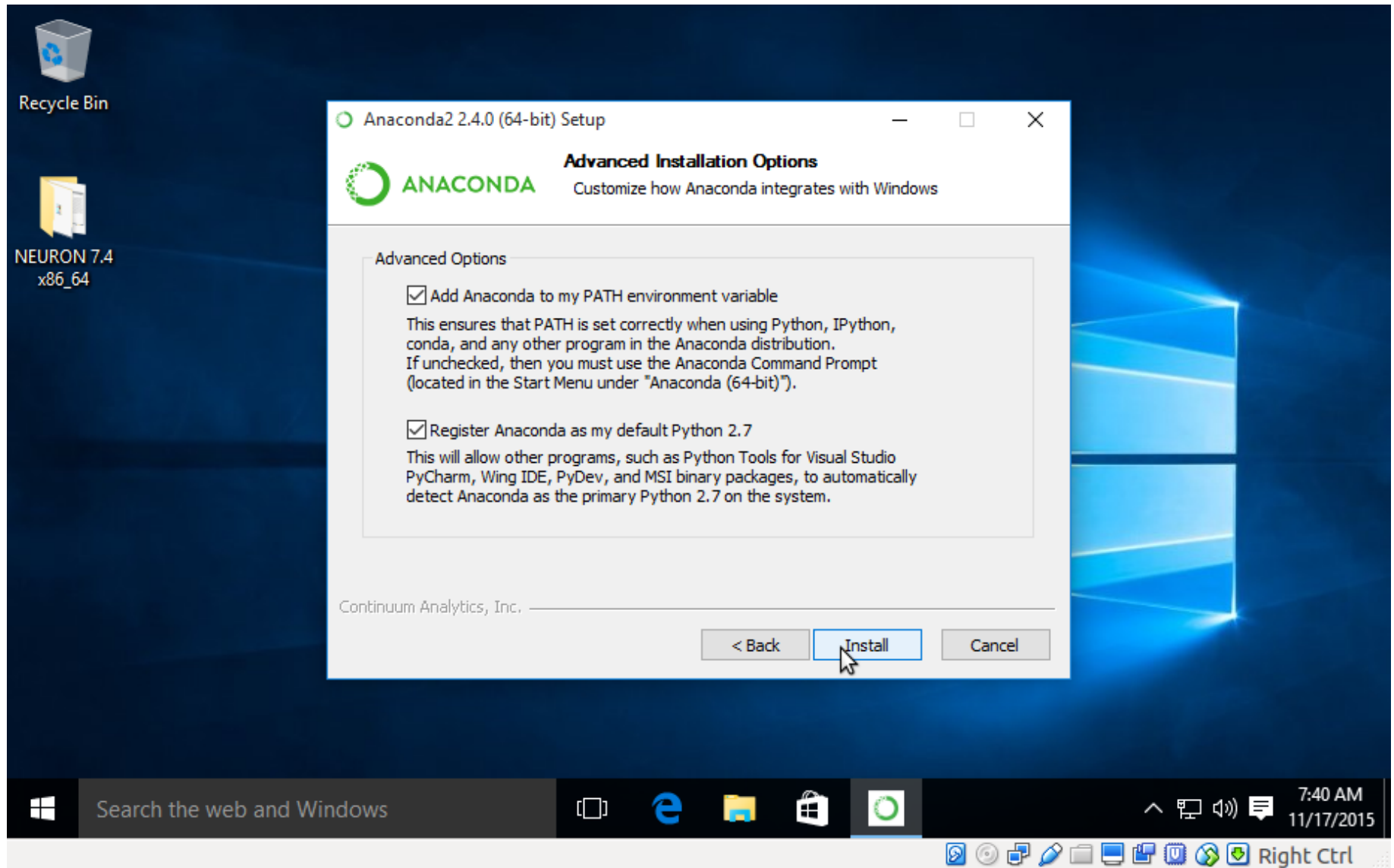
# Looks good. Select 'Next'



