Talent Intelligence

A Think Tank on AI in HR

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Slides available at jonkrohn.com/talks

August 7th, 2018

Outline

1. The Unreasonable Effectiveness of Deep Learning
2. Deep Learning for Natural Language Processing
3. Intelligence Applications to Talent

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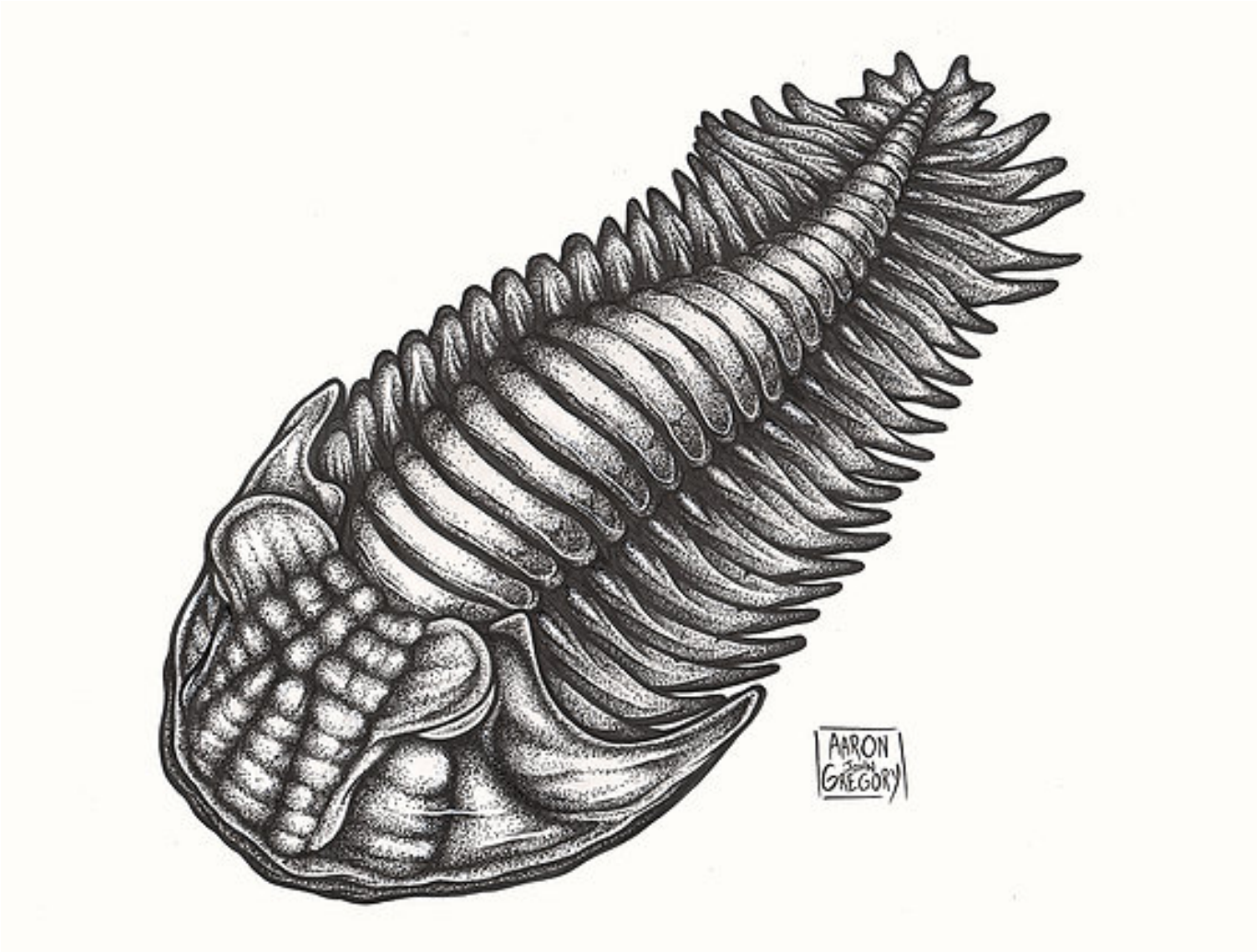
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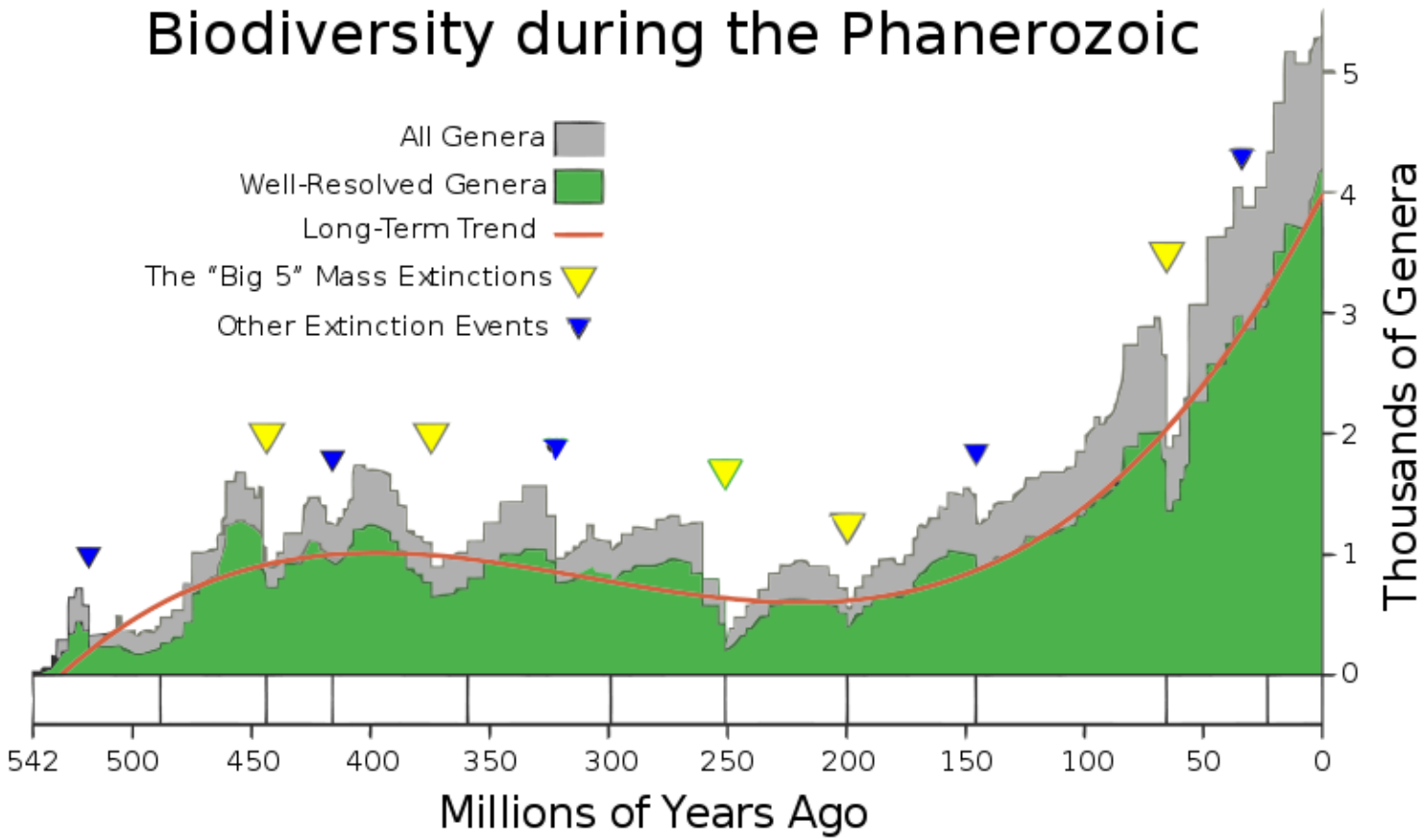
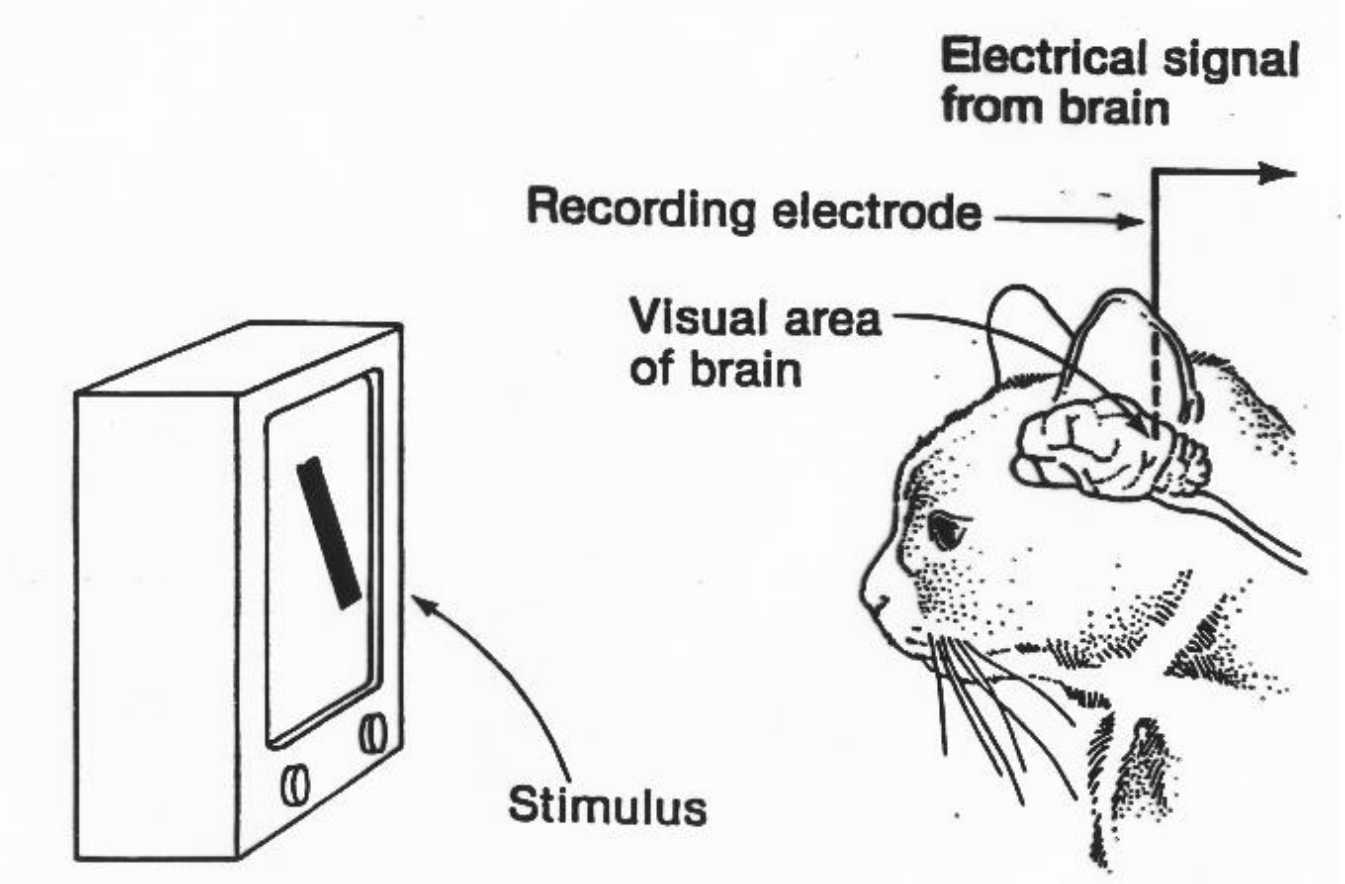
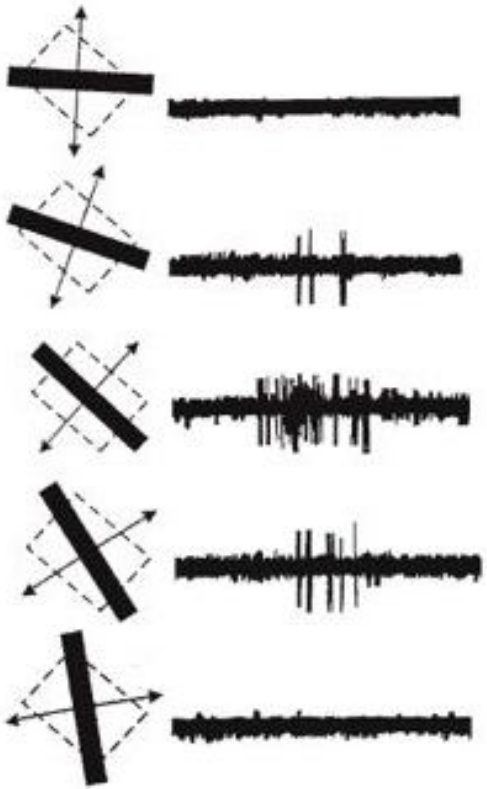
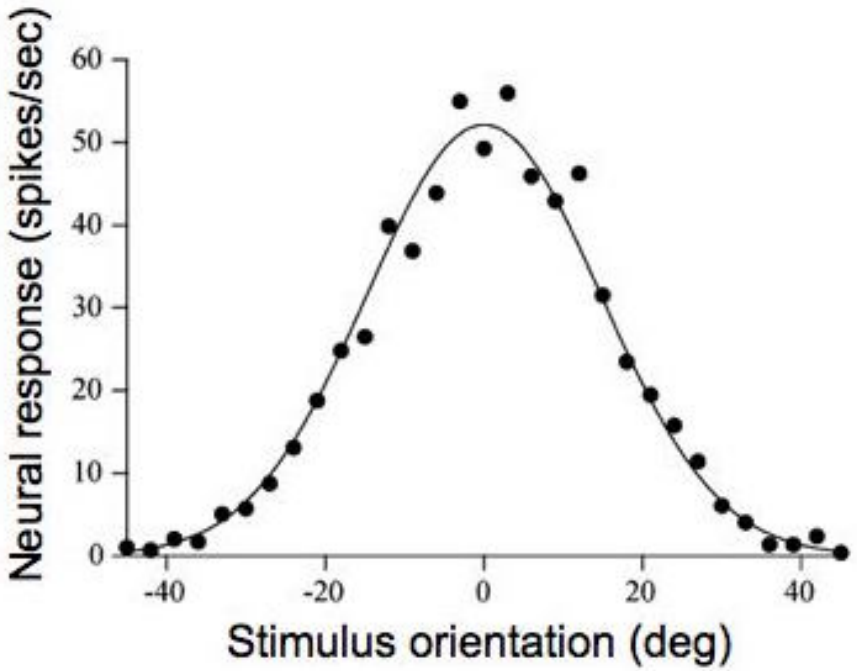
GREGORY


