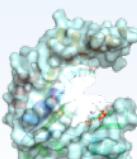


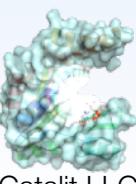


WELCOME



# LOGISTICS

- doors
- water
- restrooms
- breaks and lunch
- theory / practice ratio
- computer setup
- wifi
- skill level



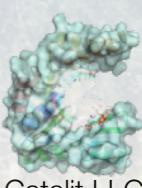
Catalit LLC

# WHY ARE WE HERE ?



# AGENDA

- 09:00 am - 09:30 am Registration
- **09:30 am - 11:20 am Deep Learning review**
- 11:20 am - 11:30 am Break
- **11:30 am - 01:00 pm Tensorflow**
- 01:00 pm - 02:00 pm Lunch
- **02:00 pm - 03:50 pm Deeper Learning**
- 03:50 pm - 04:00 pm Break
- **04:00 pm - 05:15 pm TF Utilities**
- 05:15 pm - 05:30 pm Wrap up



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# GOALS

- Learn some cool DL
- Meet fellow students
- Have fun



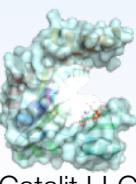
# WHAT TO EXPECT

- Accelerated learning
- Interactive
- Fun / Discovery



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# MACHINE LEARNING IN 3 SLIDES



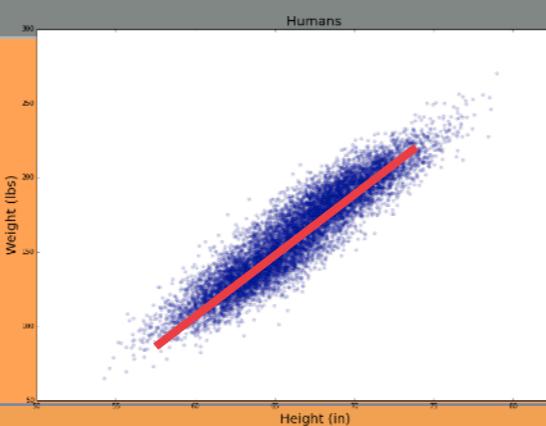
Catalit LLC

# MACHINE LEARNING PROBLEMS

SUPERVISED



CONTINUOUS

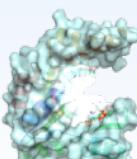
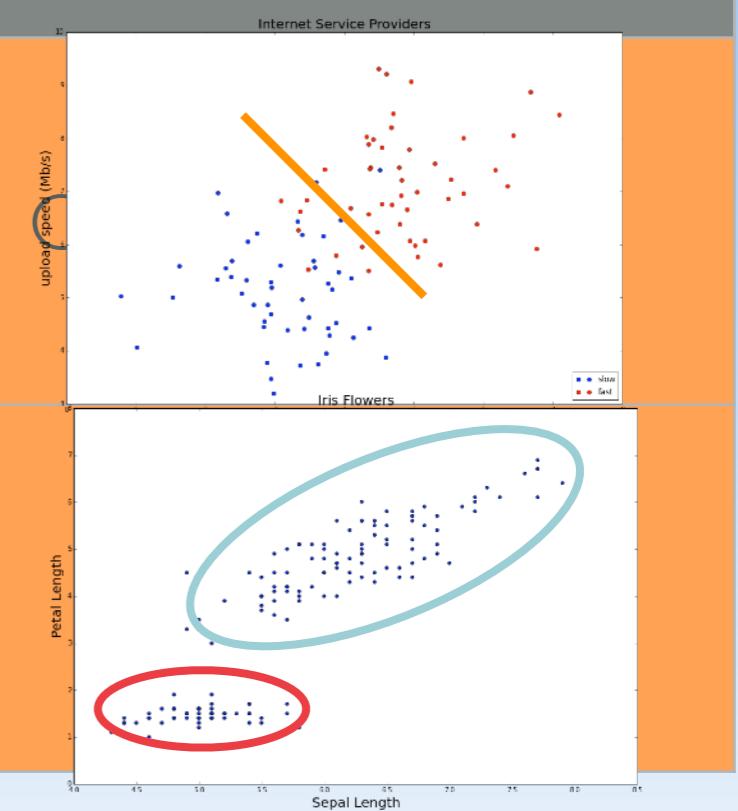


UNSUPERVISED



DIMENSION REDUCTION

CATEGORICAL



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# DATA

Unstructured

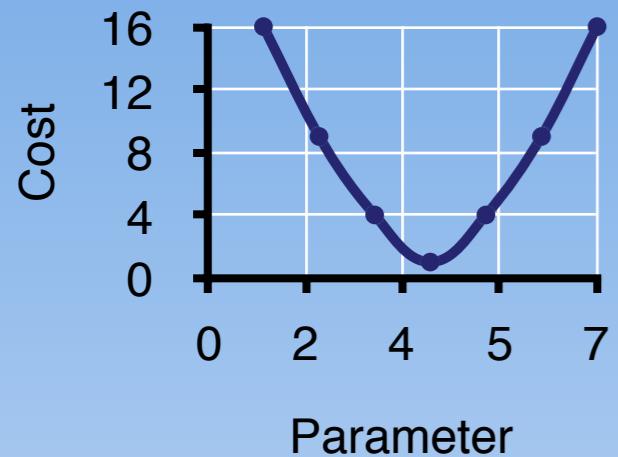
transformers armada



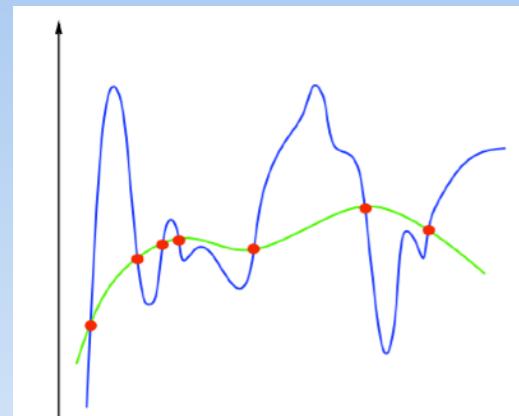
Structured

	Age	Gender	Annual Salary	Months in residence	Months in job	Current Debt	Paid off credit
Client 1	23	M	\$30,000	36	12	\$5,000	Yes
Client 2	30	F	\$45,000	12	12	\$1,000	Yes
Client 3	19	M	\$15,000	3	1	\$10,000	No
Client 4	25	M	\$25,000	12	27	\$15,000	?

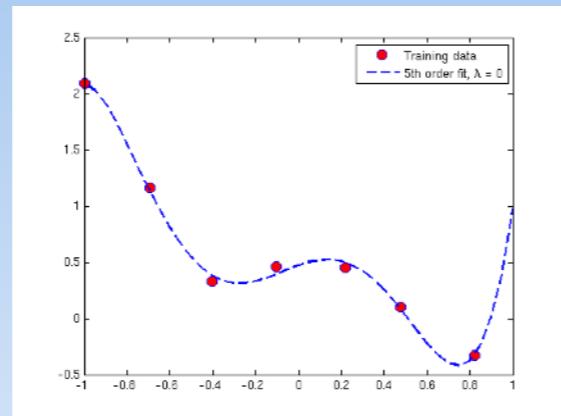
# ML MODELING



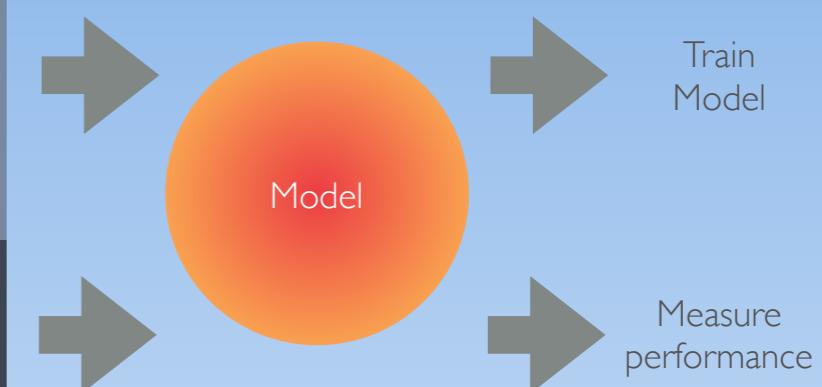
Overfitting



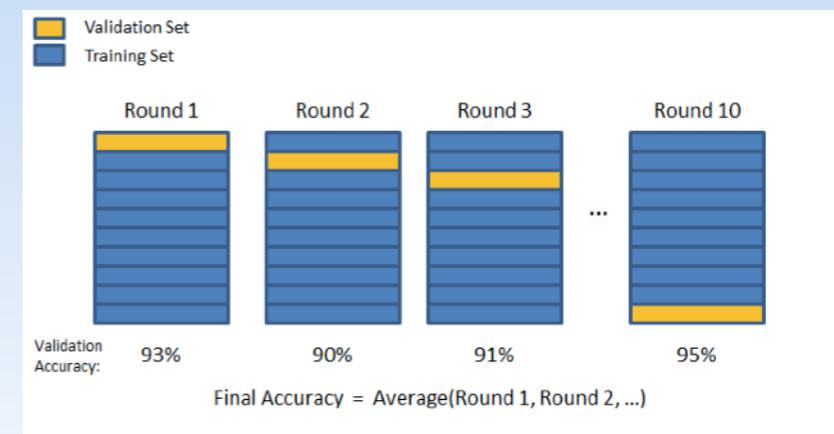
Regularization



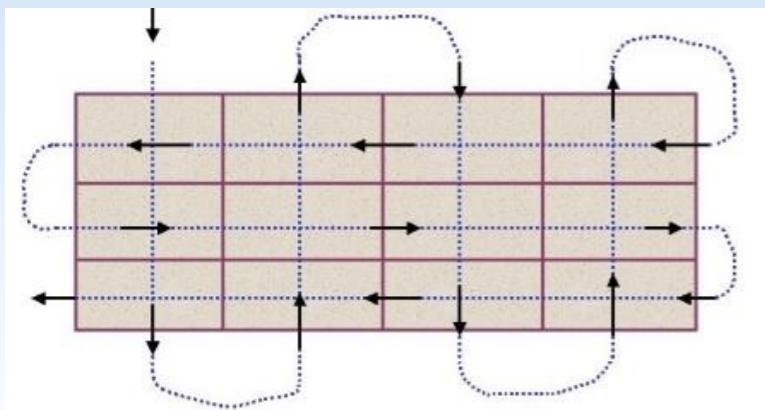
Train/Test split



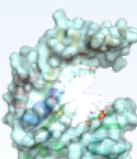
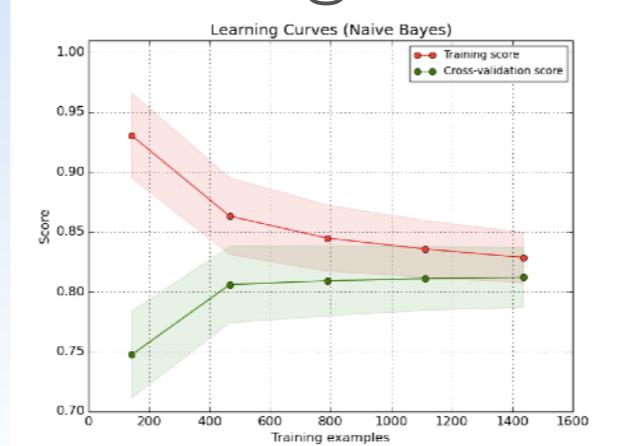
Cross validation