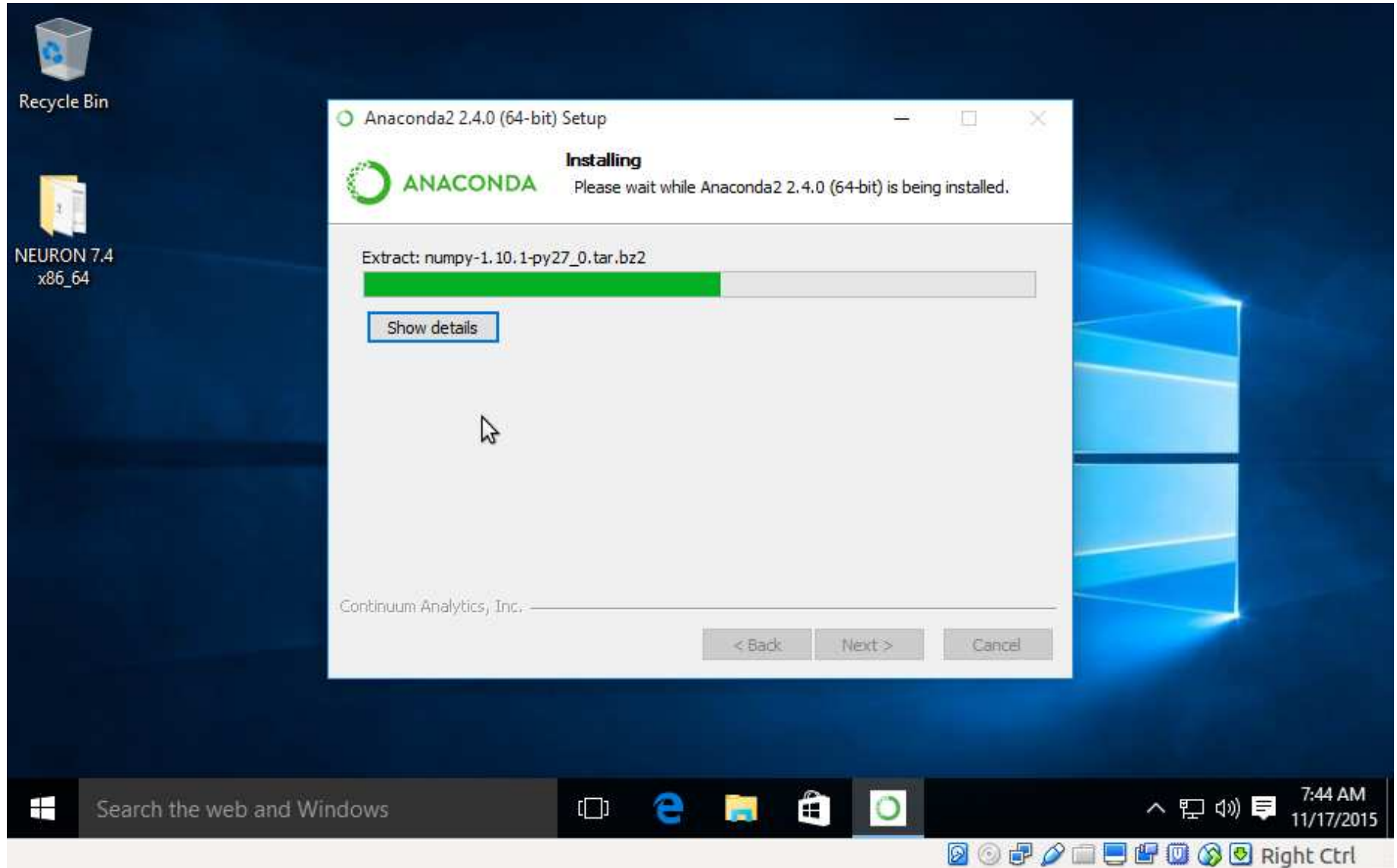
# 'Just me' is fine