Biodiversity during the Phanerozoic
All Genera
Well-Resolved Genera
Long-Term Trend
The "Big 5" Mass Extinctions
Other Extinction Events
542
500
450
400
350
300
250
200
150
100
50
0
Millions of Years Ago
0
1
2
3
4
5
Thousands of Genera

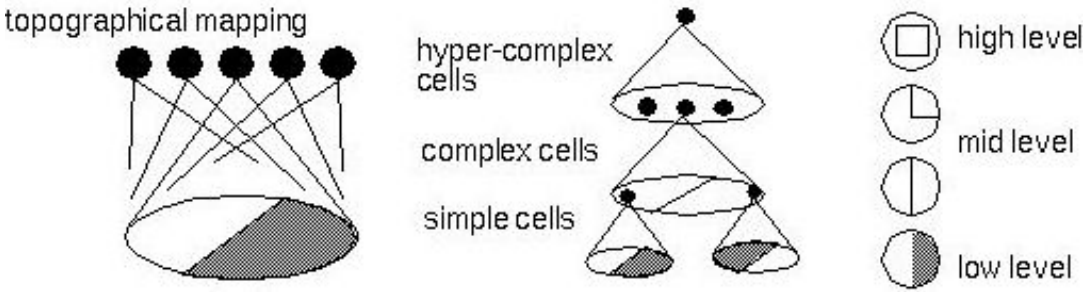
Hubel & Wiesel (1959)

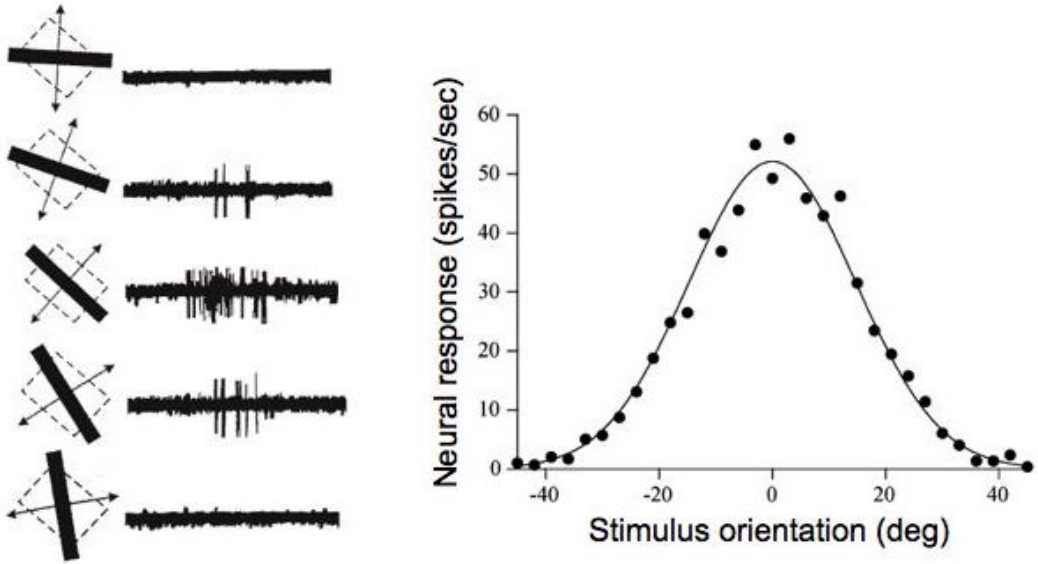




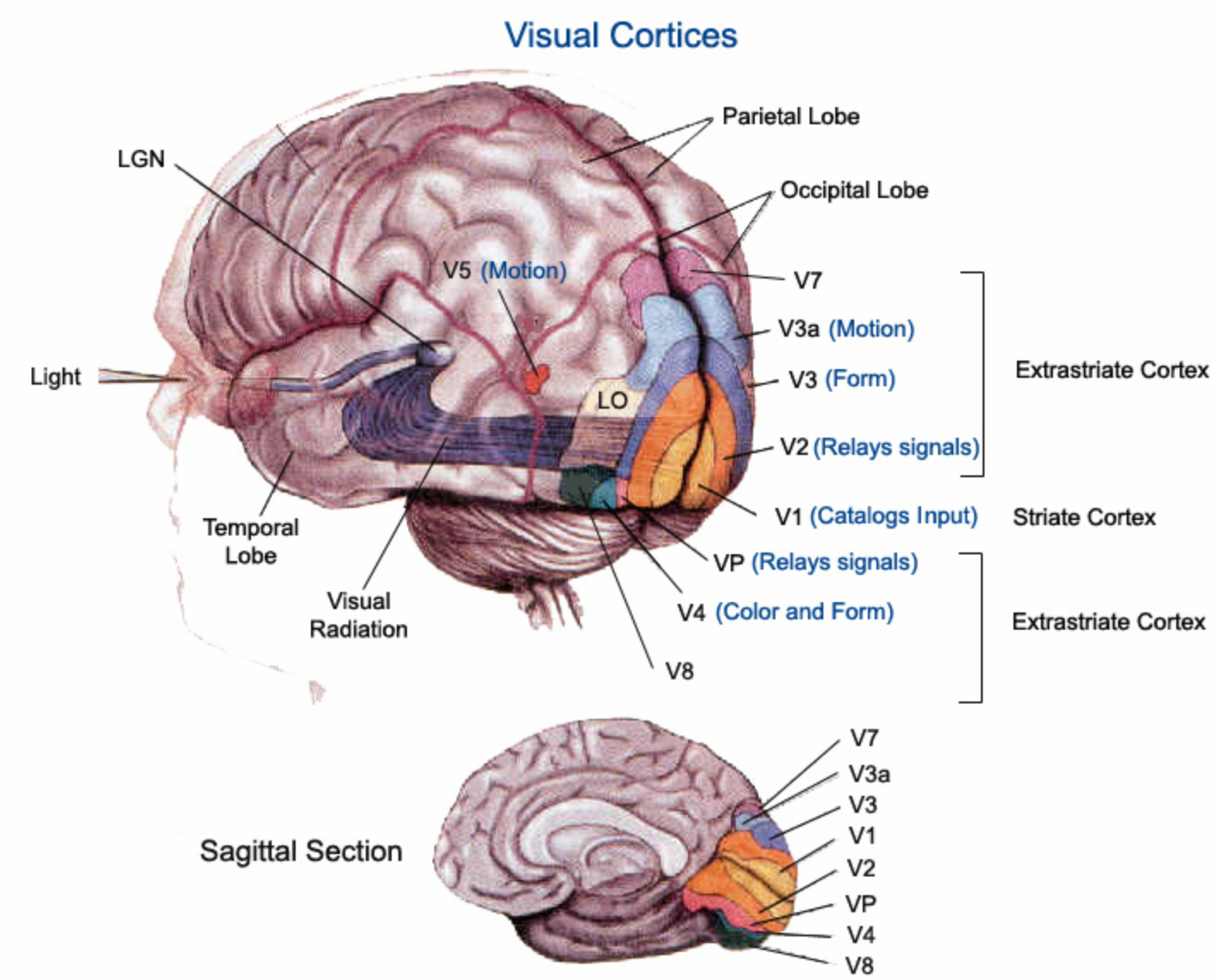


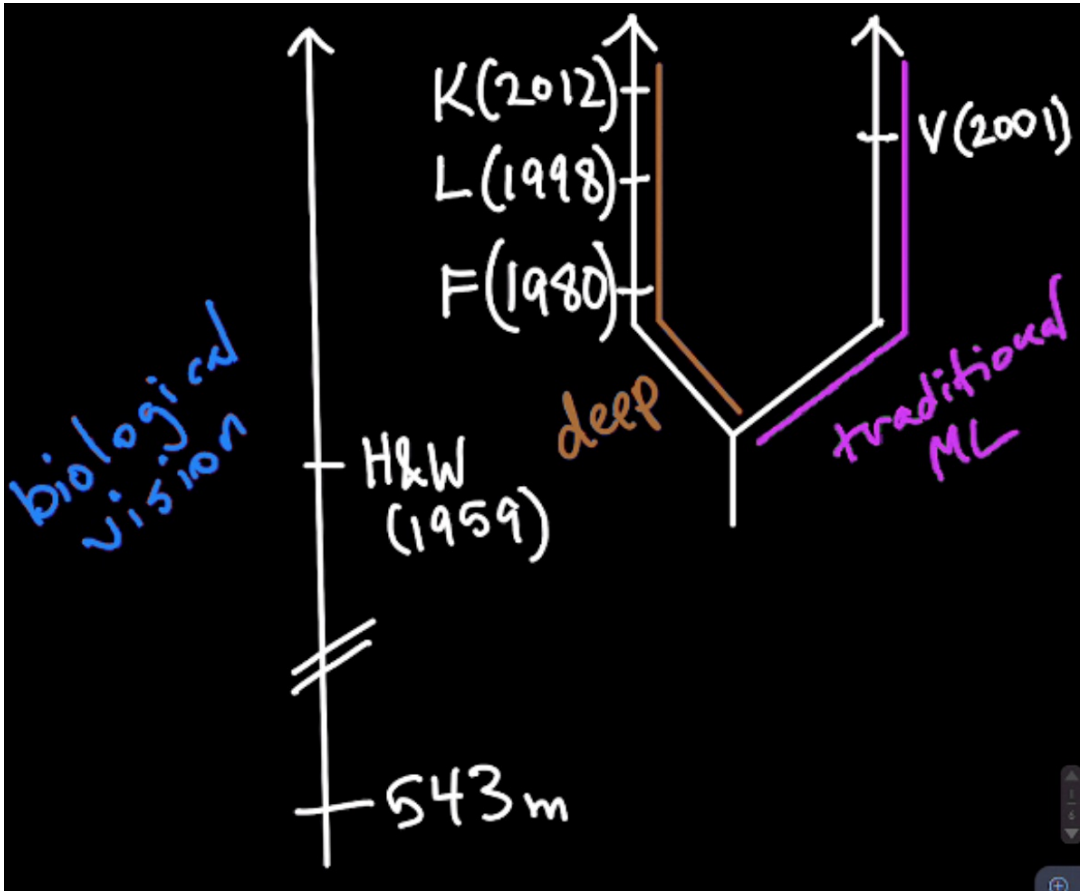
Hubel & Wiesel, 1968

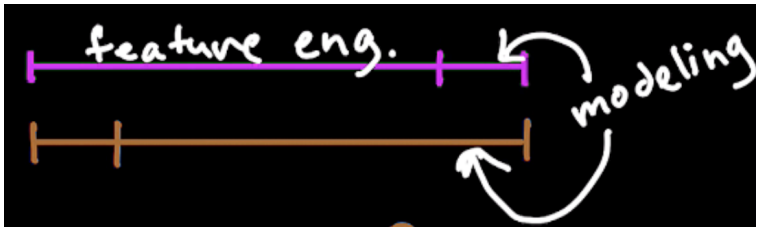




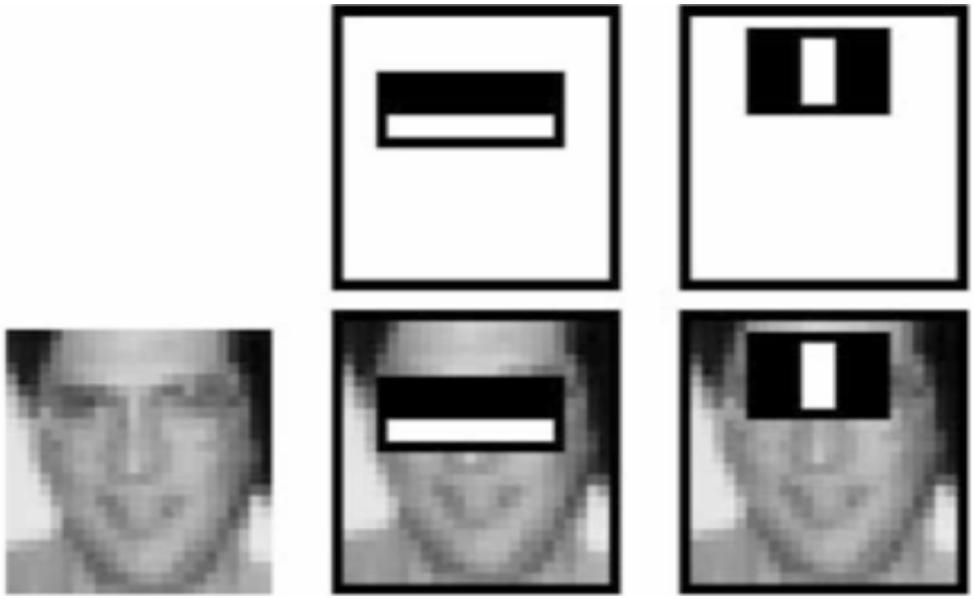
Hubel & Wiesel, 1968


Visual Cortices
Parietal Lobe
LGN
Occipital Lobe
V5 (Motion)
V7
V3a (Motion)
Light
V3 (Form)
LO
Extrastriate Cortex
V2 (Relays signals)
V1 (Catalogs Input)
Striate Cortex
Temporal Lobe
VP (Relays signals)
Visual Radiation
V4 (Color and Form)
Extrastriate Cortex
V8
Sagittal Section
V7
V3a
V3
V1
V2
VP
V4
V8