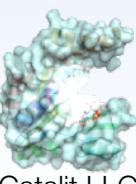
Grid Search



Learning curves

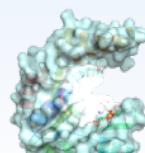
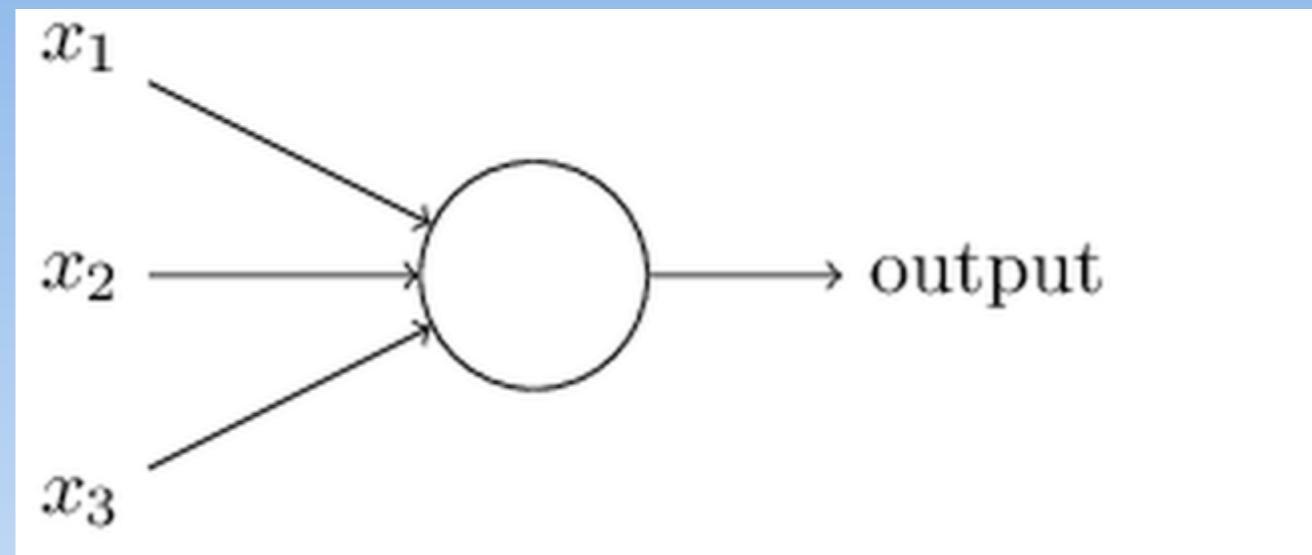
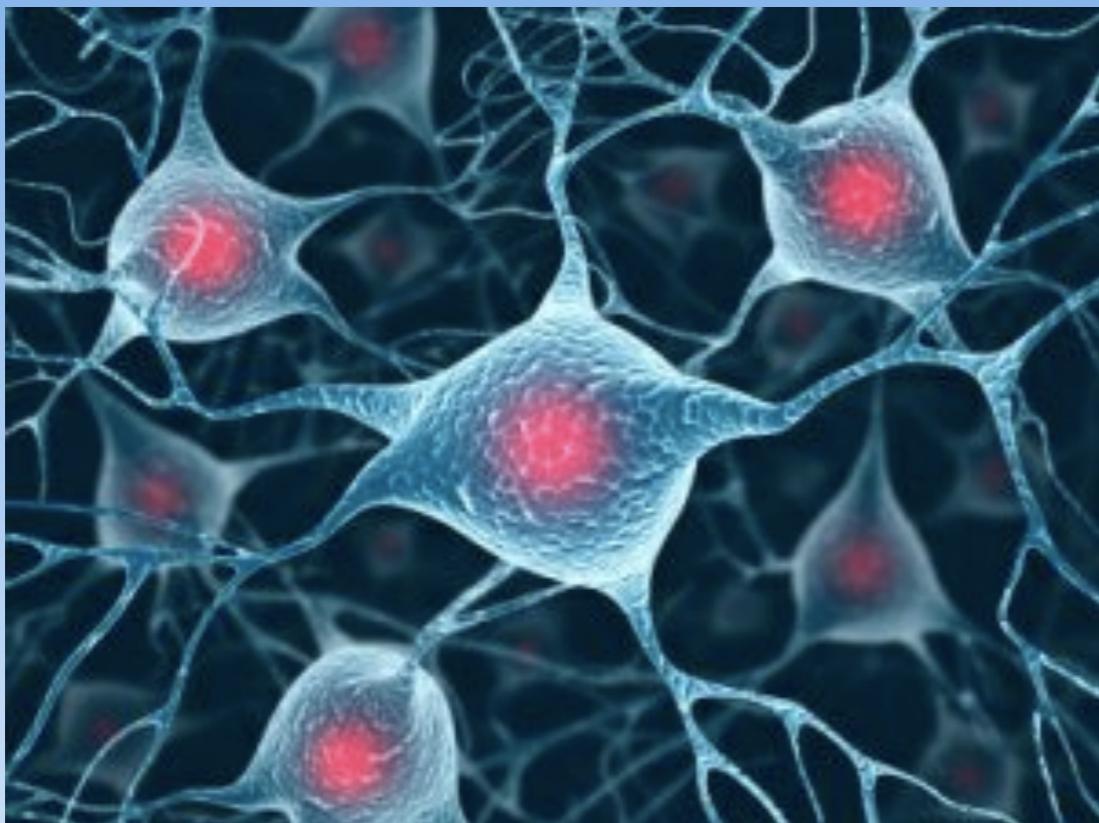


# DEEP LEARNING RECAP



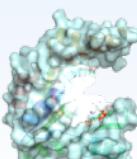
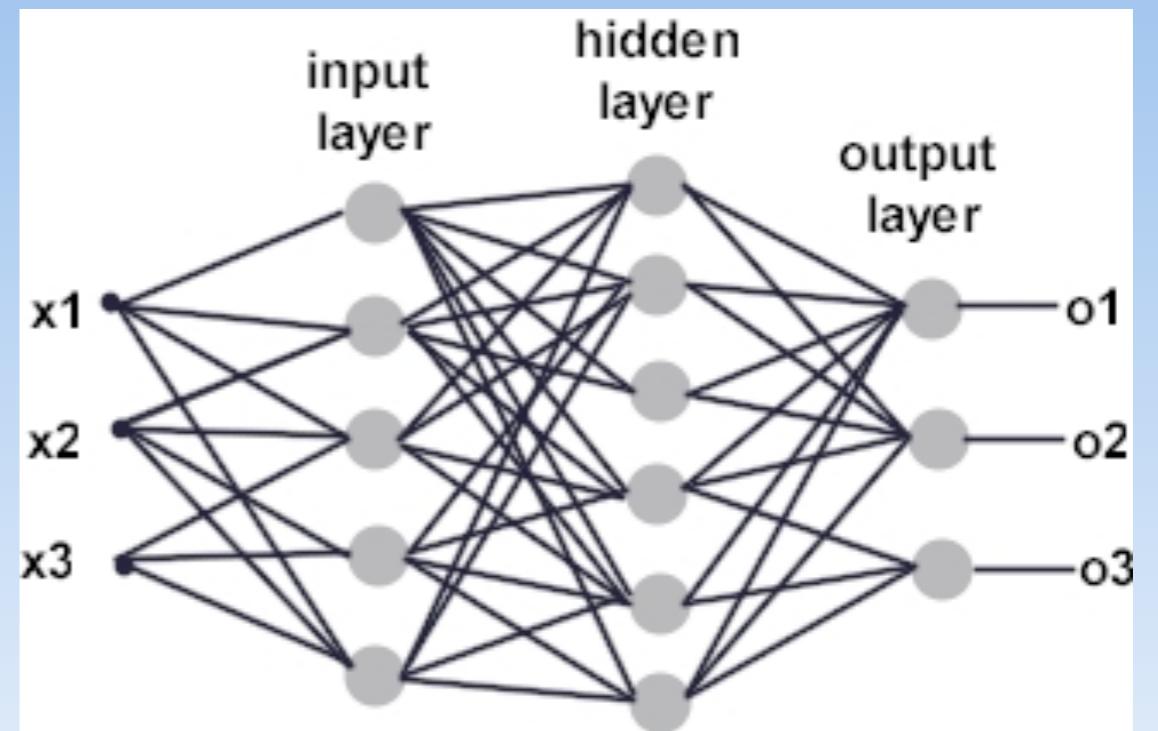
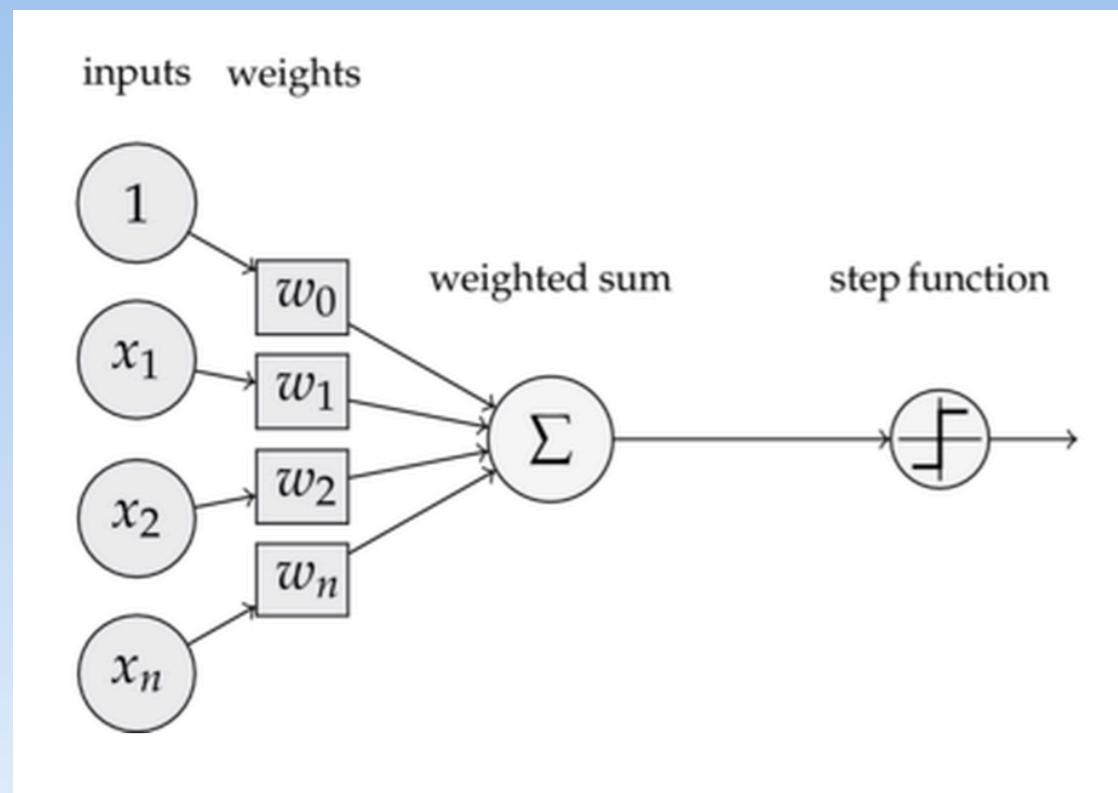
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# INSPIRATION