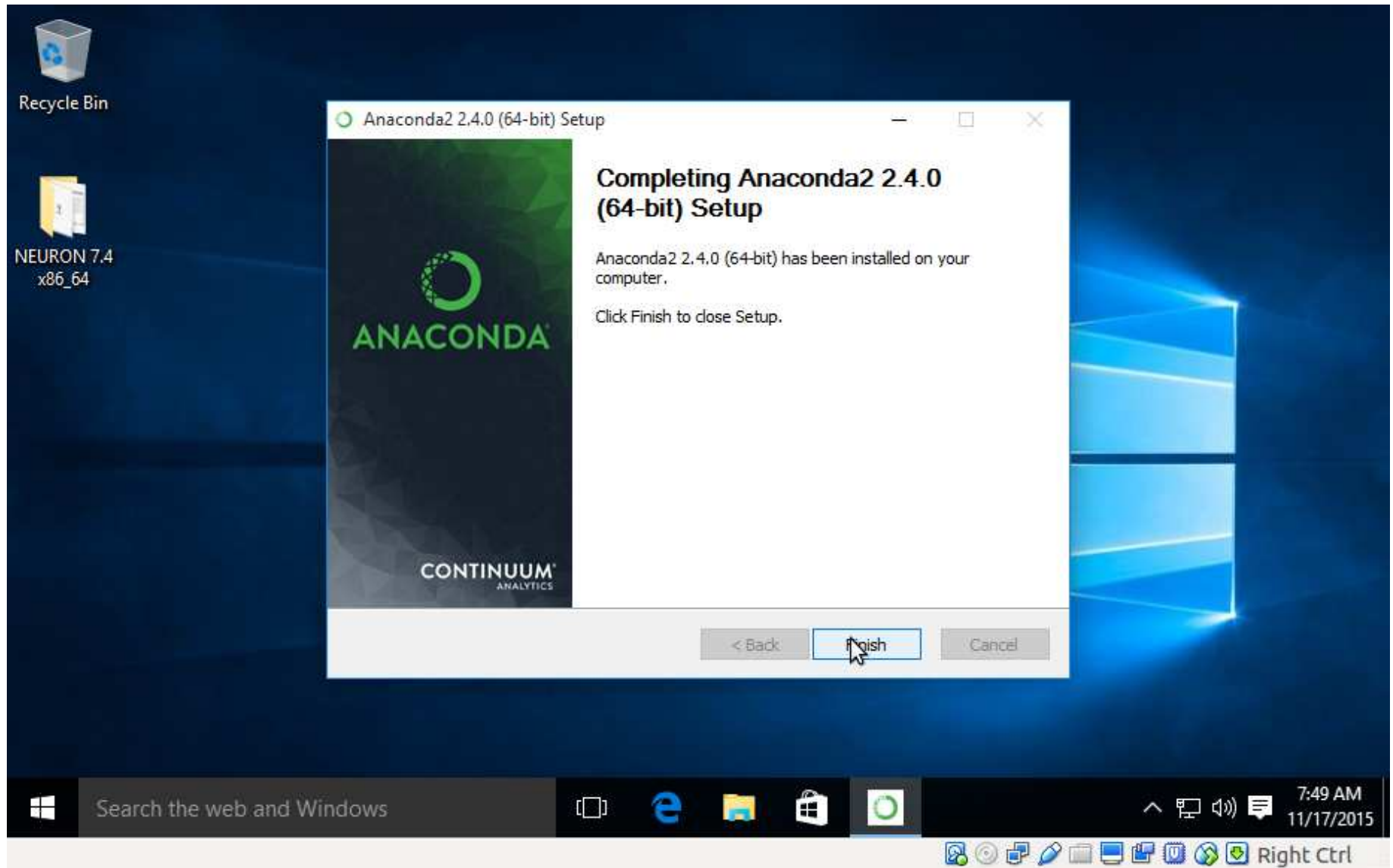
# I accepted the defaults.