K(2012)
L(1998)
F(1980)
V(2001)
biological vision
H&W (1959)
deep
traditional ML
543m

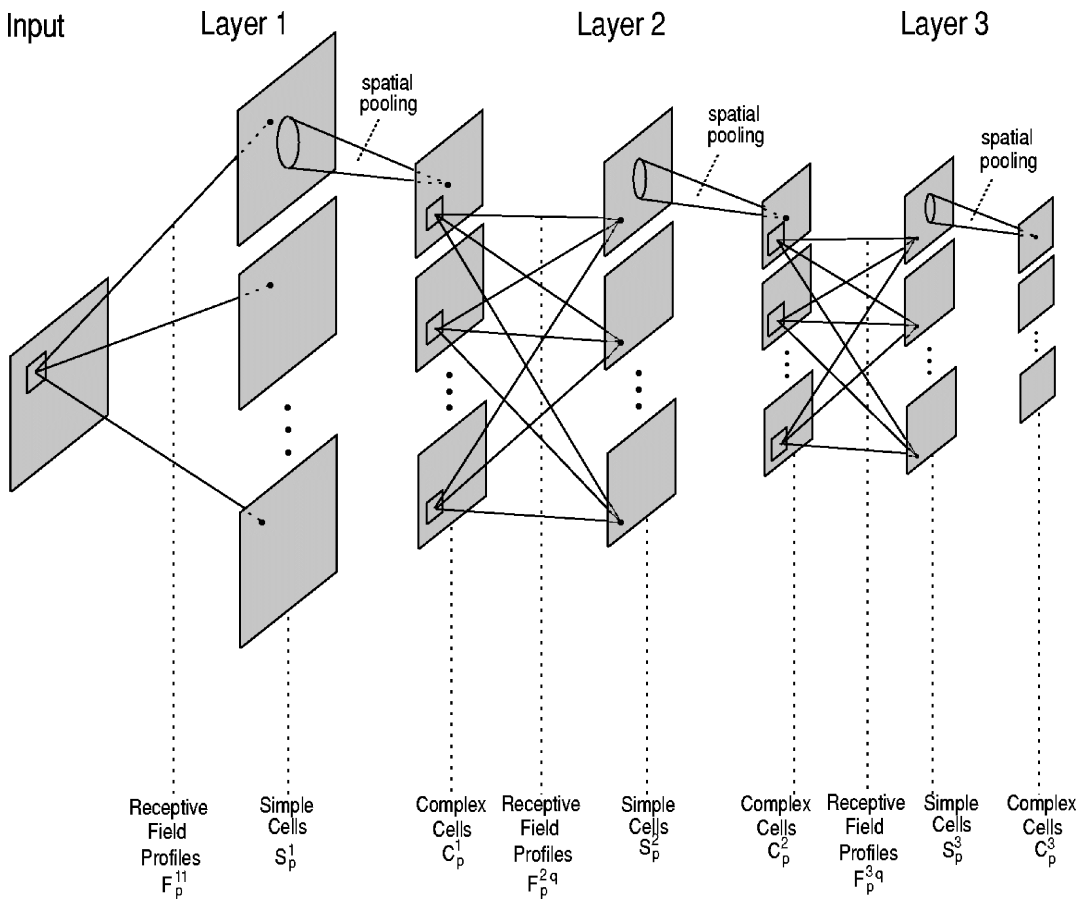

feature eng.
modeling

Viola & Jones (2001)



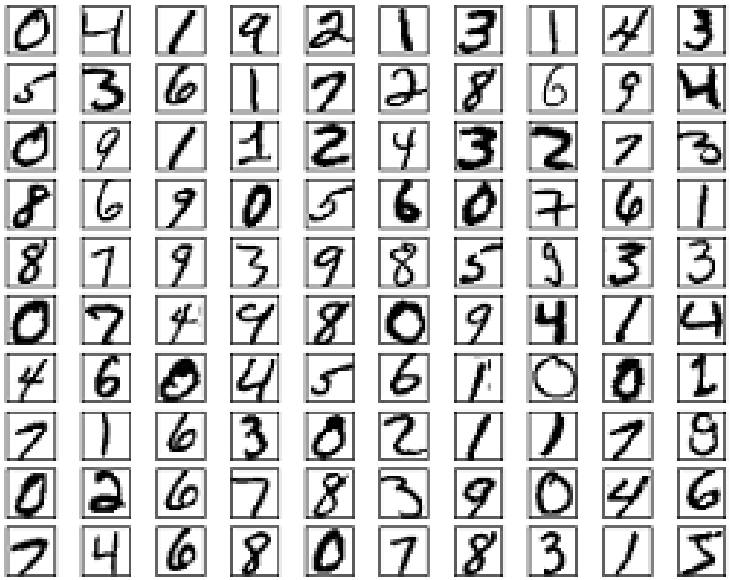
Neurocognitron

Fukushima (1980)



MNIST & LeNet-5

LeCun et al. (1998)



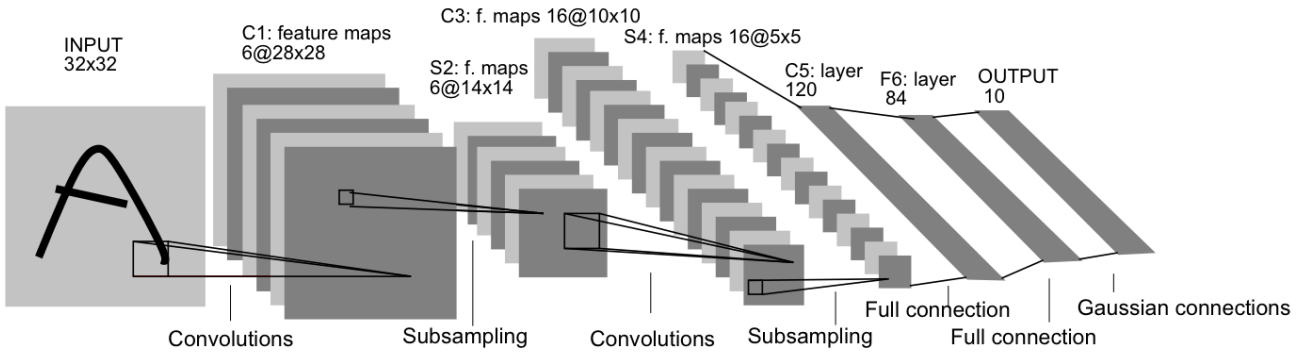
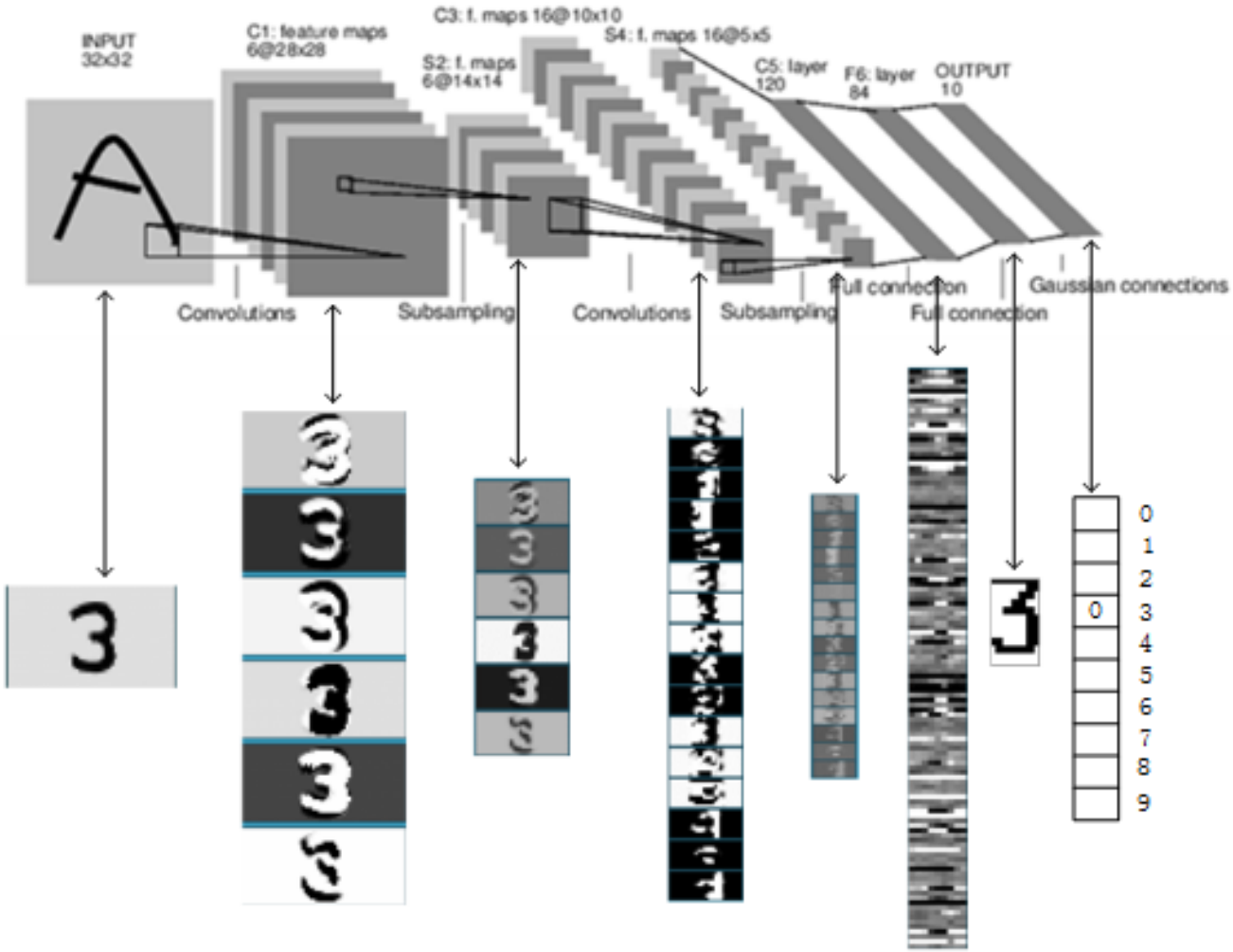
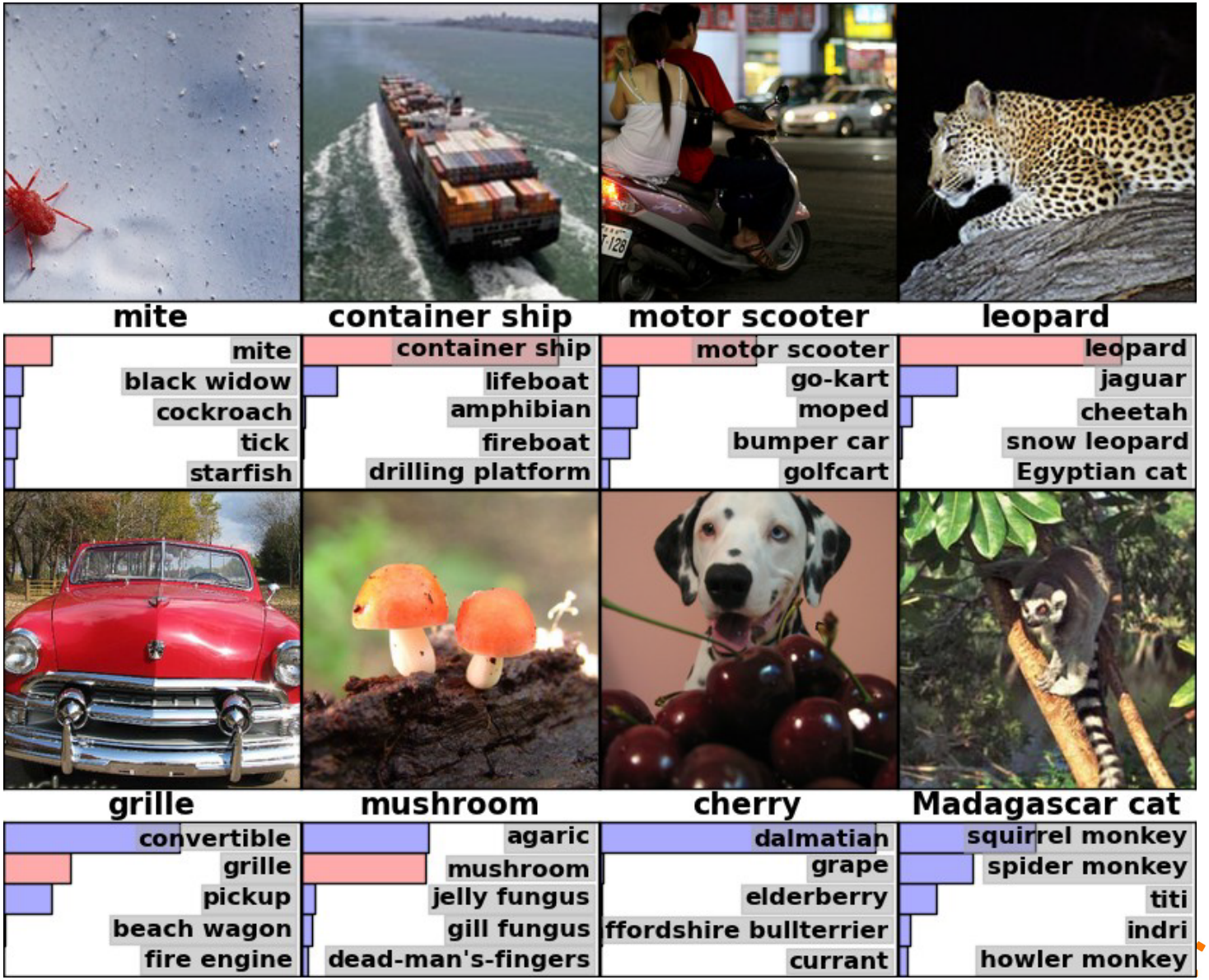


Fig. 2. Architecture of LeNet-5, a Convolutional Neural Network, here for digits recognition. Each plane is a feature map, i.e. a set of units whose weights are constrained to be identical.