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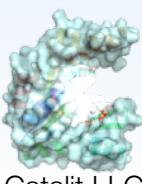
# FULLY CONNECTED



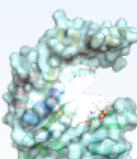
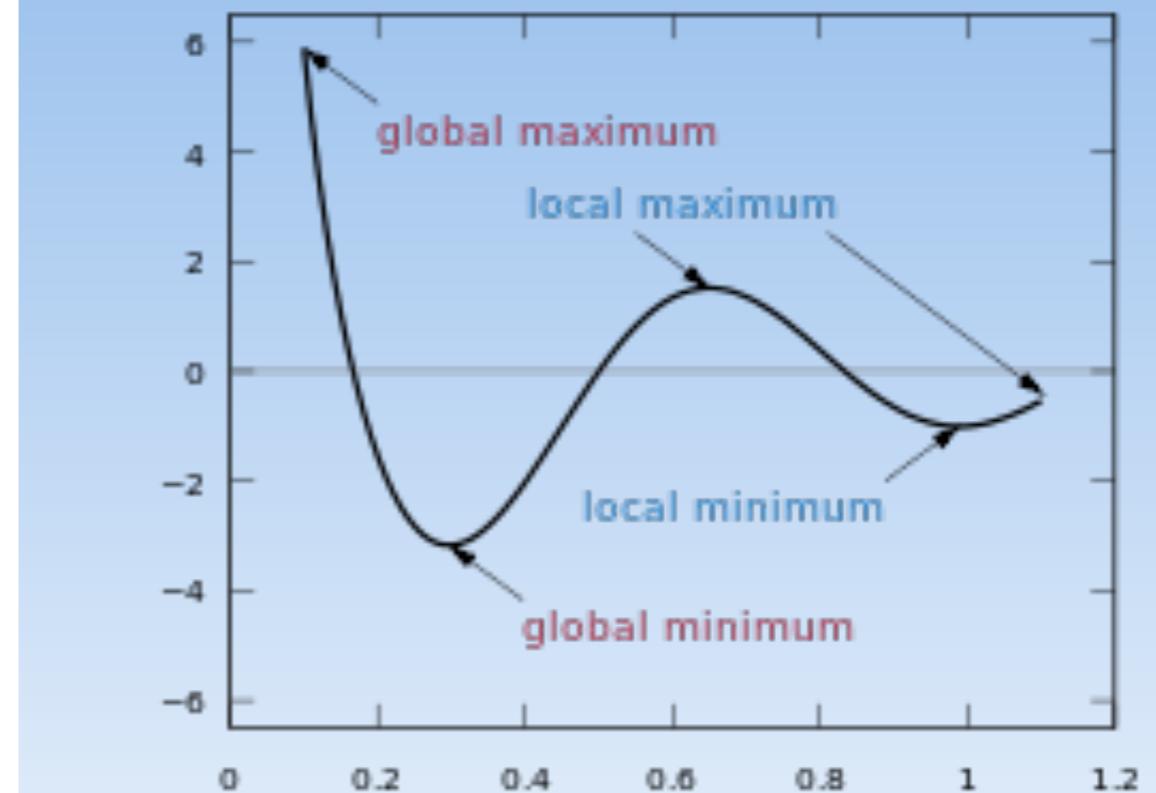
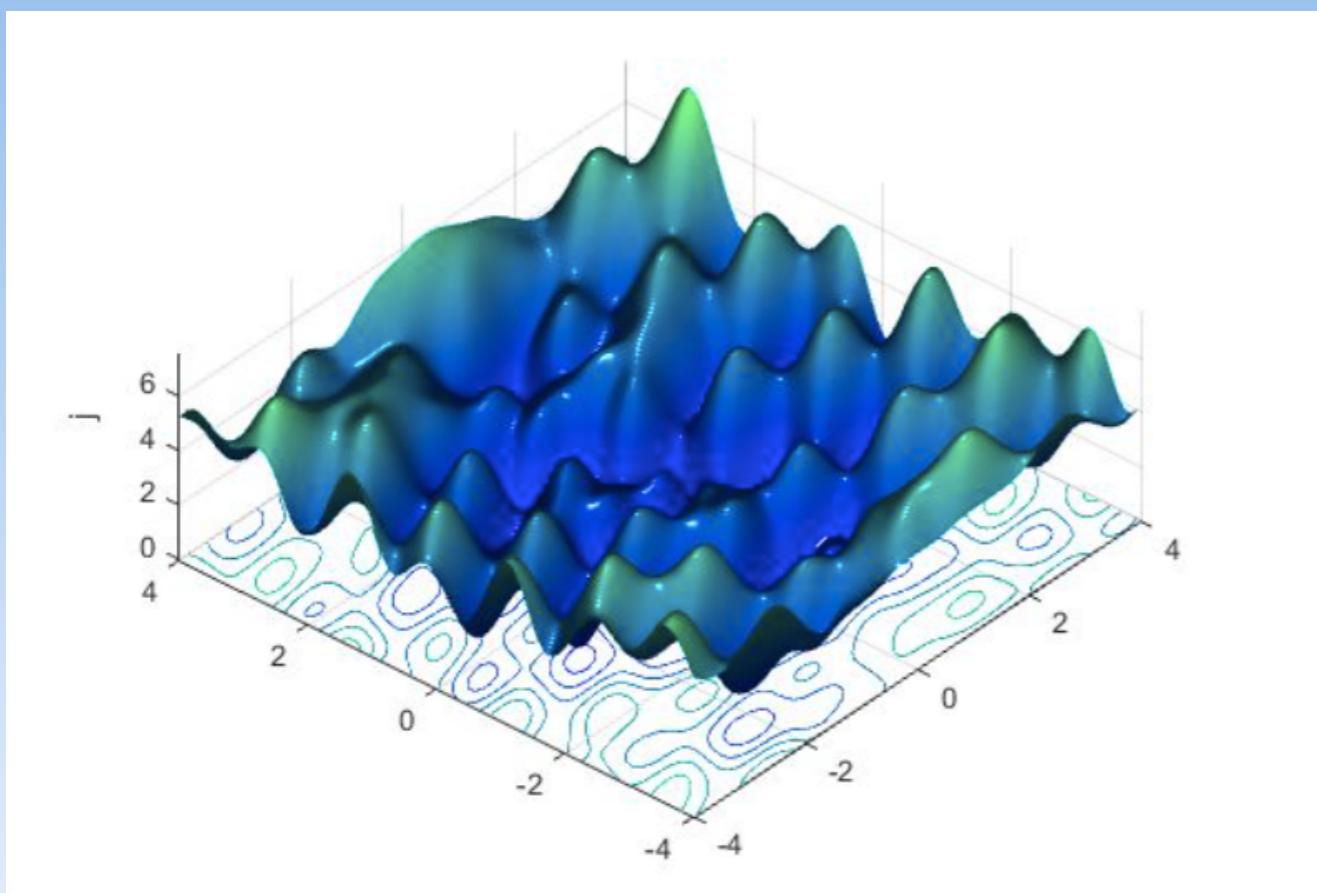
Catalit LLC