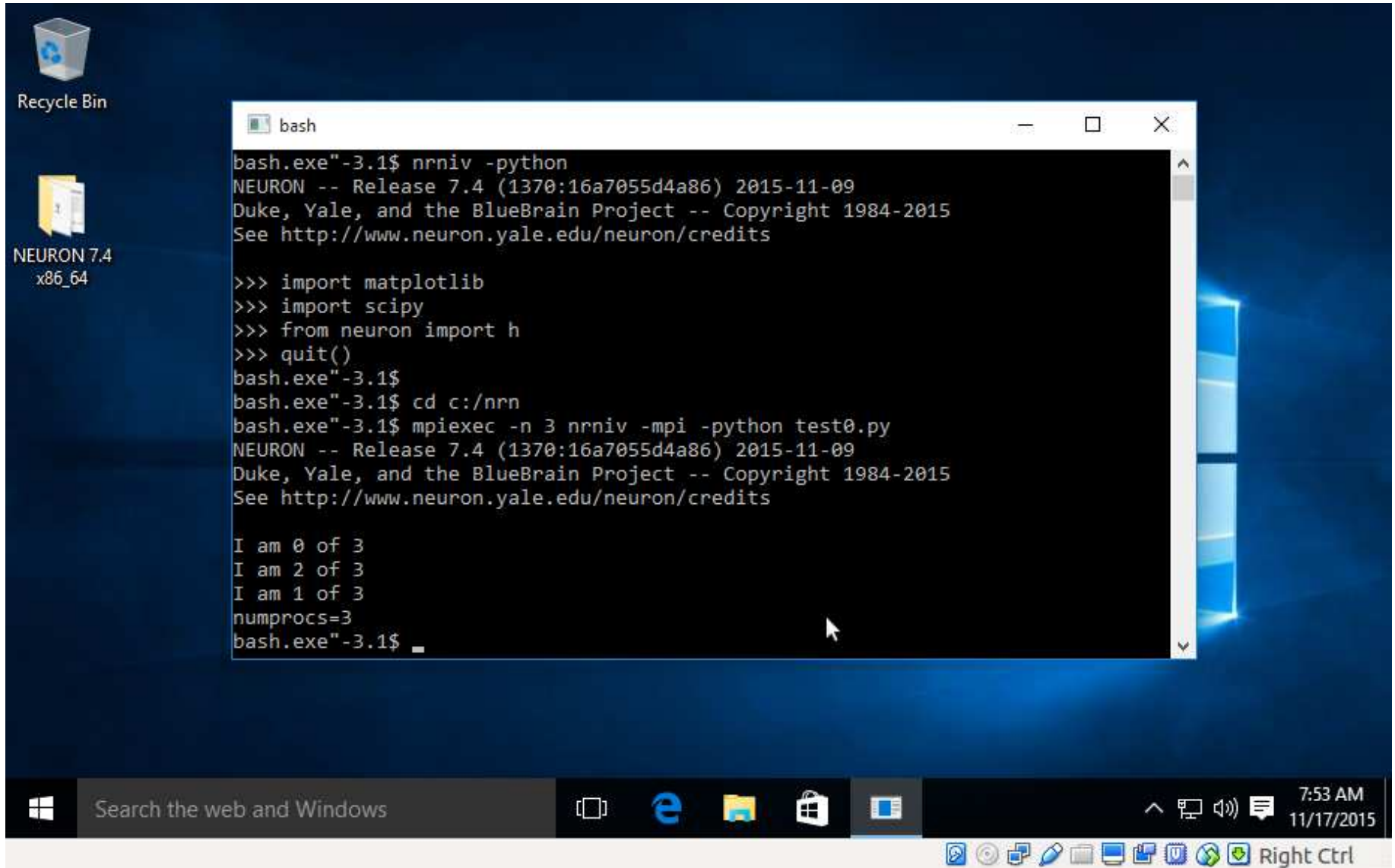
# Takes a fair amount of time to install...