LeCun, Boutou, Bengio & Haffner (1998)

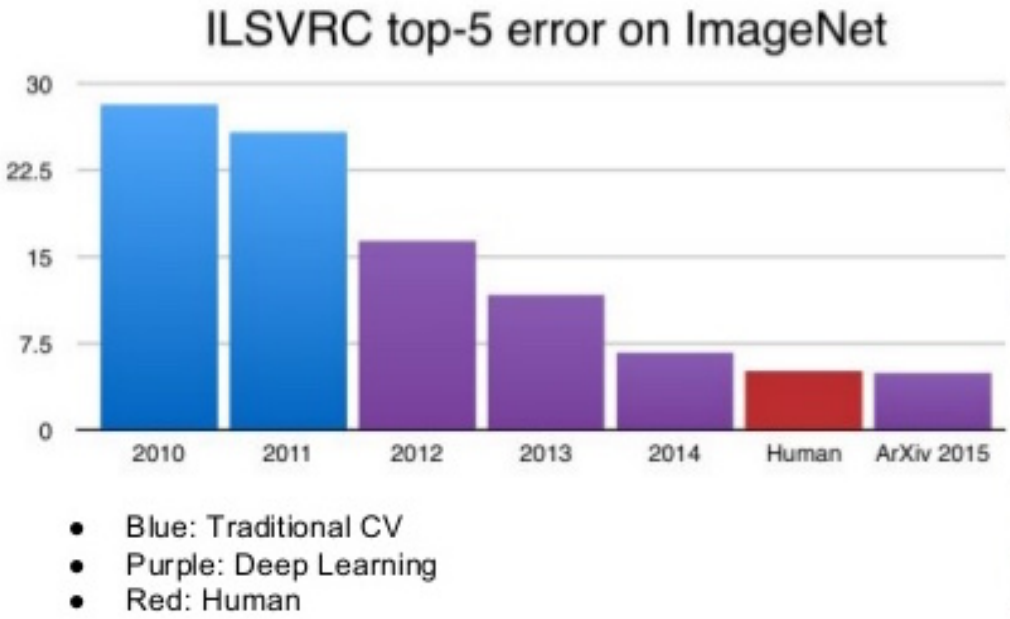


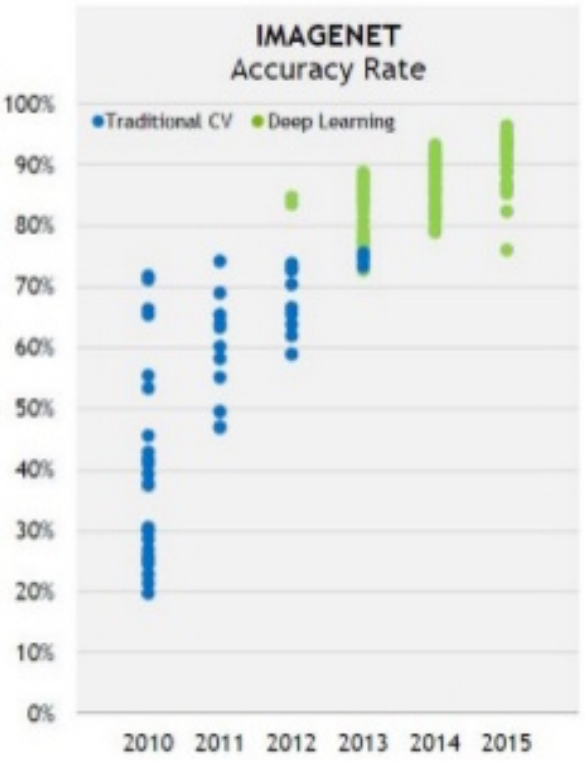
ImageNet


mite
mite
black widow
cockroach
tick
starfish
container ship
container ship
lifeboat
amphibian
fireboat
drilling platform
motor scooter
motor scooter
go-kart
moped
bumper car
golfcart
leopard
leopard
jaguar
cheetah
snow leopard
Egyptian cat
grille
convertible
grille
pickup
beach wagon
fire engine
mushroom
agaric
mushroom
jelly fungus
gill fungus
dead-man's-fingers
cherry
dalmatian
grape
elderberry
ffordshire bullterrier
currant
Madagascar cat
squirrel monkey
spider monkey
titi
indri
howler monkey

ImageNet Classification Error

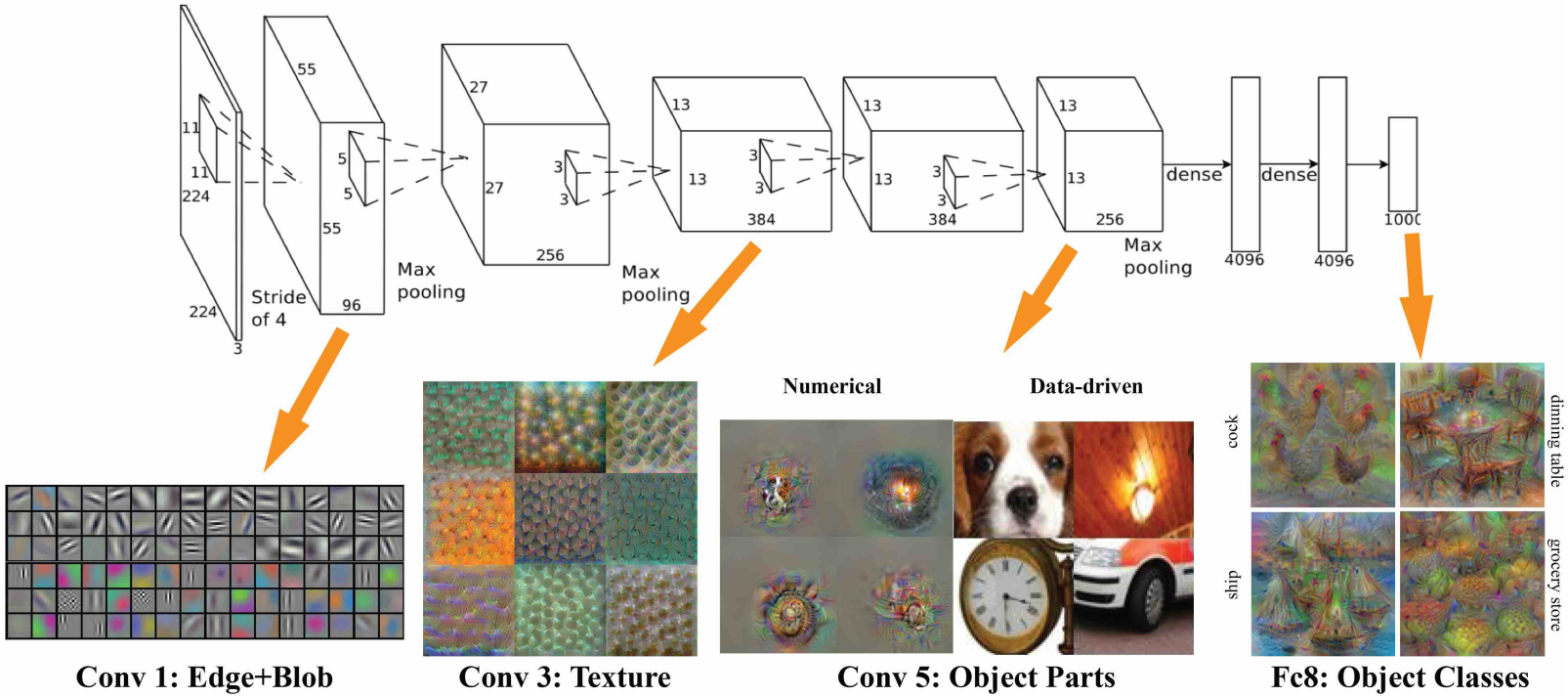
ILSVRC: 1.4m, 1k object classes





AlexNet

Krizhevsky, Sutskever & Hinton (2012)

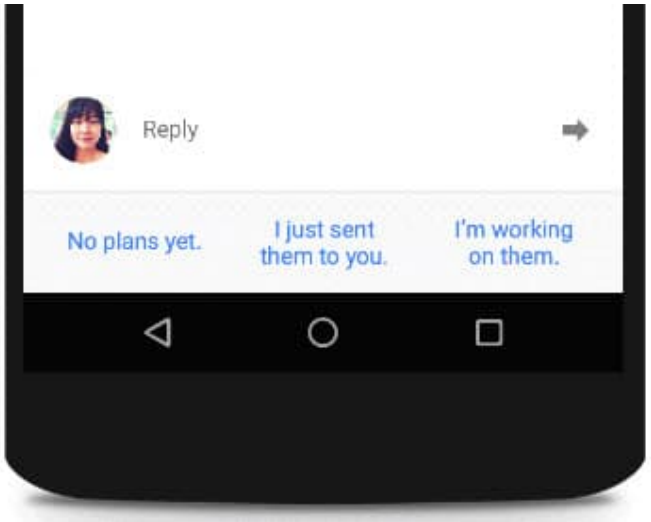


What AlexNet “Sees”

Yosinski et al. (2015)

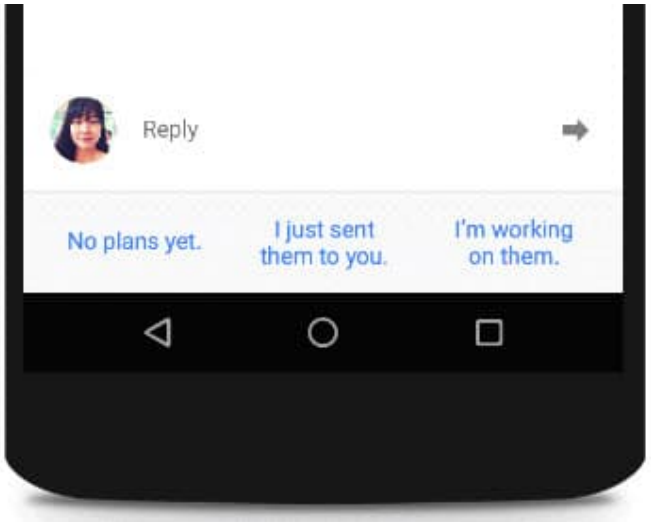
[Deep Visualization Toolbox]

mark zuckerberg
Mark Zuckerberg
11,814 like this. · Business P...


Reply
No plans yet.
I just sent them to you.
I'm working on them.

"Remind me about this when I get home"
tap to edit
OK, I'll remind you when you arrive at home:
Reminder
11 Hot Beach Escapes - Jetsetter
Arriving: Home
Remove

mark zuckerberg
Mark Zuckerberg
11,814 like this. · Business P...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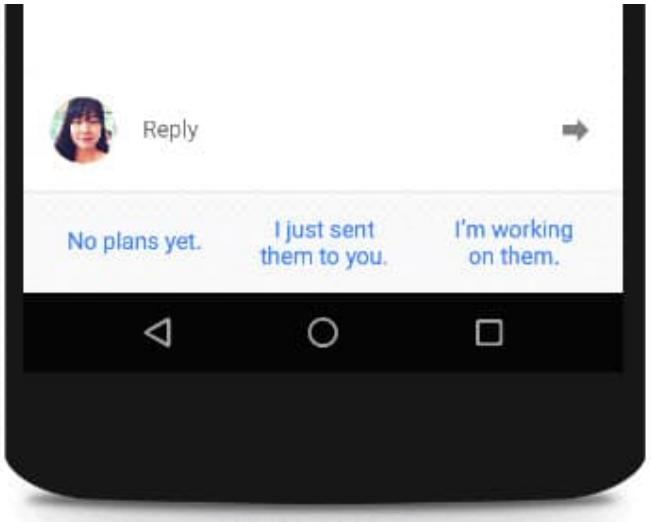
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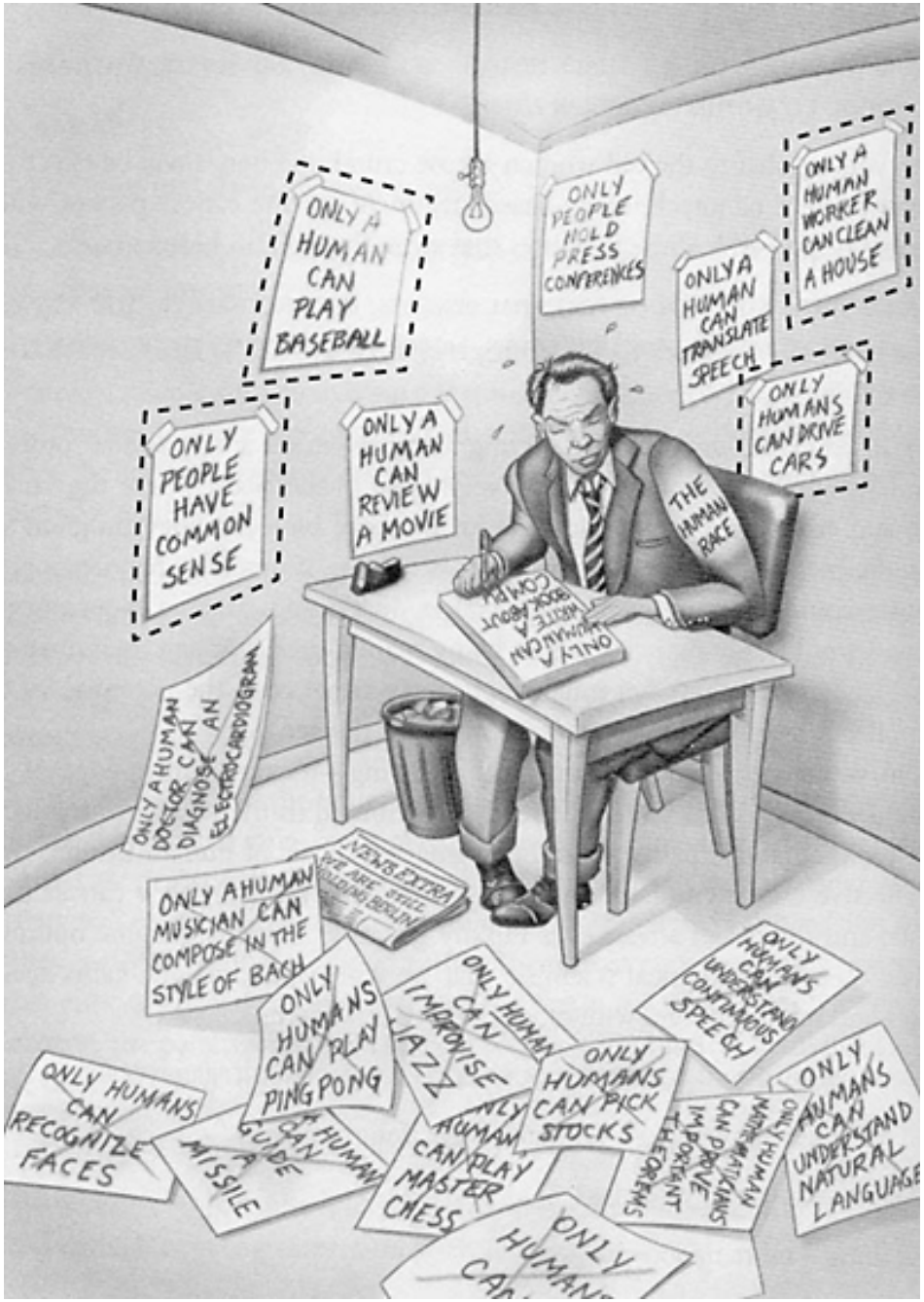
Remove