# MASTER FORMULA

model = data + structure + loss + optimizer

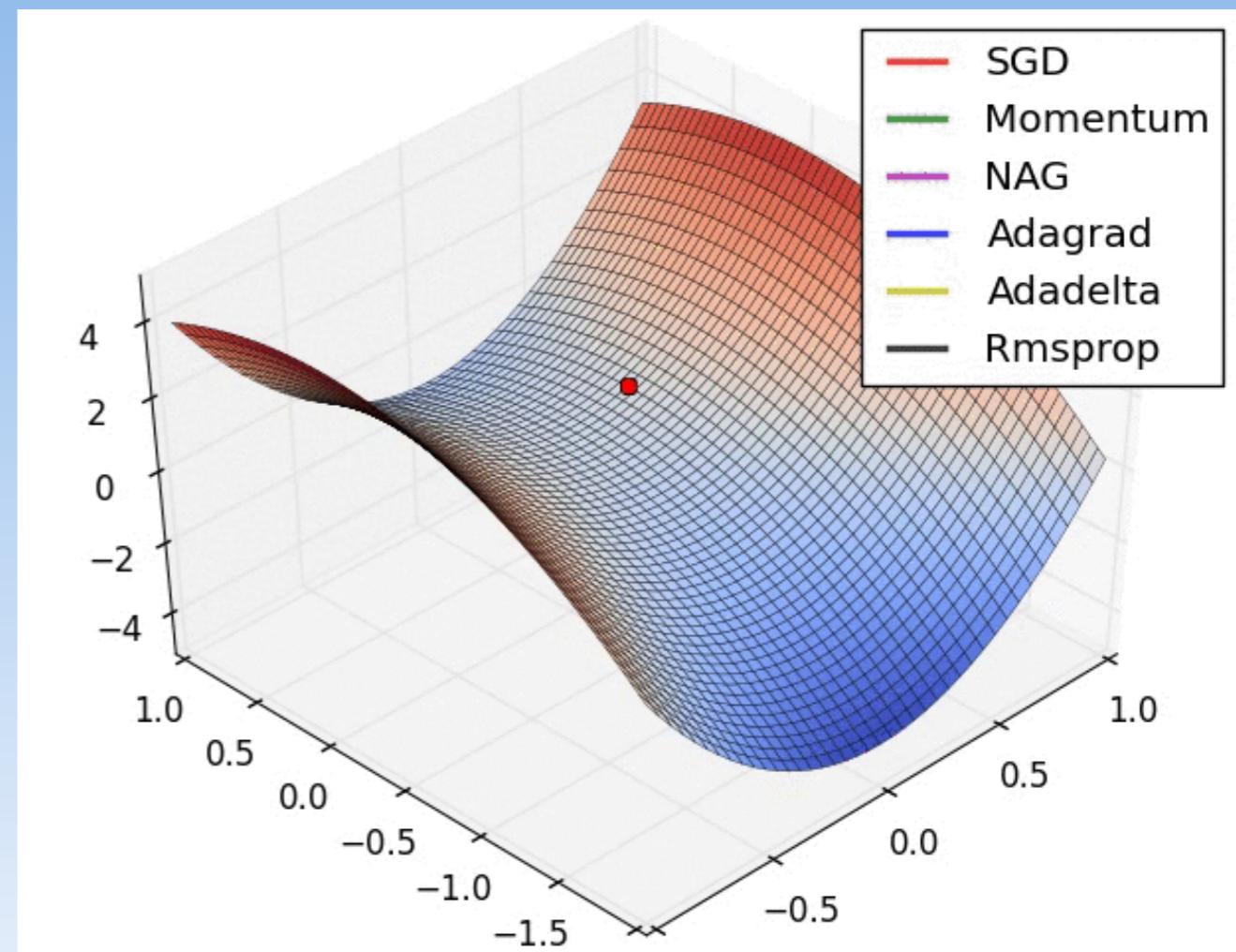
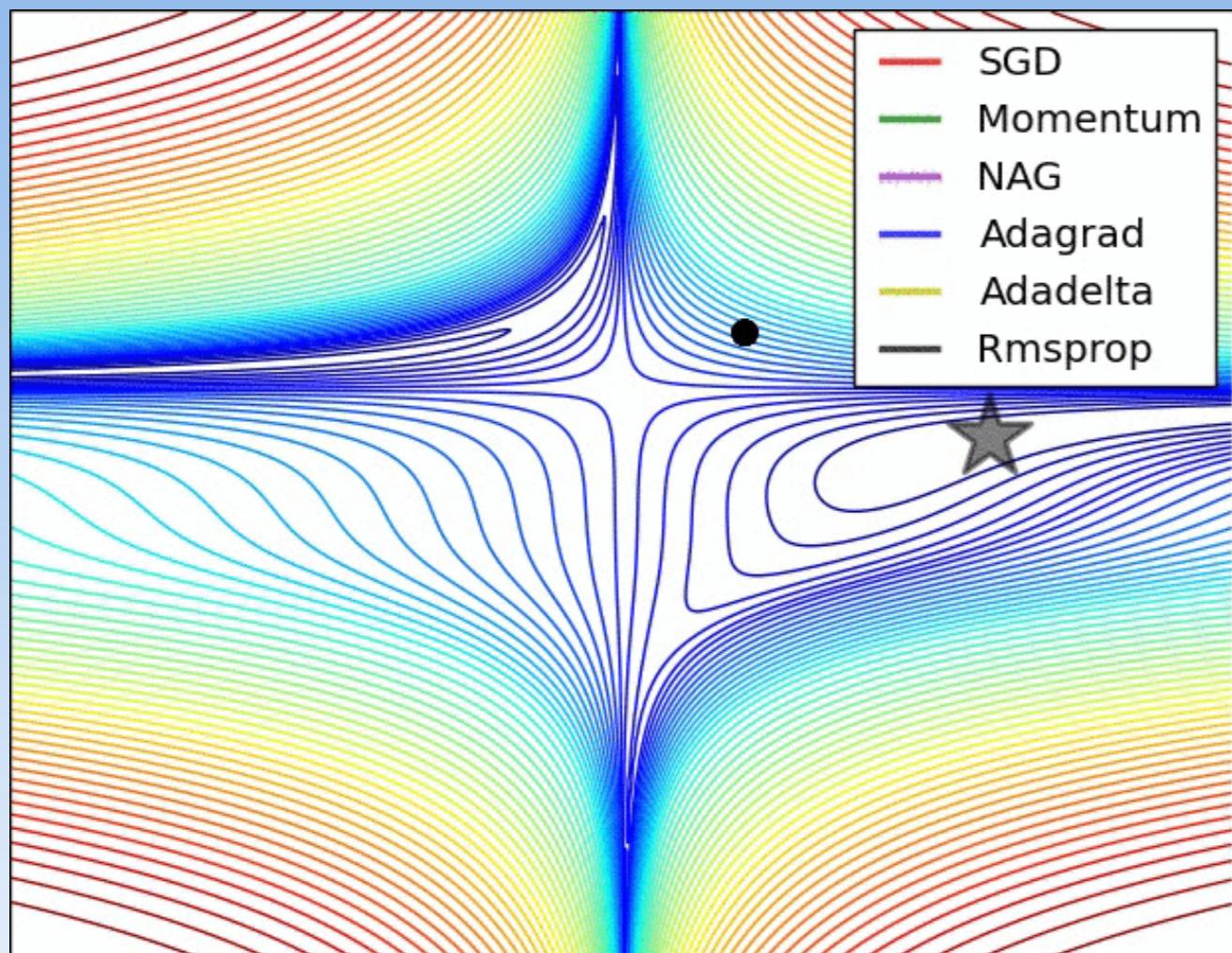


# LOSS SURFACE

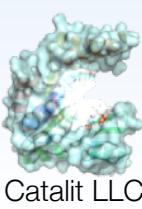


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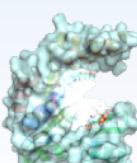
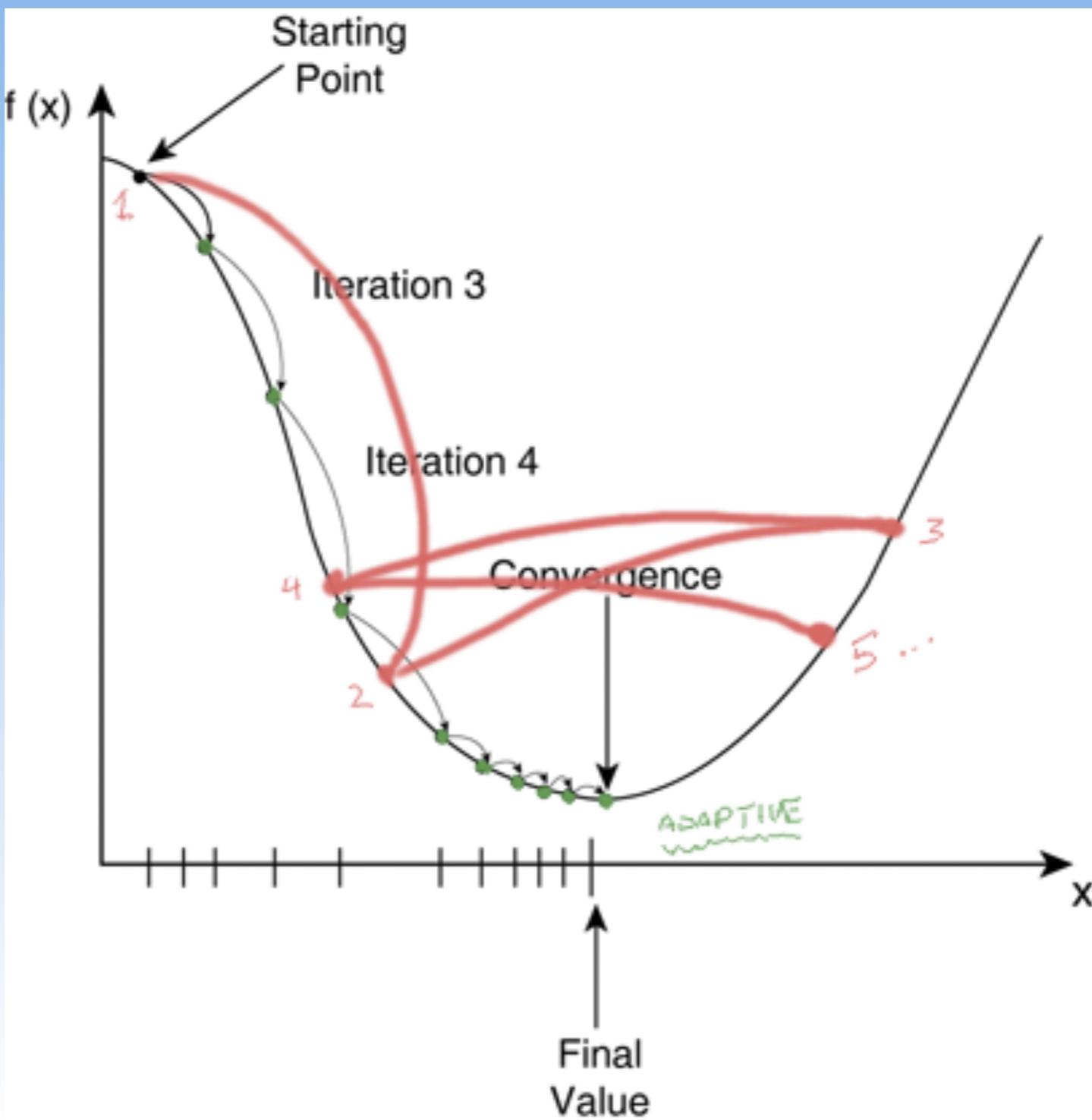
# OPTIMIZERS