# Anaconda installed



# NEURON works with Python and MPI



The screenshot shows a Windows desktop with a dark blue background. On the left side, there is a Recycle Bin icon and a folder icon labeled "NEURON 7.4 x86\_64". In the center, a terminal window titled "bash" is open, displaying the following text:

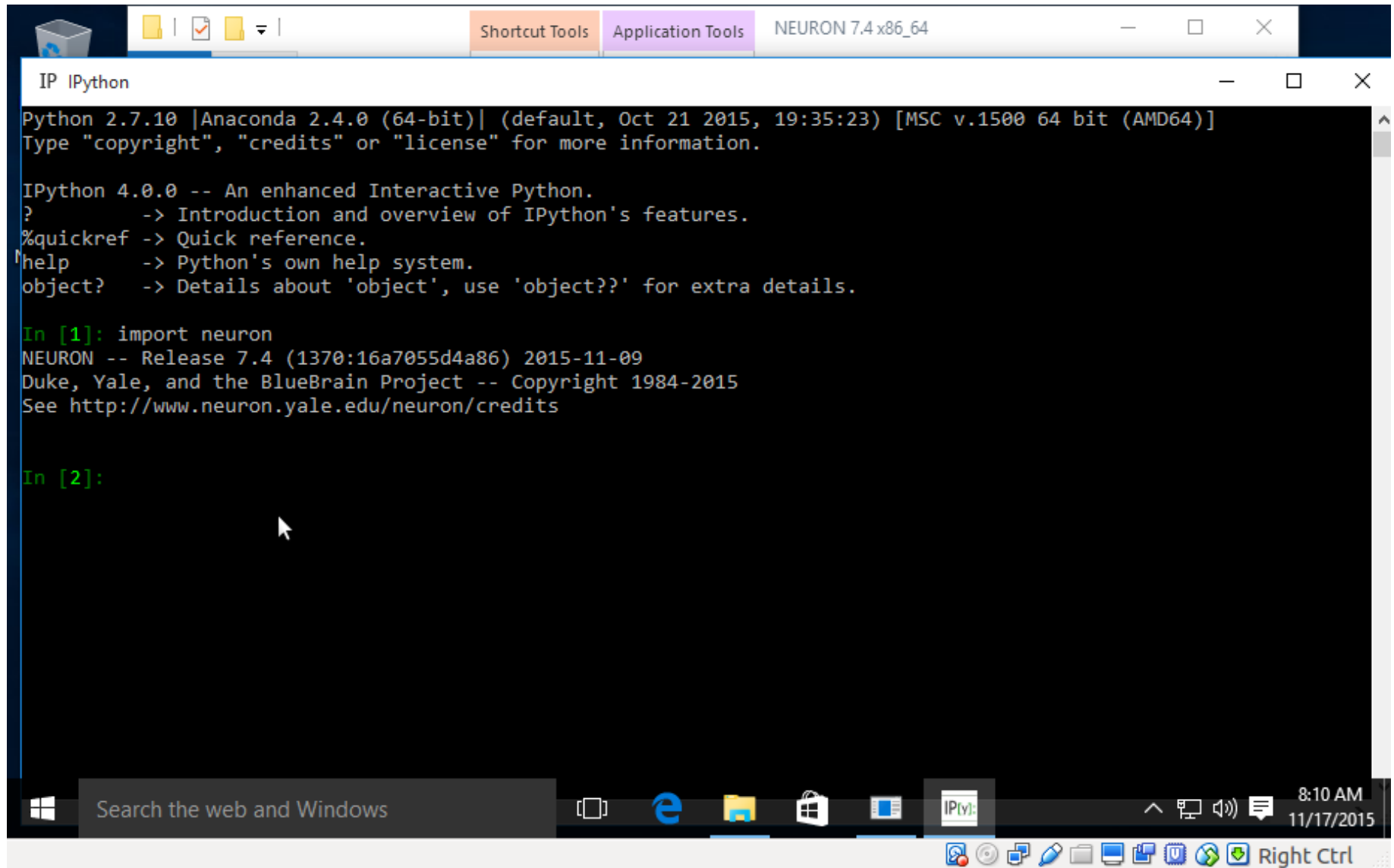
```
bash.exe"-3.1$ nrniv -python
NEURON -- Release 7.4 (1370:16a7055d4a86) 2015-11-09
Duke, Yale, and the BlueBrain Project -- Copyright 1984-2015
See http://www.neuron.yale.edu/neuron/credits

>>> import matplotlib
>>> import scipy
>>> from neuron import h
>>> quit()
bash.exe"-3.1$
bash.exe"-3.1$ cd c:/nrn
bash.exe"-3.1$ mpiexec -n 3 nrniv -mpi -python test0.py
NEURON -- Release 7.4 (1370:16a7055d4a86) 2015-11-09
Duke, Yale, and the BlueBrain Project -- Copyright 1984-2015
See http://www.neuron.yale.edu/neuron/credits

I am 0 of 3
I am 2 of 3
I am 1 of 3
numprocs=3
bash.exe"-3.1$
```