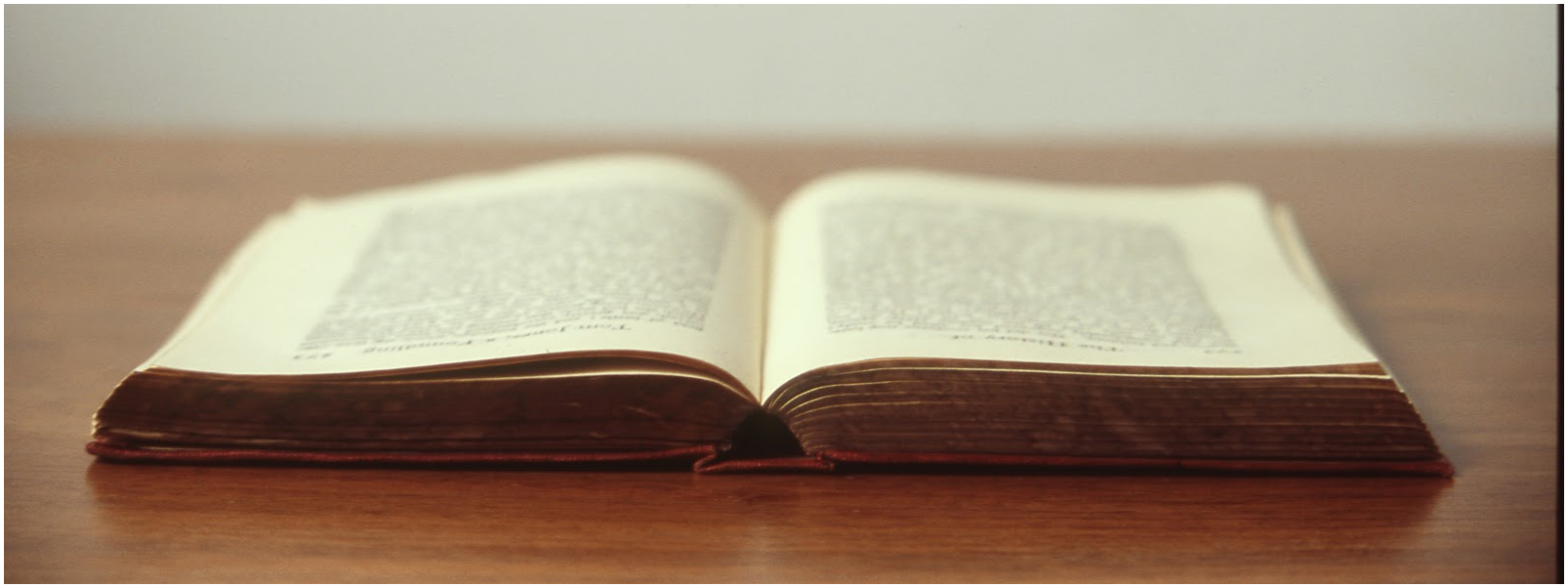

ONLY A HUMAN CAN PLAY BASEBALL
ONLY PEOPLE HOLD PRESS CONFERENCES
ONLY A HUMAN WORKER CAN CLEAN A HOUSE
ONLY A HUMAN CAN TRANSLATE SPEECH
ONLY PEOPLE HAVE COMMON SENSE
ONLY A HUMAN CAN REVIEW A MOVIE
ONLY HUMANS CAN DRIVE CARS
THE HUMAN RACE
ONLY A HUMAN DOCTOR CAN DIAGNOSE AN ELECTROCARDIOGRAM
ONLY A HUMAN MUSICIAN CAN COMPOSE IN THE STYLE OF BACH
NEWS EXTRA
ONLY HUMANS CAN PLAY PING PONG
ONLY HUMANS CAN IMPROVISE JAZZ
ONLY HUMANS CAN PICK STOCKS
ONLY HUMANS CAN UNDERSTAND CONTINUOUS SPEECH
ONLY HUMANS CAN RECOGNIZE FACES
A HUMAN CAN GUIDE A MISSILE
A HUMAN CAN PLAY MASTER CHESS
ONLY HUMANS CAN UNDERSTAND NATURAL LANGUAGE

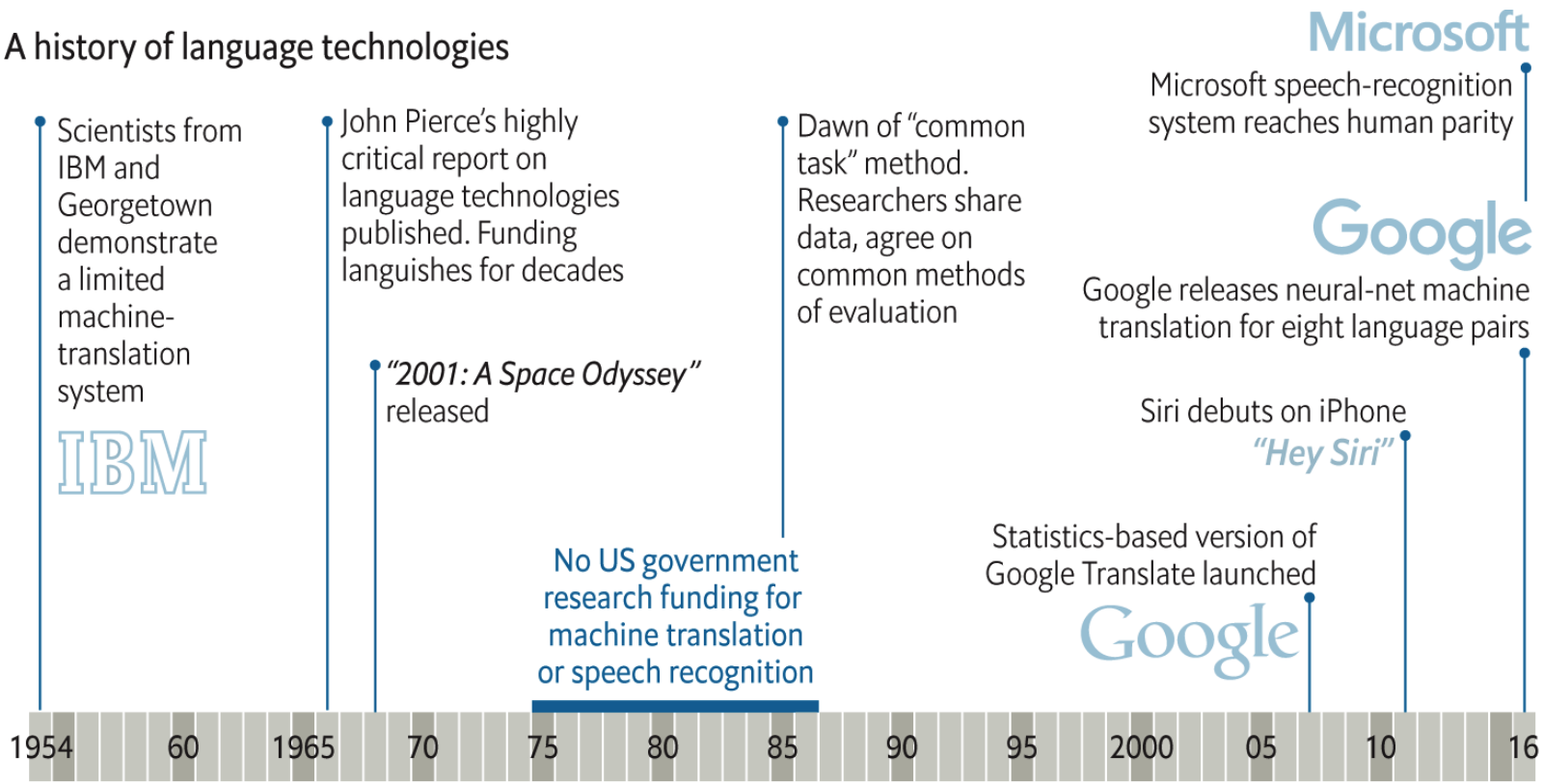
Outline

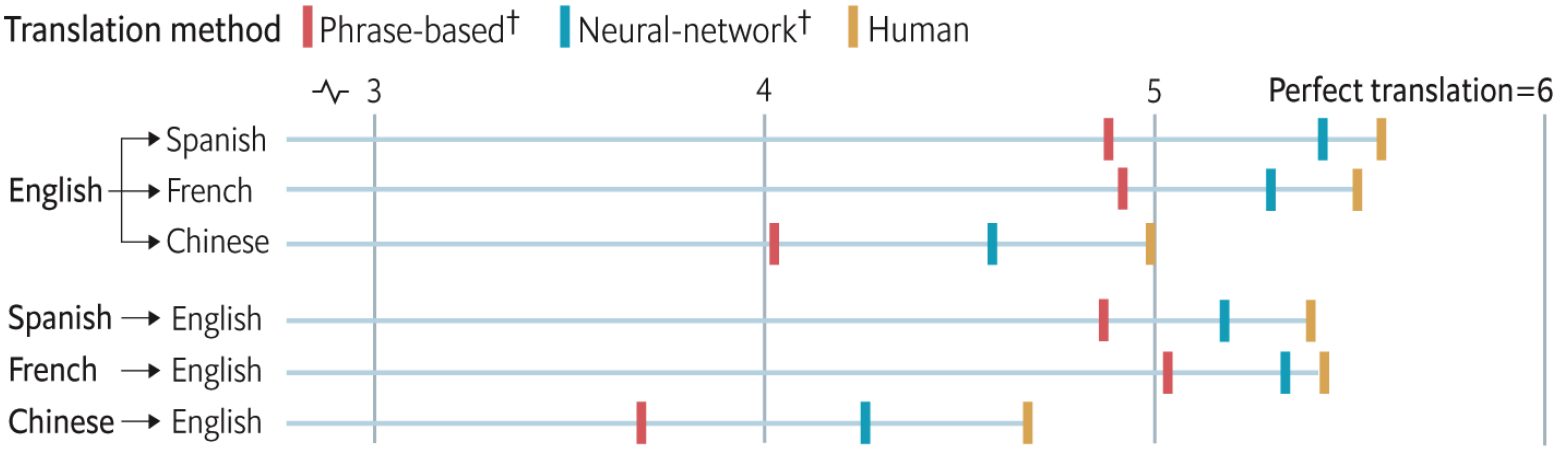
1 The Unreasonable Effectiveness of Deep Learning

2 Deep Learning for Natural Language Processing

3 Intelligence Applications to Talent

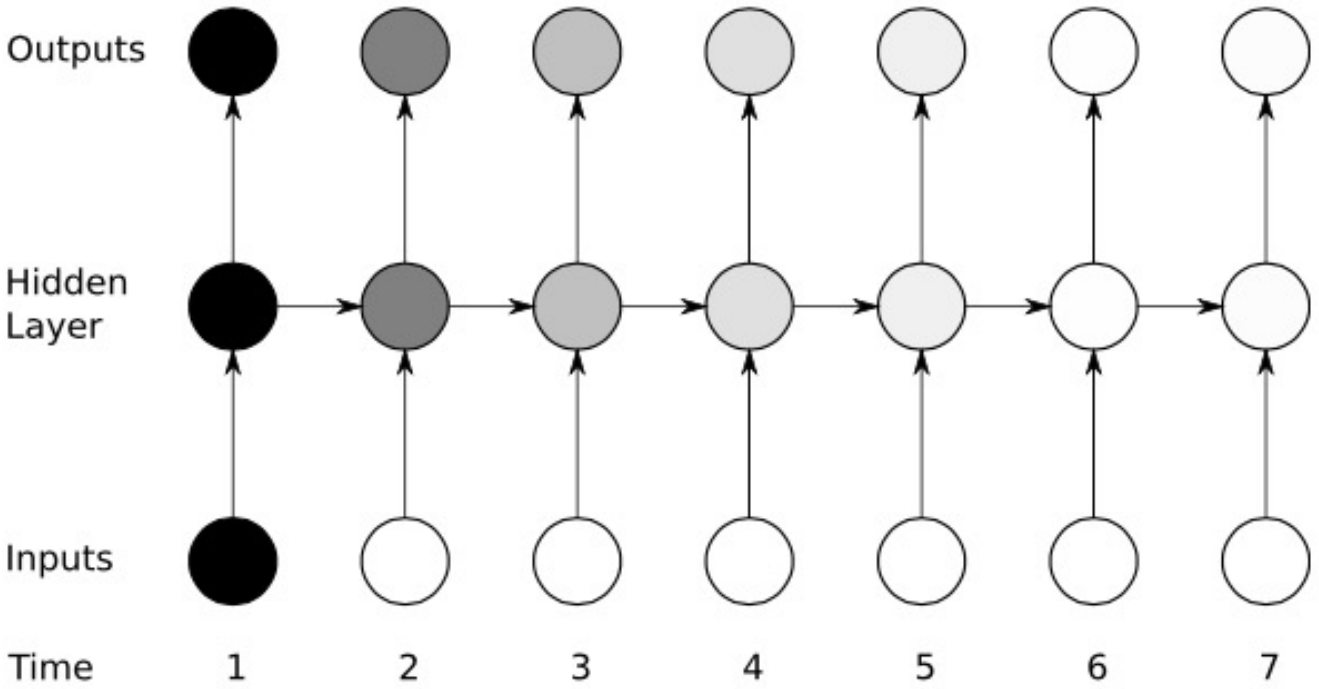



A history of language technologies
Scientists from IBM and Georgetown demonstrate a limited machine-translation system
IBM
John Pierce's highly critical report on language technologies published. Funding languishes for decades
"2001: A Space Odyssey" released
No US government research funding for machine translation or speech recognition
Dawn of "common task" method. Researchers share data, agree on common methods of evaluation
Statistics-based version of Google Translate launched
Google
Siri debuts on iPhone
"Hey Siri"
Microsoft
Microsoft speech-recognition system reaches human parity
Google
Google releases neural-net machine translation for eight language pairs
1954
60
1965
70
75
80
85
90
95
2000
05
10
16