<http://sebastianruder.com/optimizing-gradient-descent/>

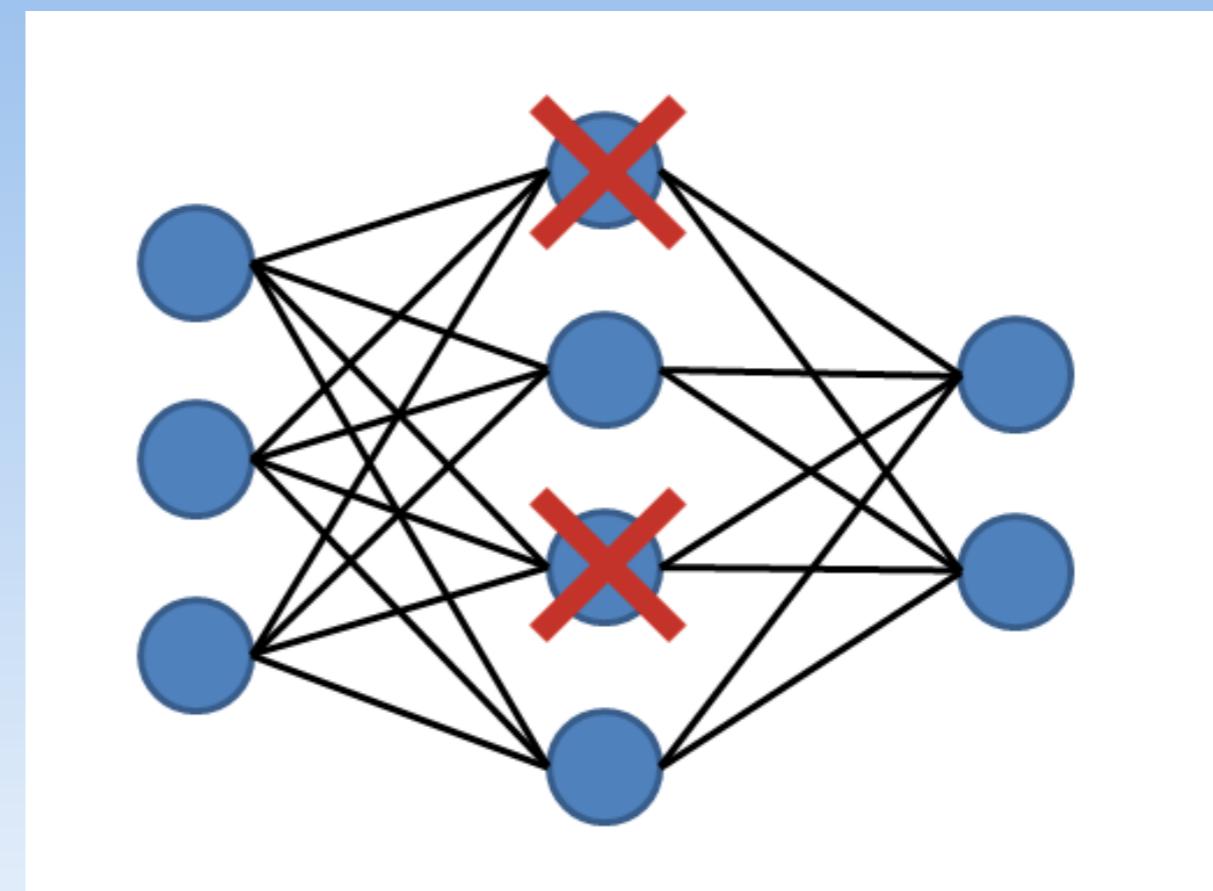
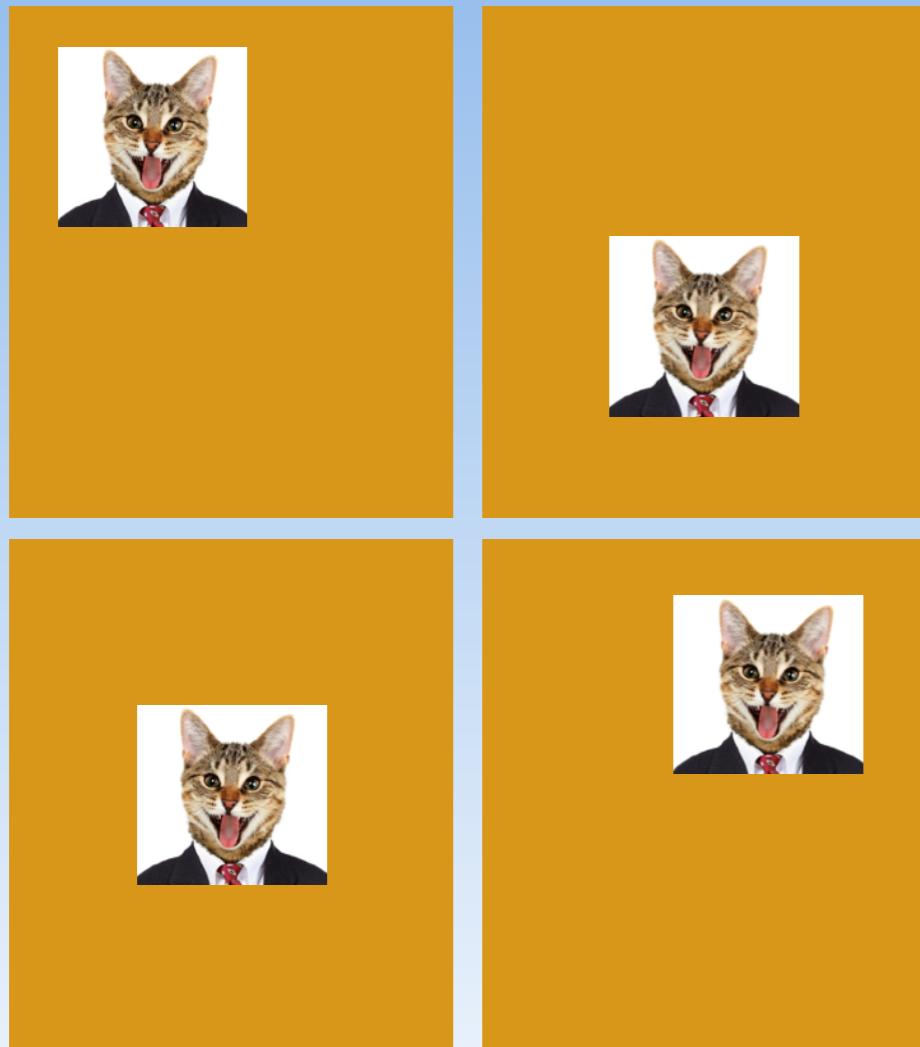


# LEARNING RATE

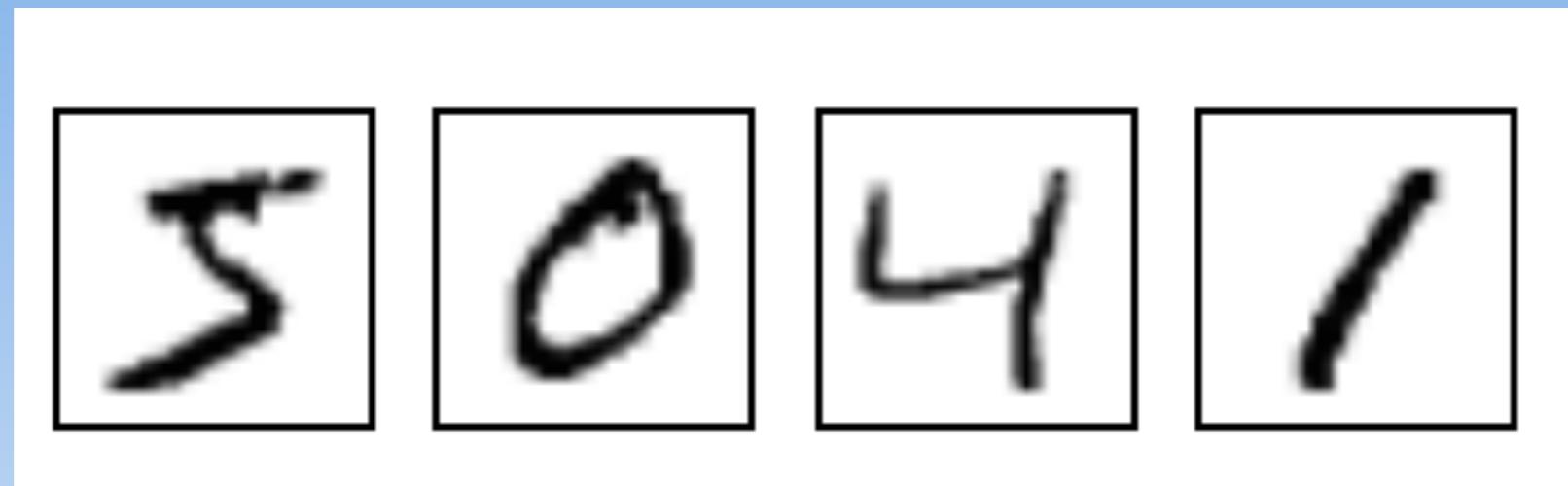


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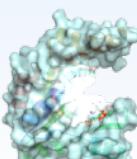
# REGULARIZATION



# MNIST



5 0 4 1



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# CONVOLUTIONAL NEURAL NETS

-1 -1 -1 -1 -1 -1 -1 -1 -1  
 -1 1 -1 -1 -1 -1 -1 1 -1  
 -1 -1 1 -1 -1 -1 1 -1 -1  
 -1 -1 -1 1 -1 1 -1 -1 -1  
 -1 -1 -1 -1 1 -1 -1 -1 -1  
 -1 -1 -1 1 -1 -1 1 -1 -1  
 -1 1 -1 -1 -1 -1 1 -1 -1  
 -1 -1 -1 -1 -1 -1 -1 1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1  
 -1 1 -1 -1 -1 -1 -1 1 -1  
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 -1 1 -1 -1 -1 1 -1 -1 -1  
 -1 1 -1 -1 -1 -1 1 -1 -1  
 -1 -1 -1 -1 -1 -1 -1 1 -1



$$\begin{bmatrix} 1 & -1 & -1 \\ -1 & 1 & -1 \\ -1 & -1 & 1 \end{bmatrix}$$

=

$$\begin{bmatrix} 0.77 & -0.11 & 0.11 & 0.33 & 0.55 & -0.11 & 0.33 \\ -0.11 & 1.00 & -0.11 & 0.33 & -0.11 & 0.11 & -0.11 \\ 0.11 & -0.11 & 1.00 & -0.33 & 0.11 & -0.11 & 0.55 \\ 0.33 & 0.33 & -0.33 & 0.55 & -0.33 & 0.33 & 0.33 \\ 0.55 & -0.11 & 0.11 & -0.33 & 1.00 & -0.11 & 0.11 \\ -0.11 & 0.11 & -0.11 & 0.33 & -0.11 & 1.00 & -0.11 \\ 0.33 & -0.11 & 0.55 & 0.33 & 0.11 & -0.11 & 0.77 \end{bmatrix}$$