The taskbar at the bottom of the screen shows the Windows logo, a search bar with the text "Search the web and Windows", and several application icons including Internet Explorer, File Explorer, and a calendar. The system tray on the right shows the time "7:53 AM" and the date "11/17/2015", along with icons for network, volume, and notifications. A "Right Ctrl" button is visible in the bottom right corner.

# IPython can import neuron ...but..



The screenshot shows a Windows desktop environment with an IPython terminal window open. The window title is "IP IPython" and it is part of a "NEURON 7.4 x86\_64" application. The terminal output shows the IPython version (4.0.0) and the successful import of the neuron package (version 7.4). The terminal text is as follows:

```
Python 2.7.10 [Anaconda 2.4.0 (64-bit)] (default, Oct 21 2015, 19:35:23) [MSC v.1500 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

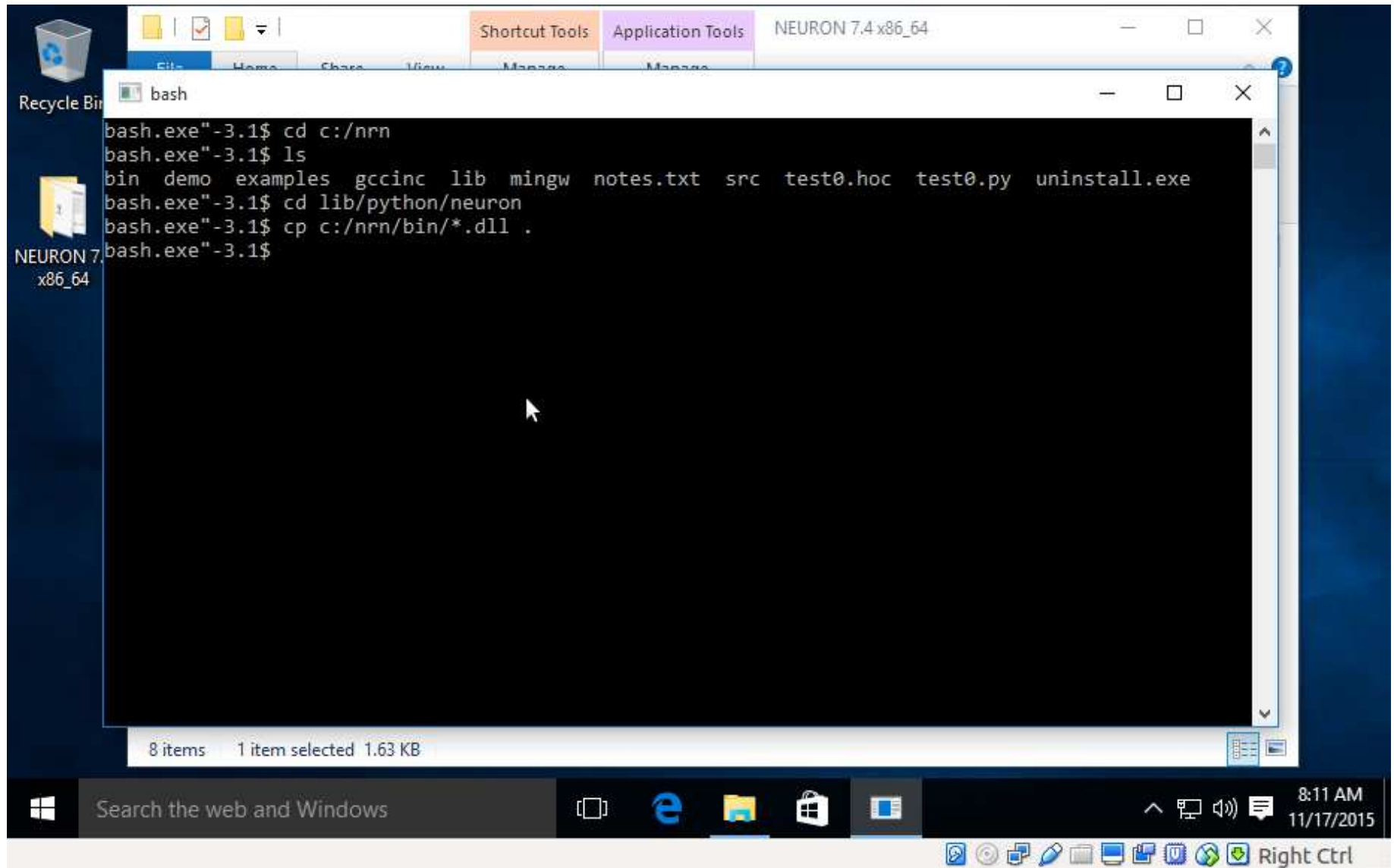
IPython 4.0.0 -- An enhanced Interactive Python.
?          -> Introduction and overview of IPython's features.
%quickref  -> Quick reference.
help       -> Python's own help system.
object?    -> Details about 'object', use 'object??' for extra details.

In [1]: import neuron
NEURON -- Release 7.4 (1370:16a7055d4a86) 2015-11-09
Duke, Yale, and the BlueBrain Project -- Copyright 1984-2015
See http://www.neuron.yale.edu/neuron/credits

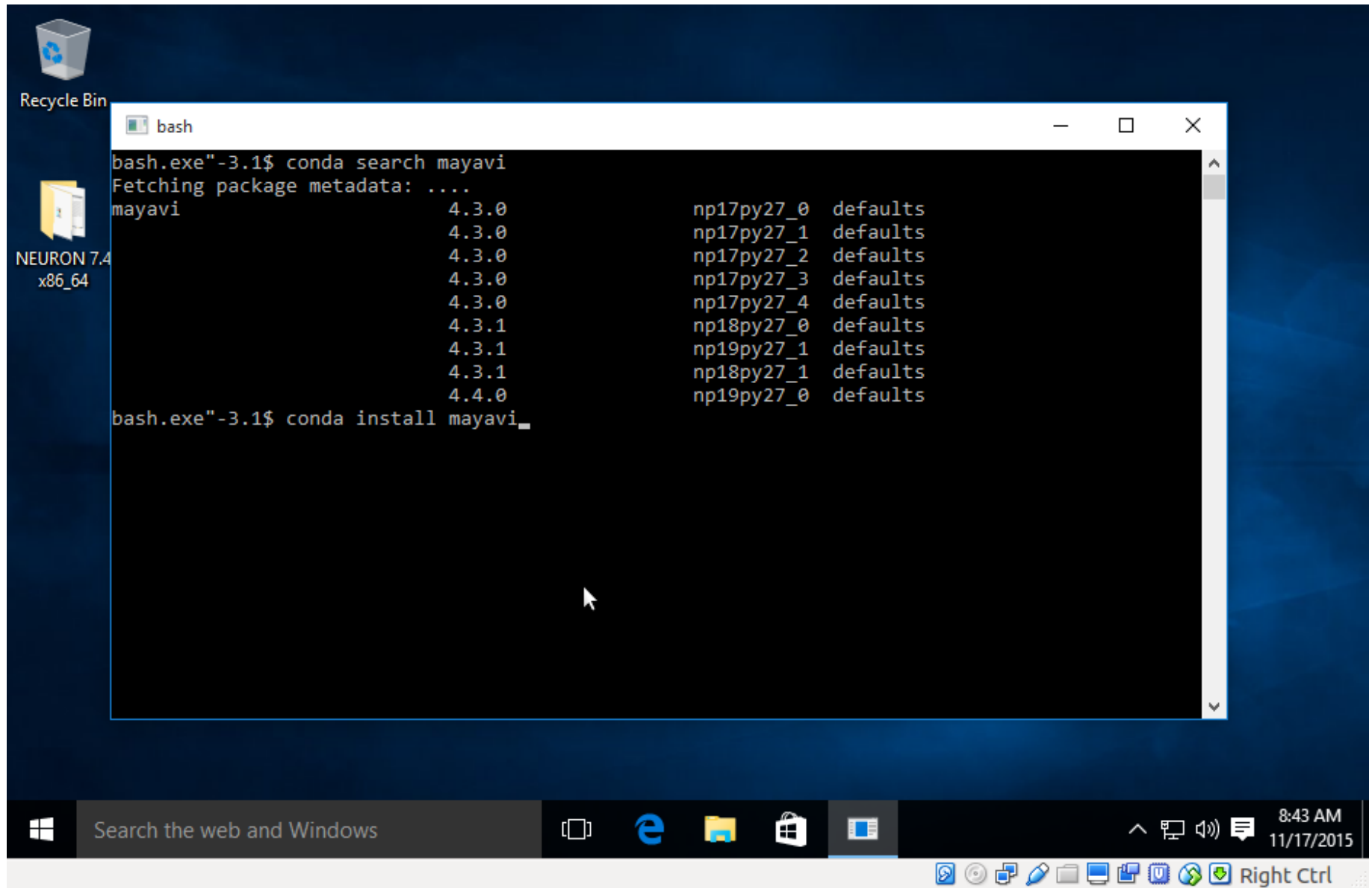
In [2]:
```