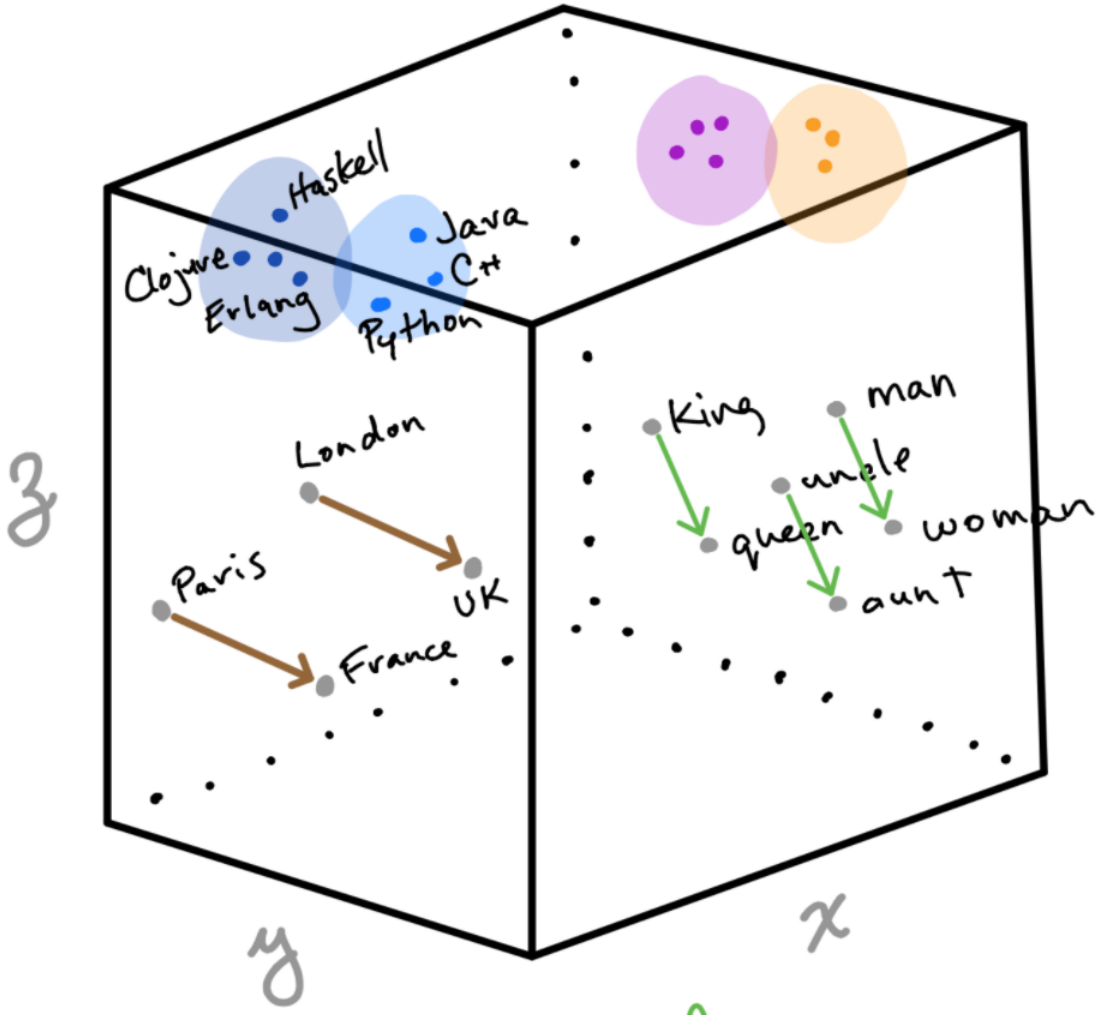

Translation method
Phrase-based†
Neural-network†
Human
3
4
5
Perfect translation=6
English → Spanish
English → French
English → Chinese
Spanish → English
French → English
Chinese → English

Long Short-Term Memory

Hochreiter & Schmidhuber (1997)

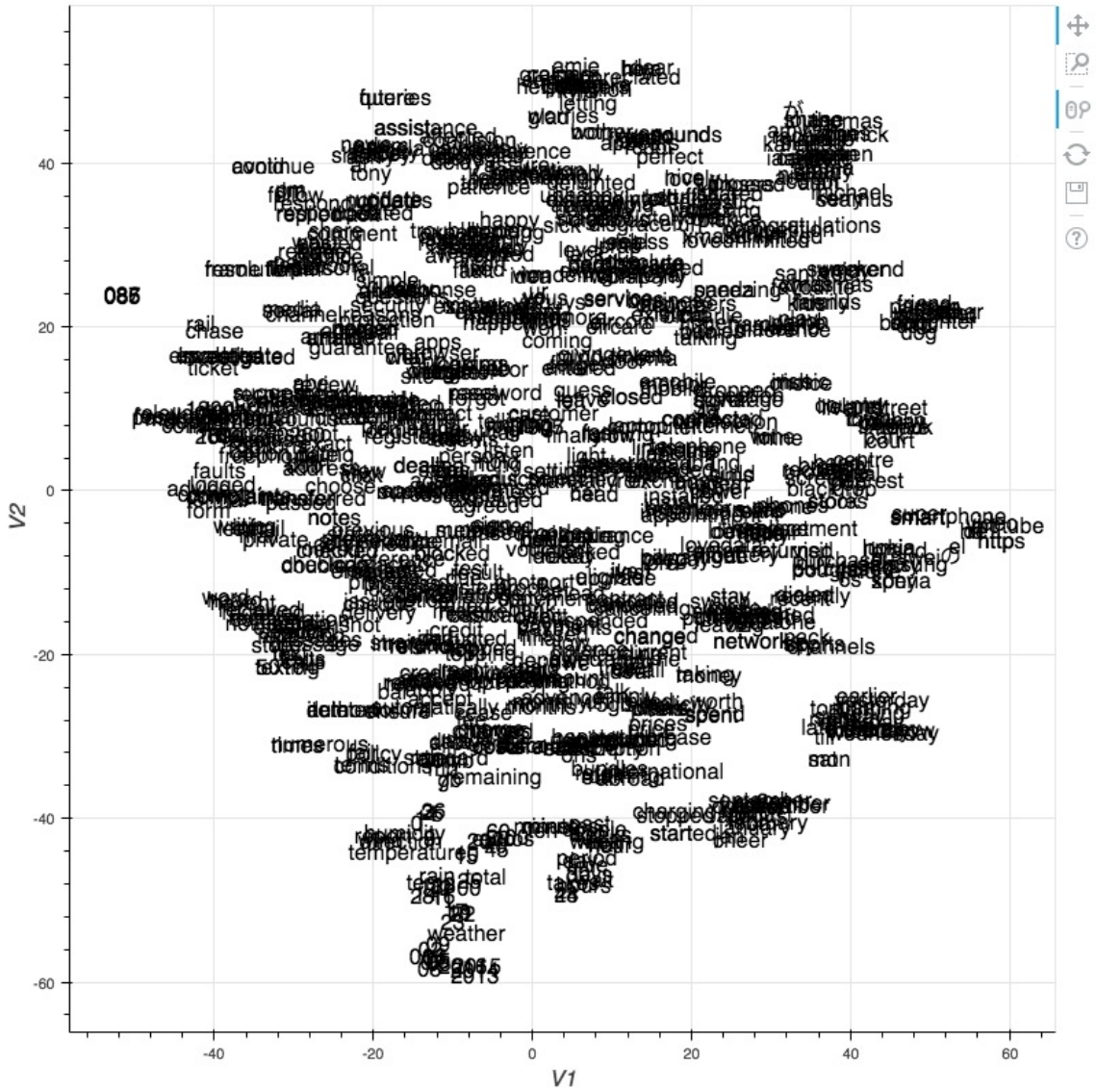


Vector Representations of Words



t-SNE

Hinton & van der Maaten (2008)



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1 The Unreasonable Effectiveness of Deep Learning

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Word Vectors

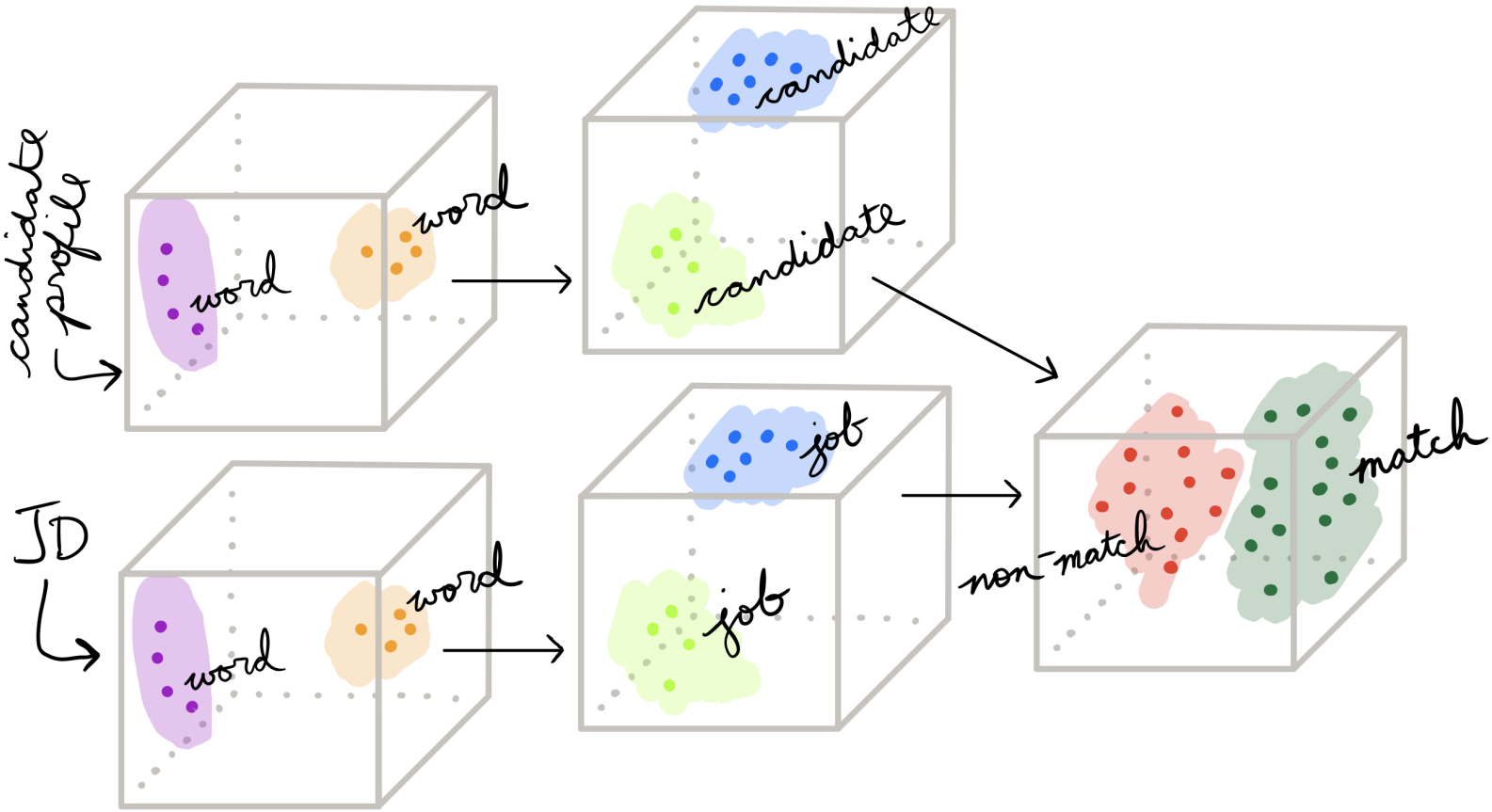
```
Similar to Java:                    j2ee, j2se, javaee, groovy, jee
Similar to Javascript:              jquery, css, html, html5, css3
Similar to Delivered:               produced, completed, presented, scoped, launched
Similar to Python + Matlab + R:     numpy, mathematica, scipy, octave, matplotlib
Similar to Python + Flask + Django: sqlalchemy, ruby, clojure, nodejs, rails
Similar to Python + Perl + Shell:   bash, awk, ksh, scripting, jython
```