$$\begin{bmatrix} 1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$$

=

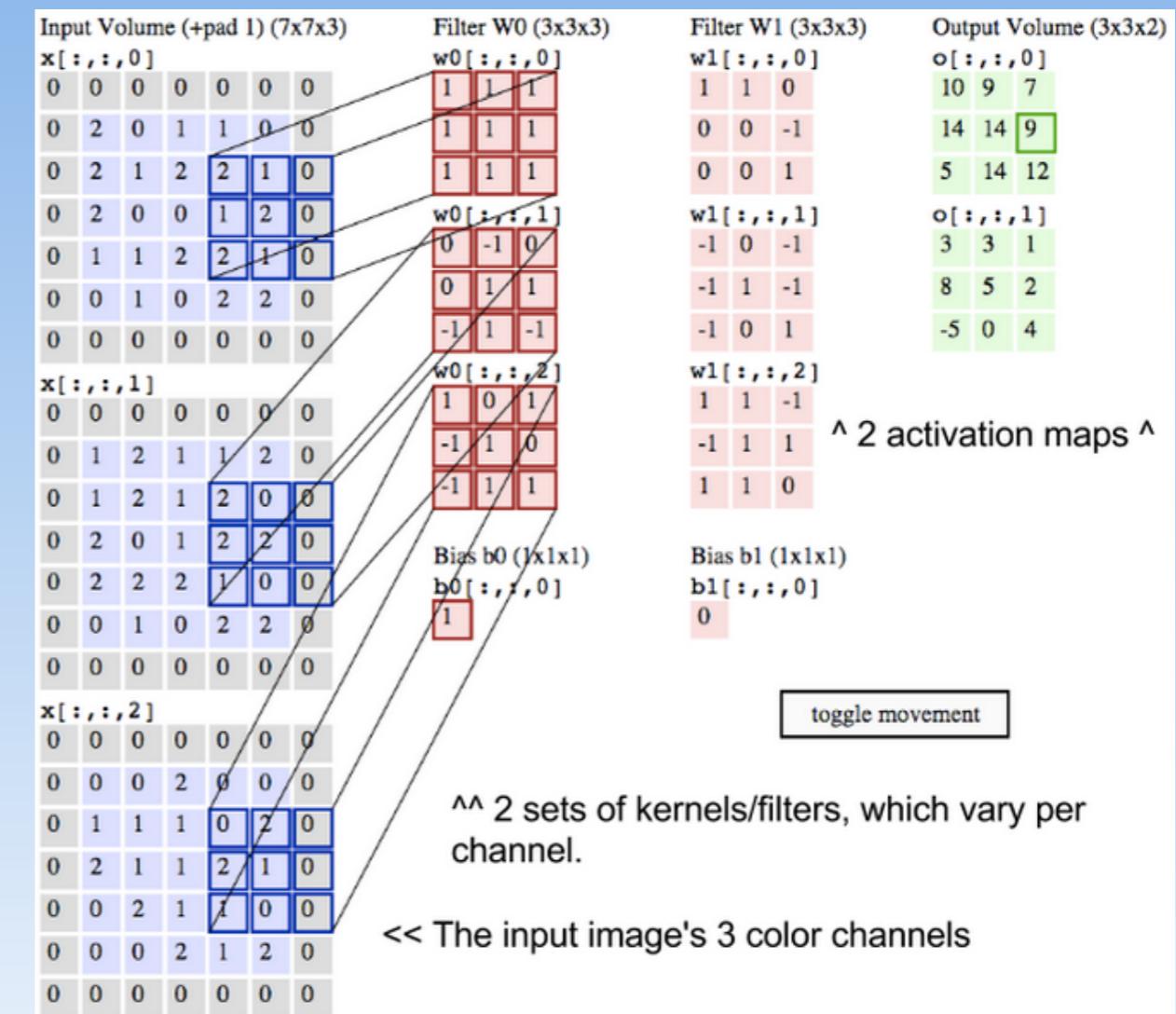
$$\begin{bmatrix} 0.33 & -0.55 & 0.11 & -0.11 & 0.11 & -0.55 & 0.33 \\ -0.55 & 0.55 & -0.55 & 0.33 & -0.55 & 0.55 & -0.55 \\ 0.11 & -0.55 & 0.55 & -0.77 & 0.55 & -0.55 & 0.11 \\ -0.11 & 0.33 & -0.77 & 1.00 & -0.77 & 0.33 & -0.11 \\ 0.11 & -0.55 & 0.55 & -0.77 & 0.55 & -0.55 & 0.11 \\ -0.55 & 0.55 & -0.55 & 0.33 & -0.55 & 0.55 & -0.55 \\ 0.33 & -0.55 & 0.11 & -0.11 & 0.11 & -0.55 & 0.33 \end{bmatrix}$$



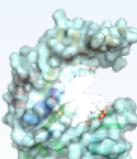
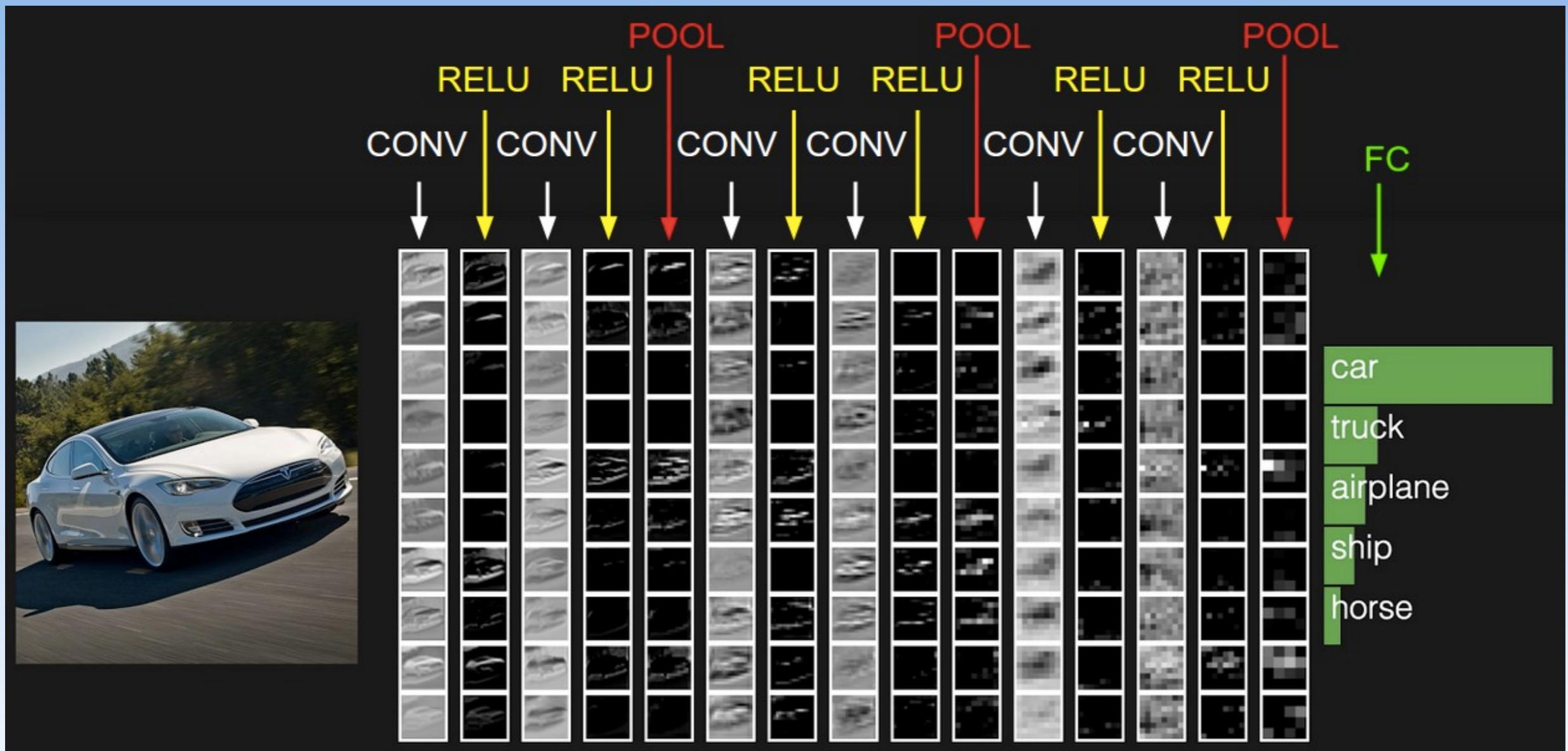
$$\begin{bmatrix} -1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$$

=

$$\begin{bmatrix} 0.33 & -0.11 & 0.55 & 0.33 & 0.11 & -0.11 & 0.77 \\ -0.11 & 0.11 & -0.11 & 0.33 & -0.11 & 1.00 & -0.11 \\ 0.55 & -0.11 & 0.11 & -0.33 & 1.00 & -0.11 & 0.11 \\ 0.33 & 0.33 & -0.33 & 0.55 & -0.33 & 0.33 & 0.33 \\ 0.11 & -0.11 & 1.00 & -0.33 & 0.11 & -0.11 & 0.55 \\ -0.11 & 1.00 & -0.11 & 0.33 & -0.11 & 0.11 & -0.11 \\ 0.77 & -0.11 & 0.11 & 0.33 & 0.55 & -0.11 & 0.33 \end{bmatrix}$$



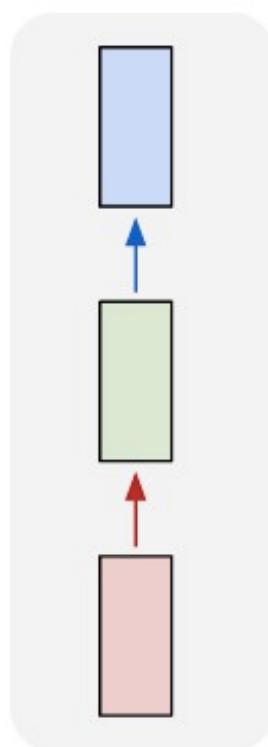
# STACKING



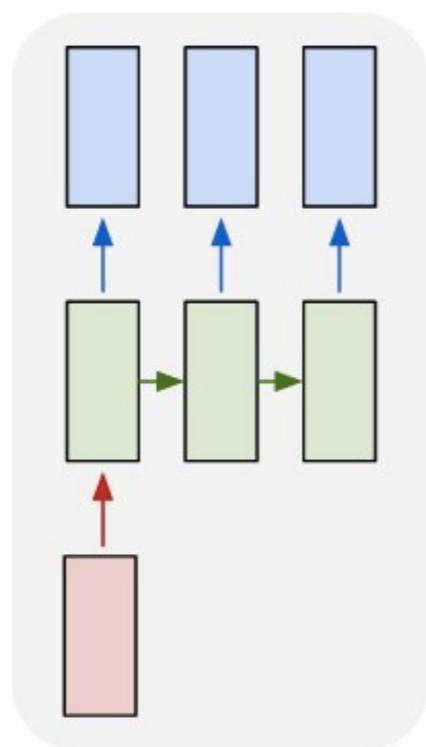
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# RECURRENT NEURAL NETS