The Windows taskbar at the bottom shows the search bar, taskbar icons for Edge, File Explorer, and IPython, and the system tray with the time 8:10 AM and date 11/17/2015.

**you might first need to copy all the dlls.**



# Conda can install many other packages.



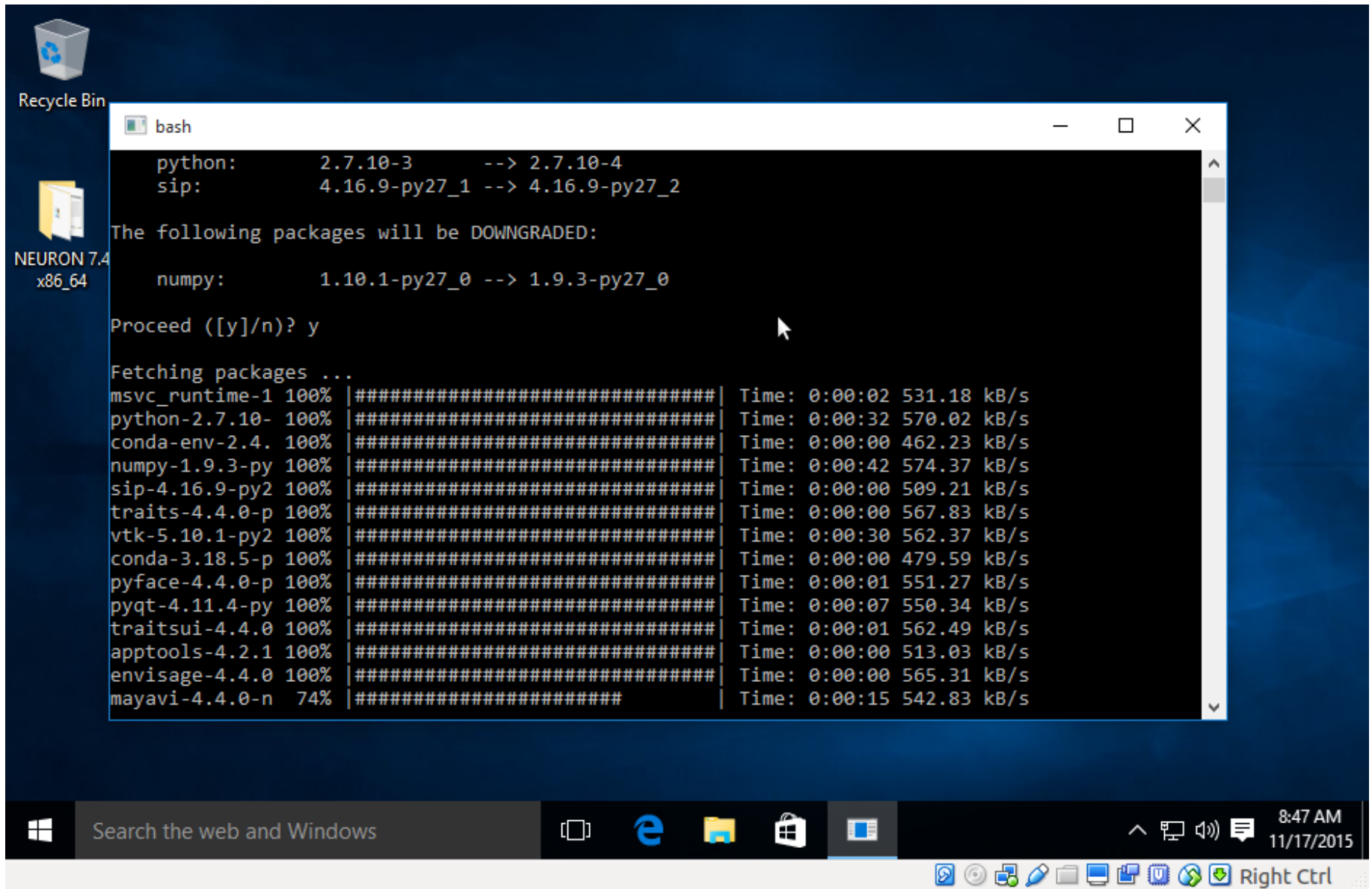
The screenshot shows a Windows desktop with a dark blue background. On the left side, there is a Recycle Bin icon and a folder icon labeled "NEURON 7.4 x86\_64". In the center, a terminal window titled "bash" is open, displaying the following text:

```
bash.exe"-3.1$ conda search mayavi
Fetching package metadata: ....
mayavi
4.3.0 np17py27_0 defaults
4.3.0 np17py27_1 defaults
4.3.0 np17py27_2 defaults
4.3.0 np17py27_3 defaults
4.3.0 np17py27_4 defaults
4.3.1 np18py27_0 defaults
4.3.1 np19py27_1 defaults
4.3.1 np18py27_1 defaults
4.4.0 np19py27_0 defaults

bash.exe"-3.1$ conda install mayavi_
```

The Windows taskbar is visible at the bottom, showing the Start button, a search bar with the text "Search the web and Windows", and several application icons including Internet Explorer, File Explorer, and a terminal window. The system tray on the right shows the time "8:43 AM" and date "11/17/2015", along with various system icons and a "Right Ctrl" button.

# Mayavi is useful for 3-D graphics.



```
python:      2.7.10-3      --> 2.7.10-4
sip:        4.16.9-py27_1  --> 4.16.9-py27_2

The following packages will be DOWNGRADED:

numpy:      1.10.1-py27_0  --> 1.9.3-py27_0

Proceed ([y]/n)? y

Fetching packages ...
msvc_runtime-1 100% |#####| Time: 0:00:02 531.18 kB/s
python-2.7.10- 100% |#####| Time: 0:00:32 570.02 kB/s
conda-env-2.4. 100% |#####| Time: 0:00:00 462.23 kB/s
numpy-1.9.3-py 100% |#####| Time: 0:00:42 574.37 kB/s
sip-4.16.9-py2 100% |#####| Time: 0:00:00 509.21 kB/s
traits-4.4.0-p 100% |#####| Time: 0:00:00 567.83 kB/s
vtk-5.10.1-py2 100% |#####| Time: 0:00:30 562.37 kB/s
conda-3.18.5-p 100% |#####| Time: 0:00:00 479.59 kB/s
pyface-4.4.0-p 100% |#####| Time: 0:00:01 551.27 kB/s
pyqt-4.11.4-py 100% |#####| Time: 0:00:07 550.34 kB/s
traitsui-4.4.0 100% |#####| Time: 0:00:01 562.49 kB/s
apptools-4.2.1 100% |#####| Time: 0:00:00 513.03 kB/s
envisage-4.4.0 100% |#####| Time: 0:00:00 565.31 kB/s
mayavi-4.4.0-n 74%  |#####| Time: 0:00:15 542.83 kB/s
```

from mayavi ... ; barchart(density)