Word Vectors

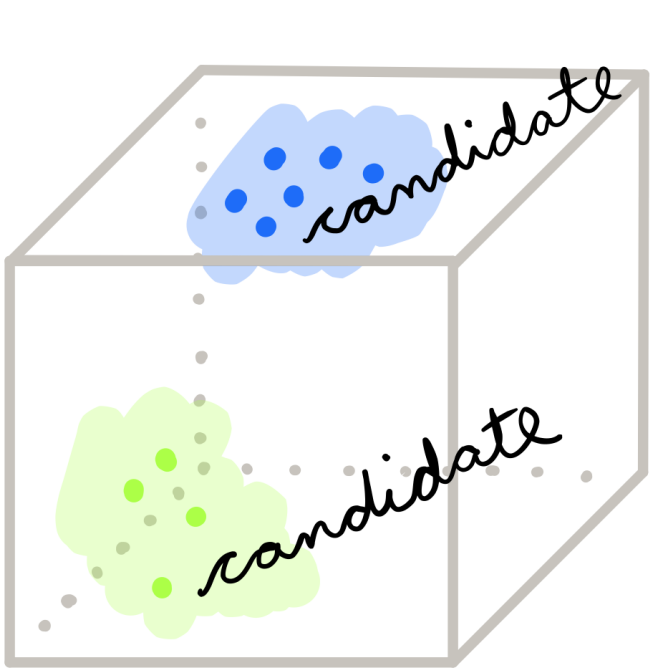
```
Similar to Java:                    j2ee, j2se, javaee, groovy, jee
Similar to Javascript:              jquery, css, html, html5, css3
Similar to Delivered:               produced, completed, presented, scoped, launched
Similar to Python + Matlab + R:     numpy, mathematica, scipy, octave, matplotlib
Similar to Python + Flask + Django: sqlalchemy, ruby, clojure, nodejs, rails
Similar to Python + Perl + Shell:   bash, awk, ksh, scripting, jython
```