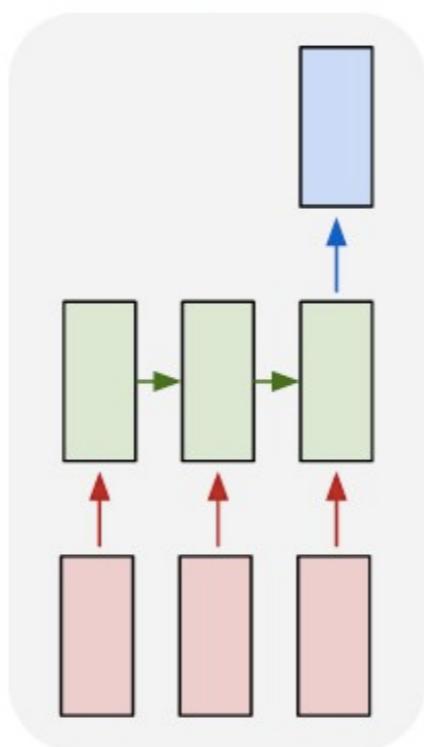
one to one



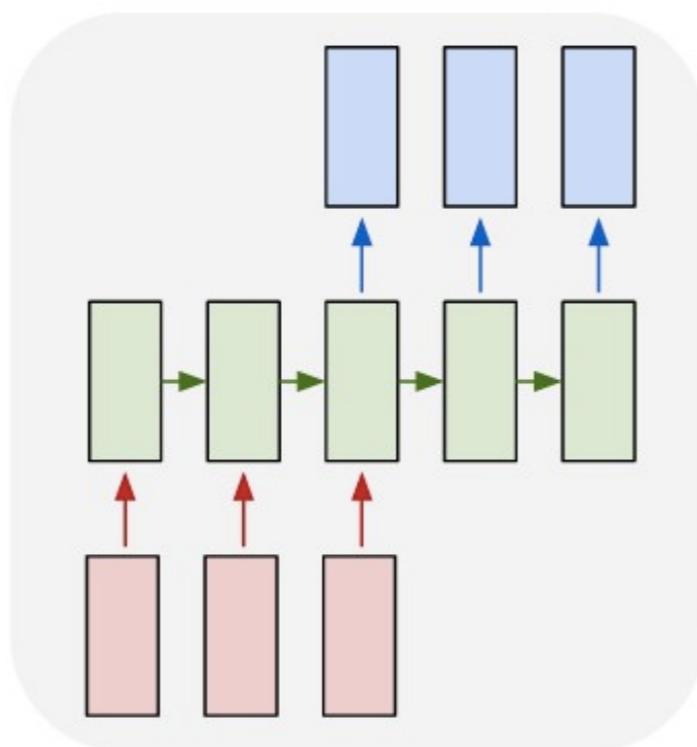
one to many



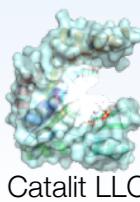
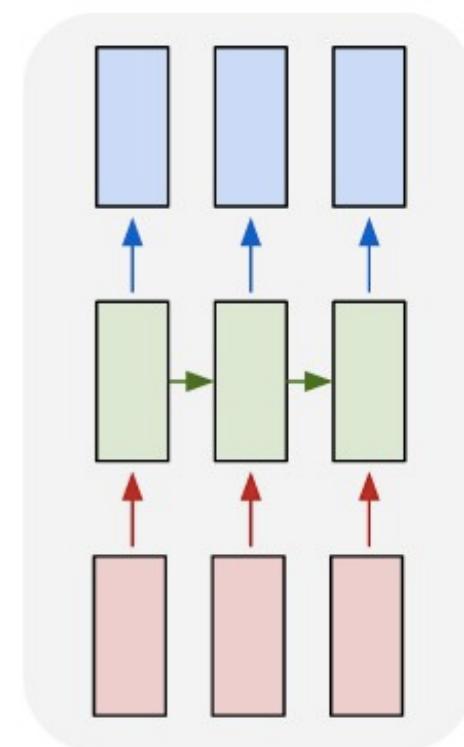
many to one



many to many

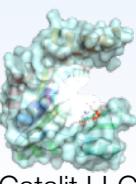


many to many



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# DEEP LEARNING APPLICATIONS



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# APPLICATIONS

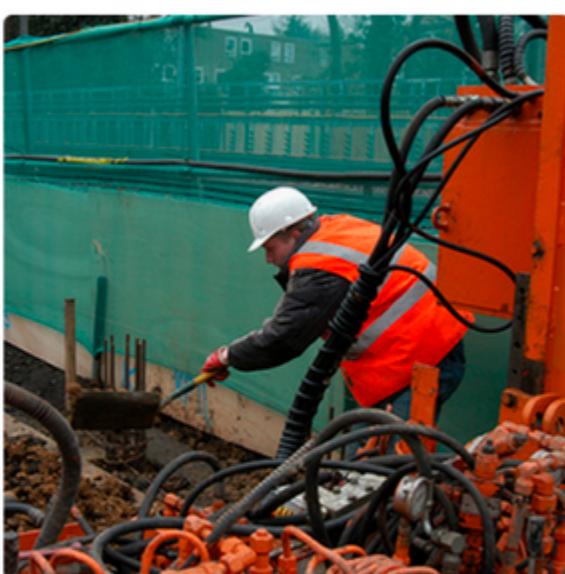
Object recognition



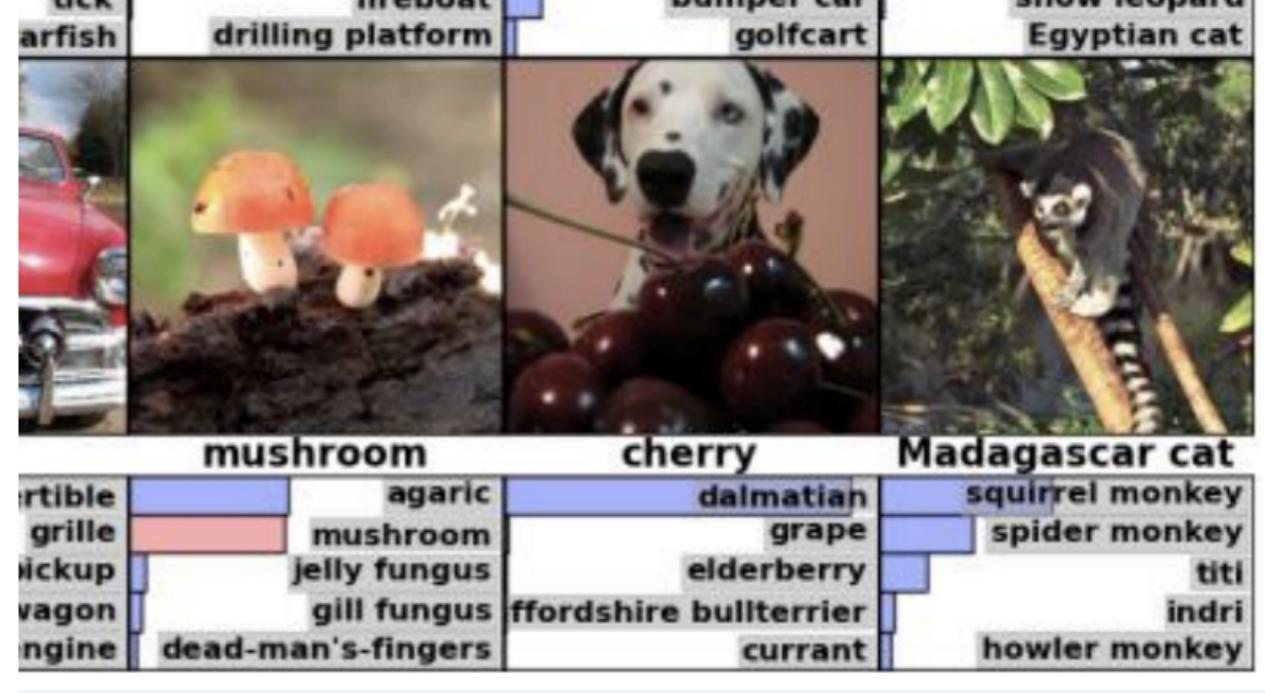
Caption generation



"man in black shirt is playing guitar."

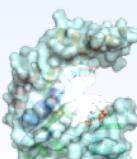
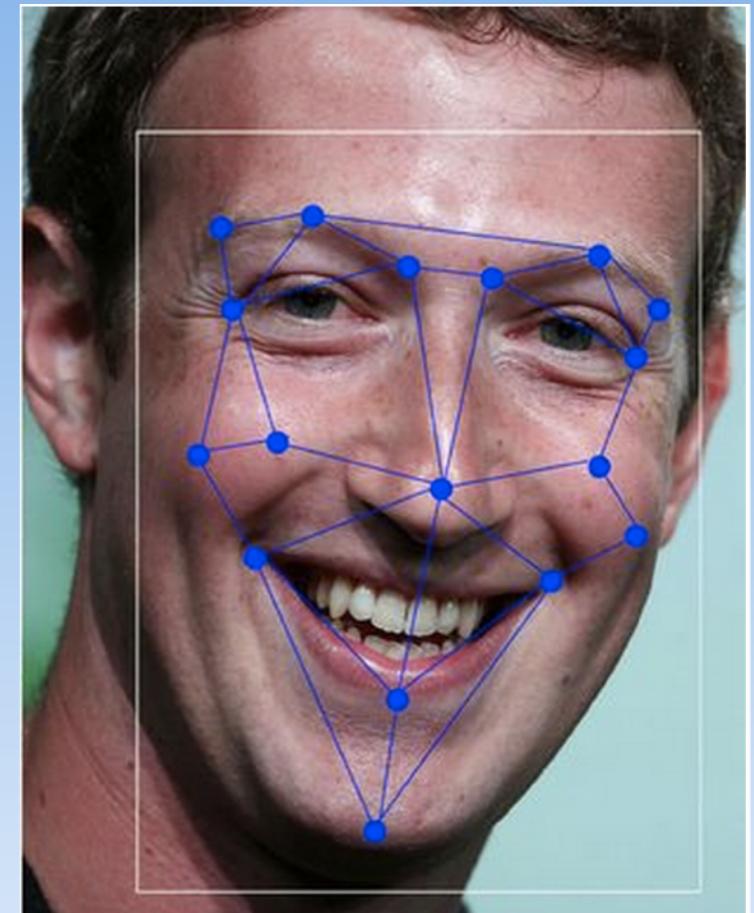
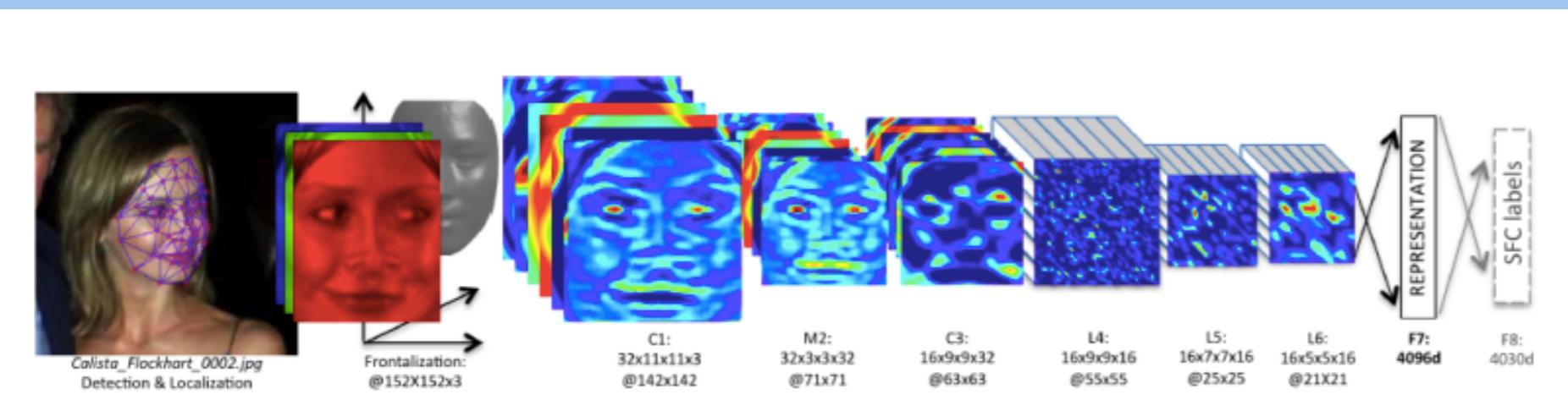


"construction worker in orange safety vest is working on road."



# APPLICATIONS

## Face recognition



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# APPLICATIONS

Speech recognition and synthesis

*Google says its speech  
recognition technology  
now has only an 8%  
word error rate...*



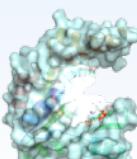
# APPLICATIONS

## Neural Machine Translation

Economic growth has slowed down in recent years .

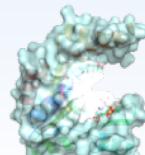


La croissance économique s'est ralentie ces dernières années .



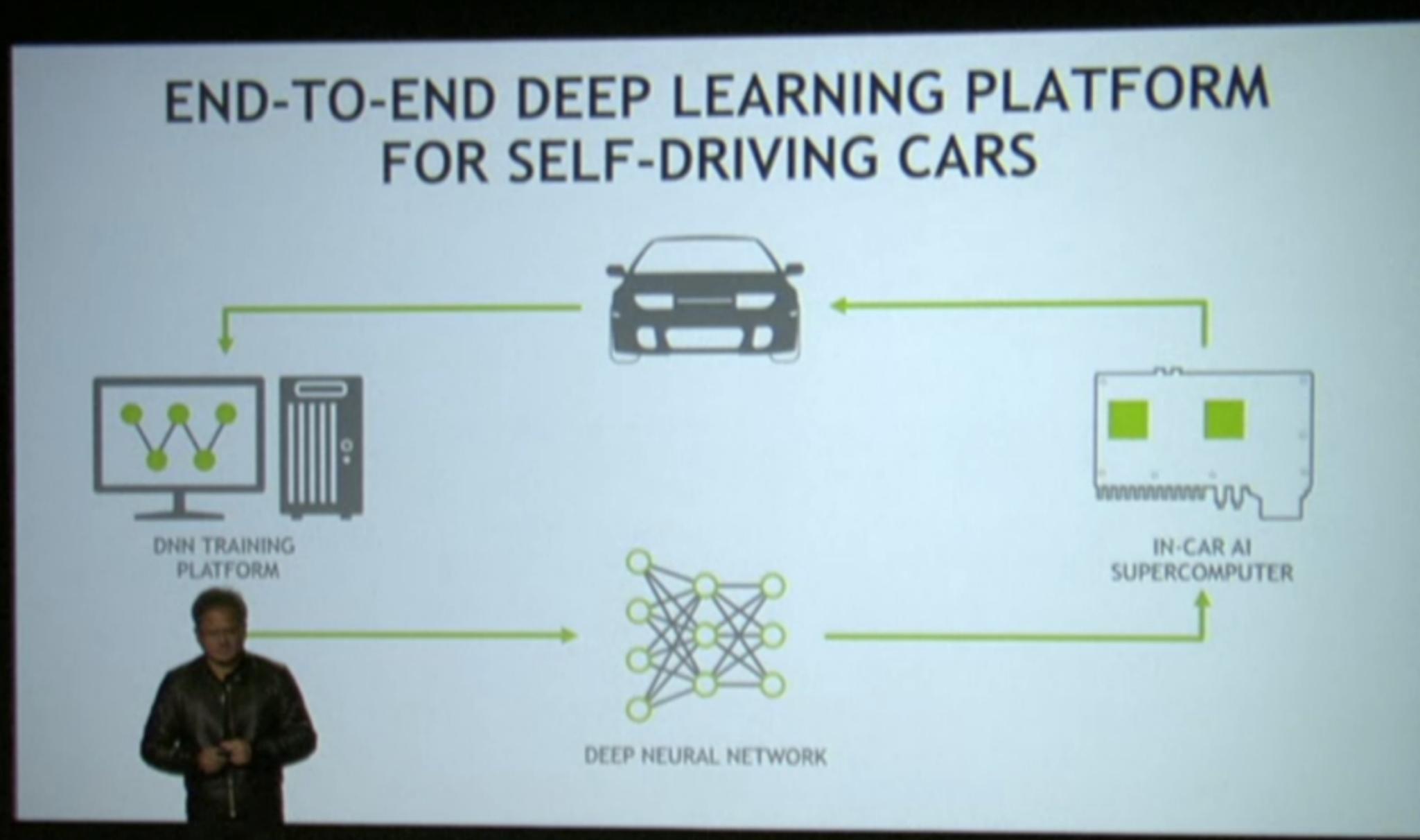
# APPLICATIONS

## Stock market prediction

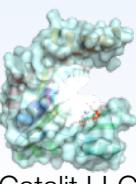


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# APPLICATIONS

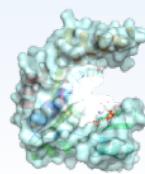


# DATA SCIENCE WITH PYTHON



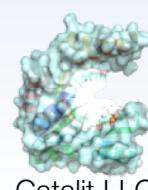
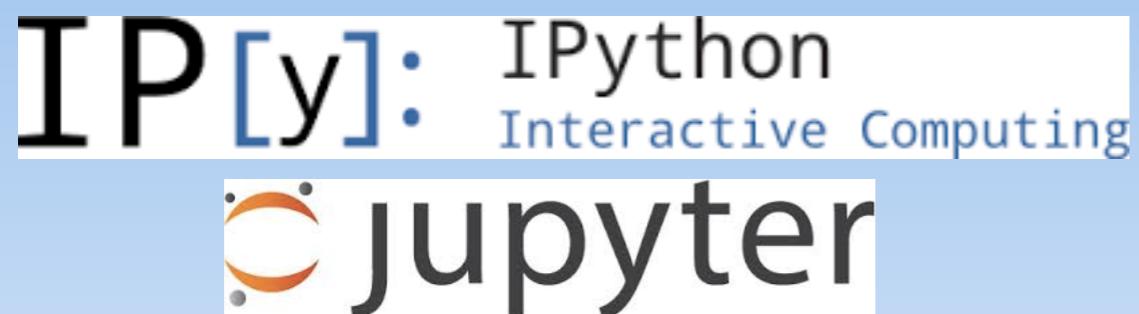
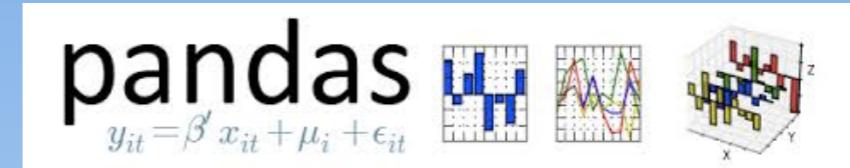
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# OPEN SOURCE



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# PYDATA ECHOSYSTEM



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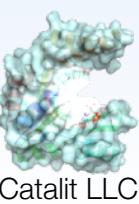
goo.gl/XS0qHJ

dataweekends-dladvanced

The screenshot shows a file browser window titled "dataweekends-dladvanced". The window has a toolbar at the top with various icons for file operations like copy, paste, and search. Below the toolbar is a search bar labeled "Search". The main area displays a list of files and folders in a table format. The columns are "Name", "Date Modified", "Size", and "Kind". The "Name" column includes icons for each file type (e.g., document, folder, shell script). The "Date Modified" column shows the last update time for each item. The "Size" column shows the file size, and the "Kind" column indicates the file type (e.g., Sublime Text Document, Folder, Shell Script, YAML, Markdown, ZIP archive). The list includes several Jupyter notebooks (ipynb files) for different topics like deep learning refresh, linear regression, logistic regression, fully connected networks, convolutional neural networks, and Word2Vec. It also contains folders for "2b\_other\_neural\_networks", "assets", "setup", "slides", and "solutions\_don\_t\_open", along with a shell script ("deploy.sh"), environment files ("environment-cpu-mac.yml"), and text files ("notes.md", "README.md"). A large ZIP archive ("text8.zip") is listed at the bottom.

Name	Date Modified	Size	Kind
0_deep_learning_refresh.ipynb	Yesterday, 10:27 PM	6 KB	Sublime Text Document
1a_intro_to_tensorflow.ipynb	Yesterday, 10:45 PM	11 KB	Sublime Text Document
1b_linear_regression.ipynb	Yesterday, 10:47 PM	5 KB	Sublime Text Document
1c_logistic_regression.ipynb	Yesterday, 10:49 PM	5 KB	Sublime Text Document
1d_fully_connected.ipynb	Yesterday, 10:54 PM	8 KB	Sublime Text Document
2a_convolutional_neural_network.ipynb	Yesterday, 11:10 PM	14 KB	Sublime Text Document
2b_other_neural_networks	Dec 3, 2016, 1:33 AM	--	Folder
3a_save_restore_model.ipynb	Yesterday, 11:22 PM	6 KB	Sublime Text Document
3b_tensorboard_basic.ipynb	Today, 12:03 AM	5 KB	Sublime Text Document
3c_tensorboard_advanced.ipynb	Today, 12:09 AM	8 KB	Sublime Text Document
4_Word2Vec.ipynb	Today, 12:40 AM	16 KB	Sublime Text Document
assets	Today, 12:04 AM	--	Folder
deploy.sh	Today, 12:45 AM	395 bytes	Shell Script (Bash)
environment-cpu-mac.yml	Yesterday, 10:12 PM	288 bytes	YAML
notes.md	Dec 3, 2016, 2:45 AM	2 KB	Markdown
README.md	Dec 2, 2016, 11:32 AM	63 bytes	Markdown
setup	Dec 2, 2016, 5:59 PM	--	Folder
slides	Yesterday, 10:28 PM	--	Folder
solutions_don_t_open	Yesterday, 10:15 PM	--	Folder
text8.zip	Today, 12:08 AM	31.3 MB	ZIP archive

LAB



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