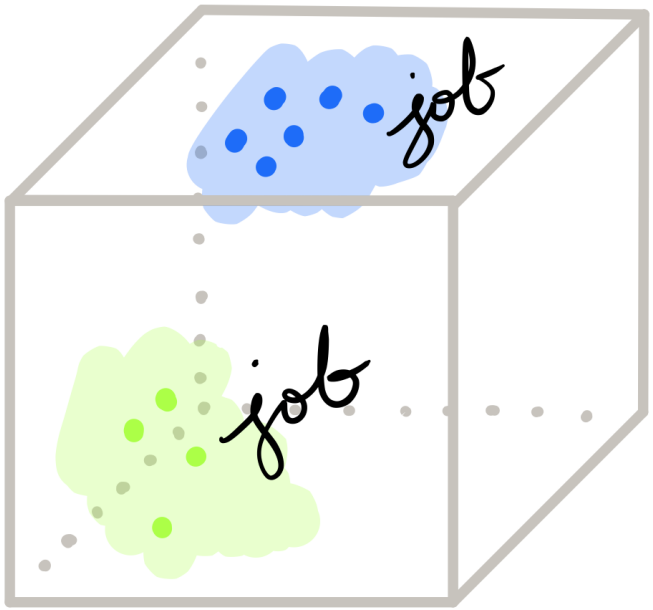
Model Architecture

Deep Learning Network



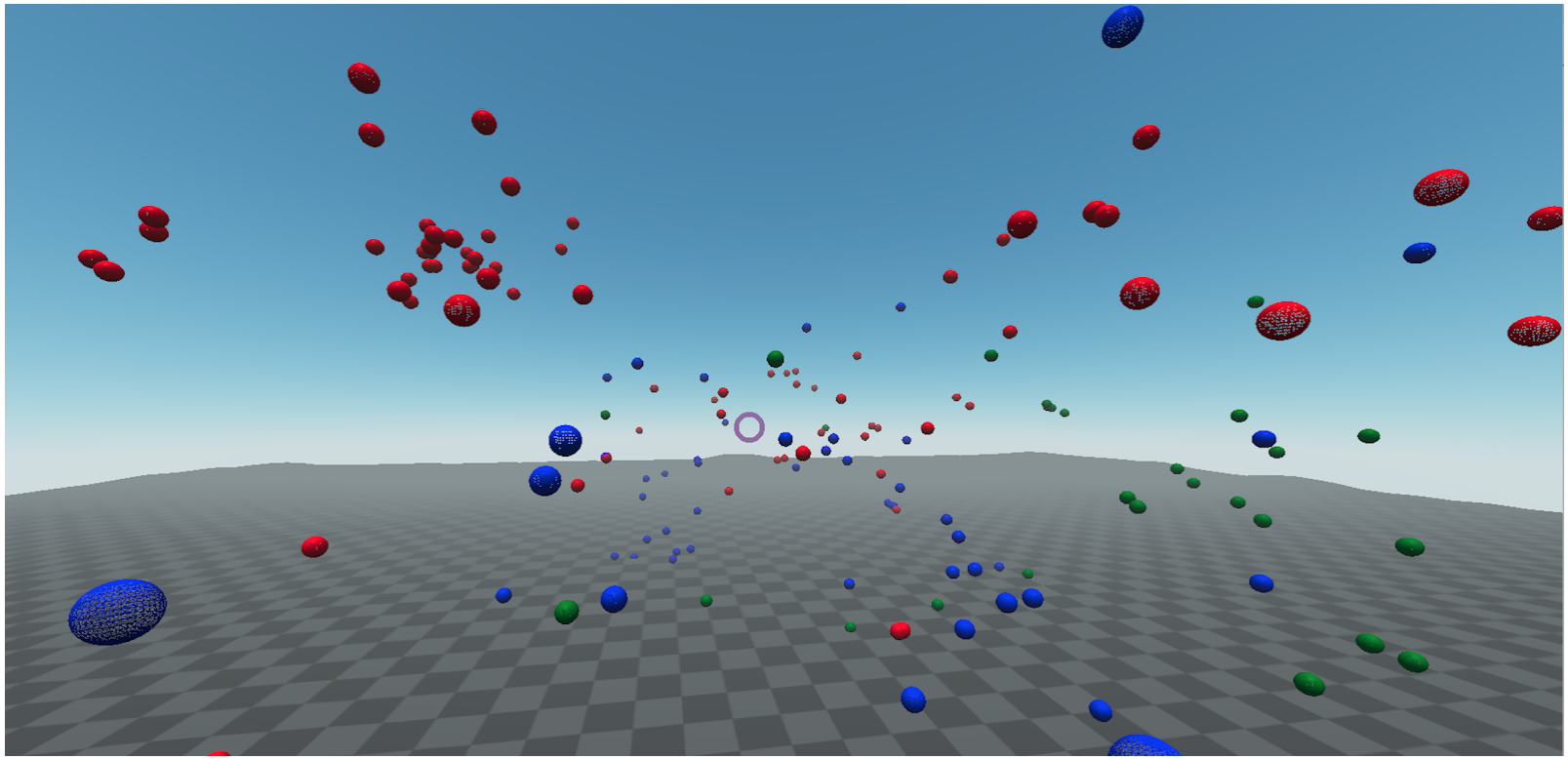
Higher-Order Embeddings





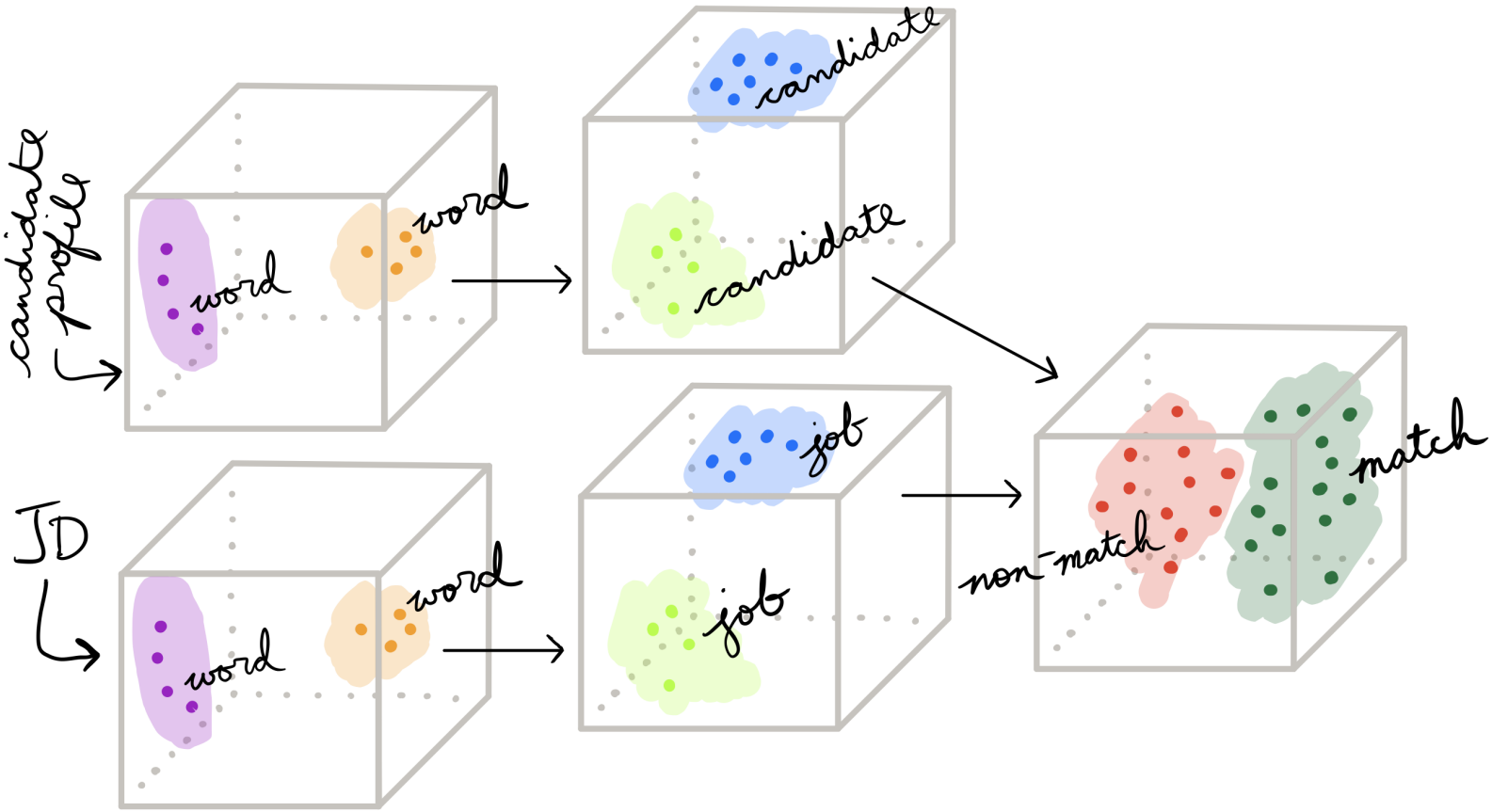
Candidate Space

Now Showing in 3D



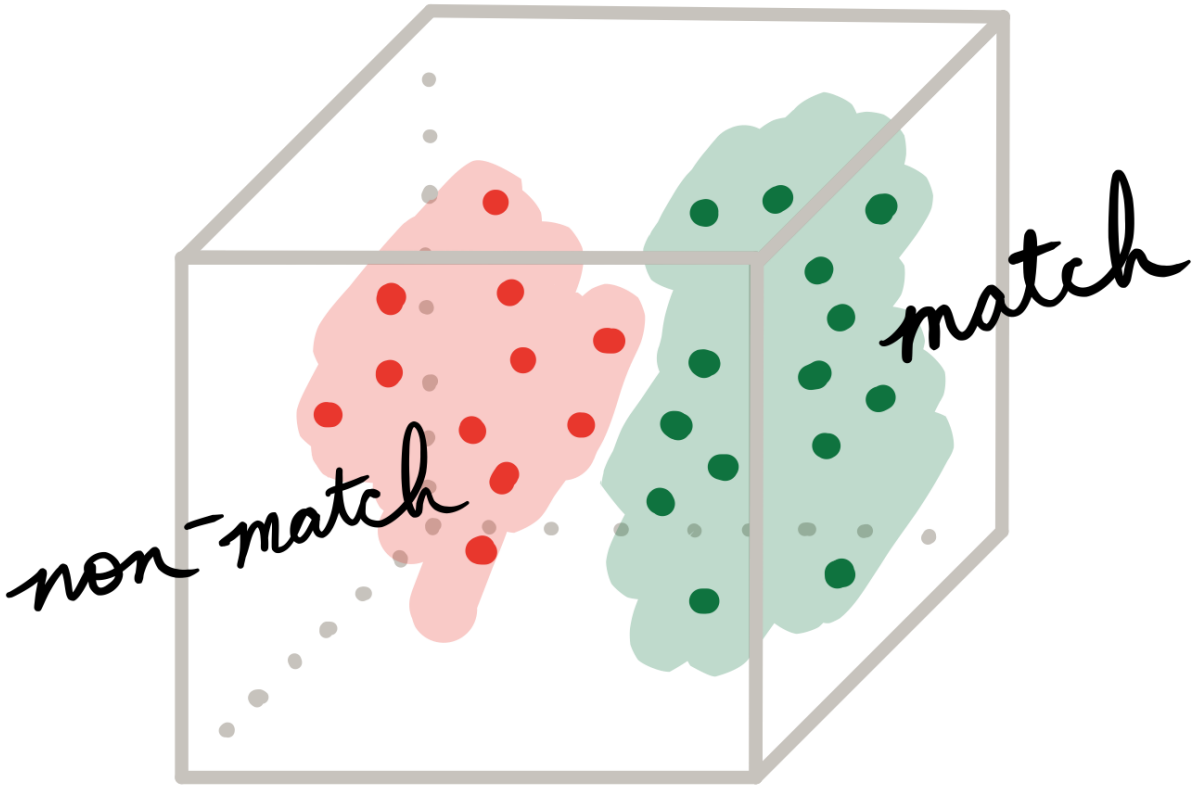
Model Architecture

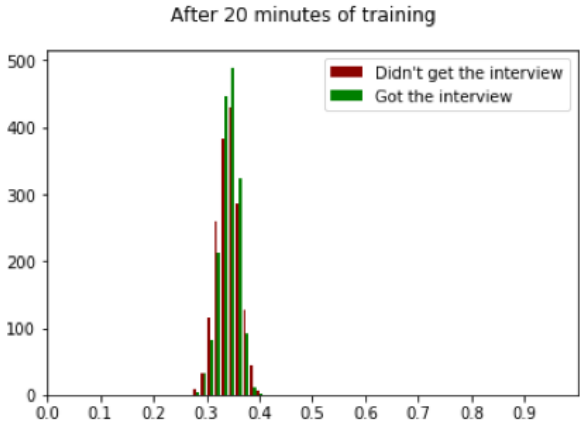
Deep Learning Network

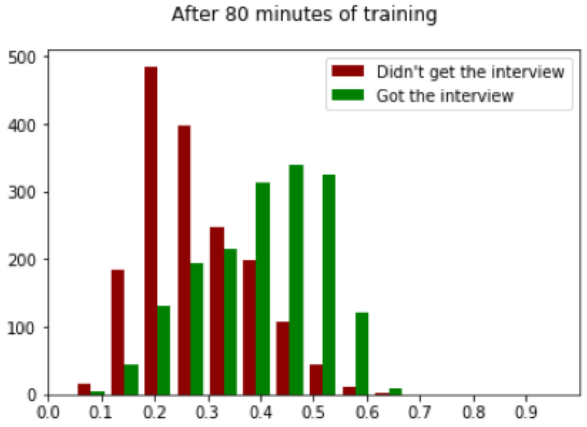


Decision-Level Embeddings

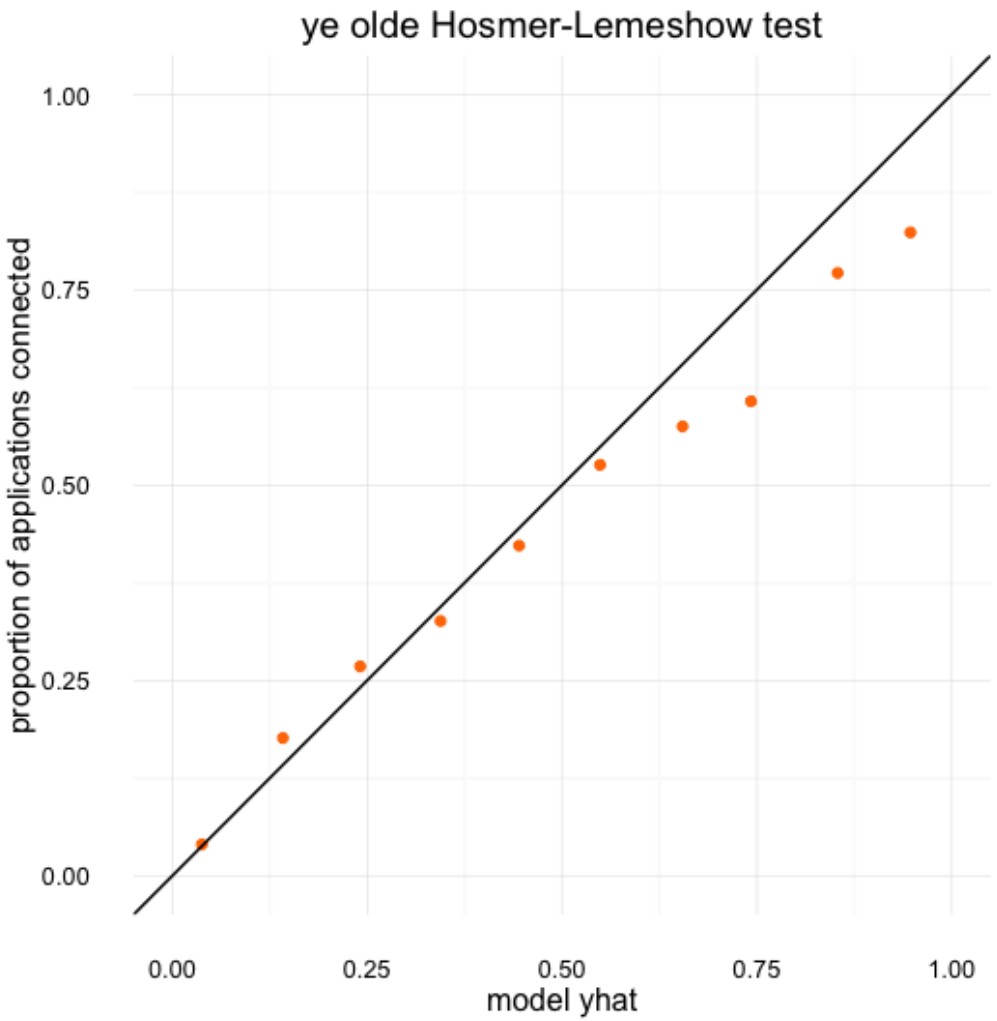
The Highest Order




After 20 minutes of training
Didn't get the interview
Got the interview
500
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9


After 80 minutes of training
Didn't get the interview
Got the interview
500
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

After 120 minutes of training
Didn't get the interview
Got the interview
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9


ye olde Hosmer-Lemeshow test
proportion of applications connected
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
model yhat

Top Jobs

Senior Back-End Engineer

untapt

Andrew Vlahutin

Hands-on Data Scientist, Developer and Technology leader looking for a role to apply data skills to business problems

New York, NY
(347)-738-3149

Career History

2016 **Cornerstone Capital Management Holdings – Vice President Director of Technology**

December 2012 to September 2016 (3.8 years)

Strategic planning and delivery of all technology initiatives and related support for asset management firm with $14 billion in assets under management. Provided strategic direction and oversight of team responsible for applications development, infrastructure, and end user support.
Designed and implemented a single strategic front office trading platform, Charles River IMS (CRIMS), to replace two disparate trade order management systems. Decoupled CRIMS and internal applications by adopting industry SOA and ETL best practices.
Redesigned and streamlined data feeds to increase efficiency of trading and settlement processes and eliminate redundant data reconciliation.
Skills: C#, .NET, IIS, Pentaho, MS Sql Server, SQL

2012 **J.P. Morgan Asset Management – Vice President Business Analyst and System Architect**

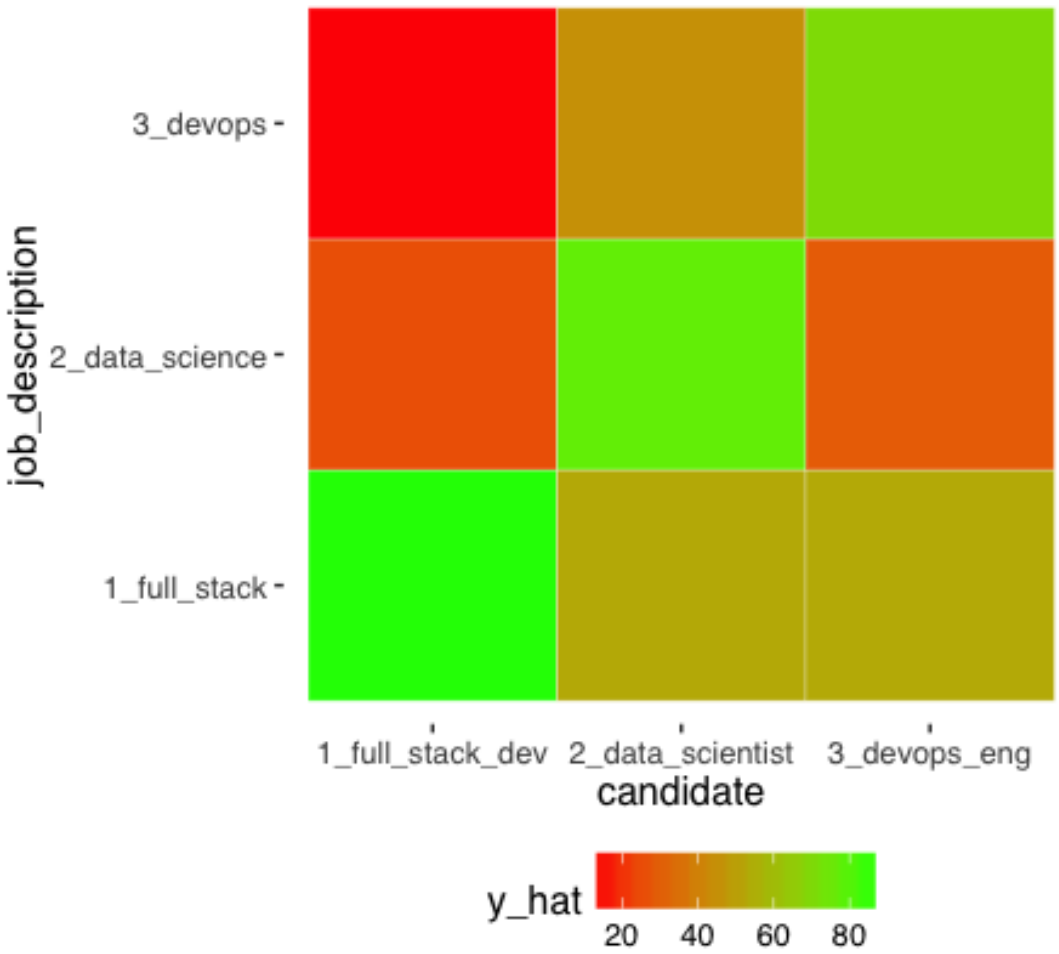
January 2008 to December 2012 (4.9 years)

U.S. based Accounting System replacement: Designed trade interface and data migration strategy between Eagle and front office trading systems, ensuring seamless transition to new accounting system. Global U.K. based Accounting System replacement: Redesigned data flow between multiple trading systems, new positional data store and service provider, resulting in greater accuracy and transparency of trade flow details. Identified and resolved timing dependencies around global data across systems in the U.S., U.K. and Asia.
Data Services Architecture: Architected and built system wide SOA layer, including multiple data services and a core Enterprise Service Bus. Facilitated adoption of Big Data solutions using Splunk log integration. Championed use of development methodologies around TDD, Agile development and efficient QA testing efforts.
Skills: Java, Spring, Mulesoft, Websphere, Agile (Scrum), Sybase, IBM DB2, SQL

Top Jobs

Senior Back-End Engineer

	Title	Client	Score
1	Java Developer	BlackRock	72.4
2	Director of Project Management	Hachette	68.0
3	VP of Technical Innovation	Texell	66.1
4	Database Engineer	WisdomTree	65.4
5	Data Analyst	Cerberus	64.5
6	CTO	Risk Priorities	63.9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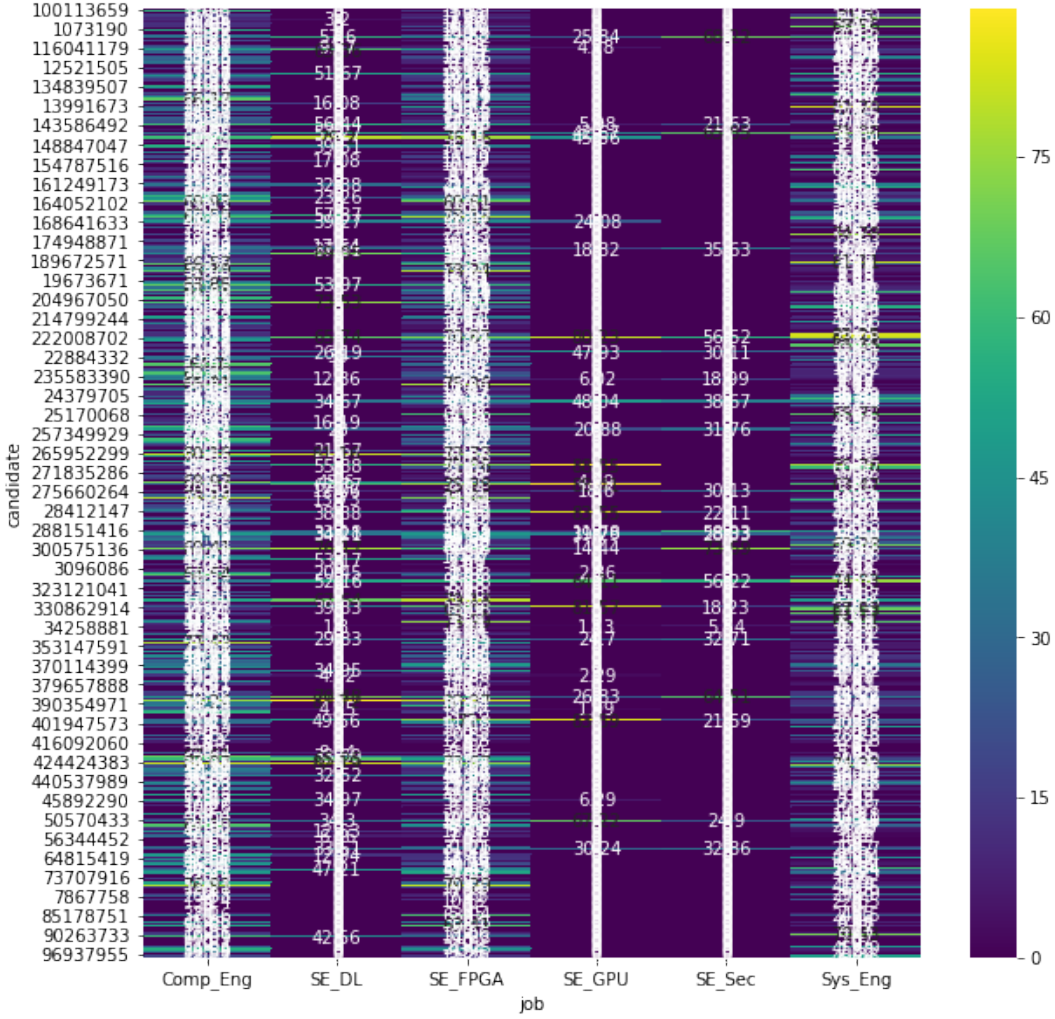
3_devops
2_data_science
1_full_stack
1_full_stack_dev
2_data_scientist
3_devops_eng
candidate
y_hat
20
40
60
80

“Genome” Plot


candidate
job
Comp_Eng
SE_DL
SE_FPGA
SE_GPU
SE_Sec
Sys_Eng
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60
45
30
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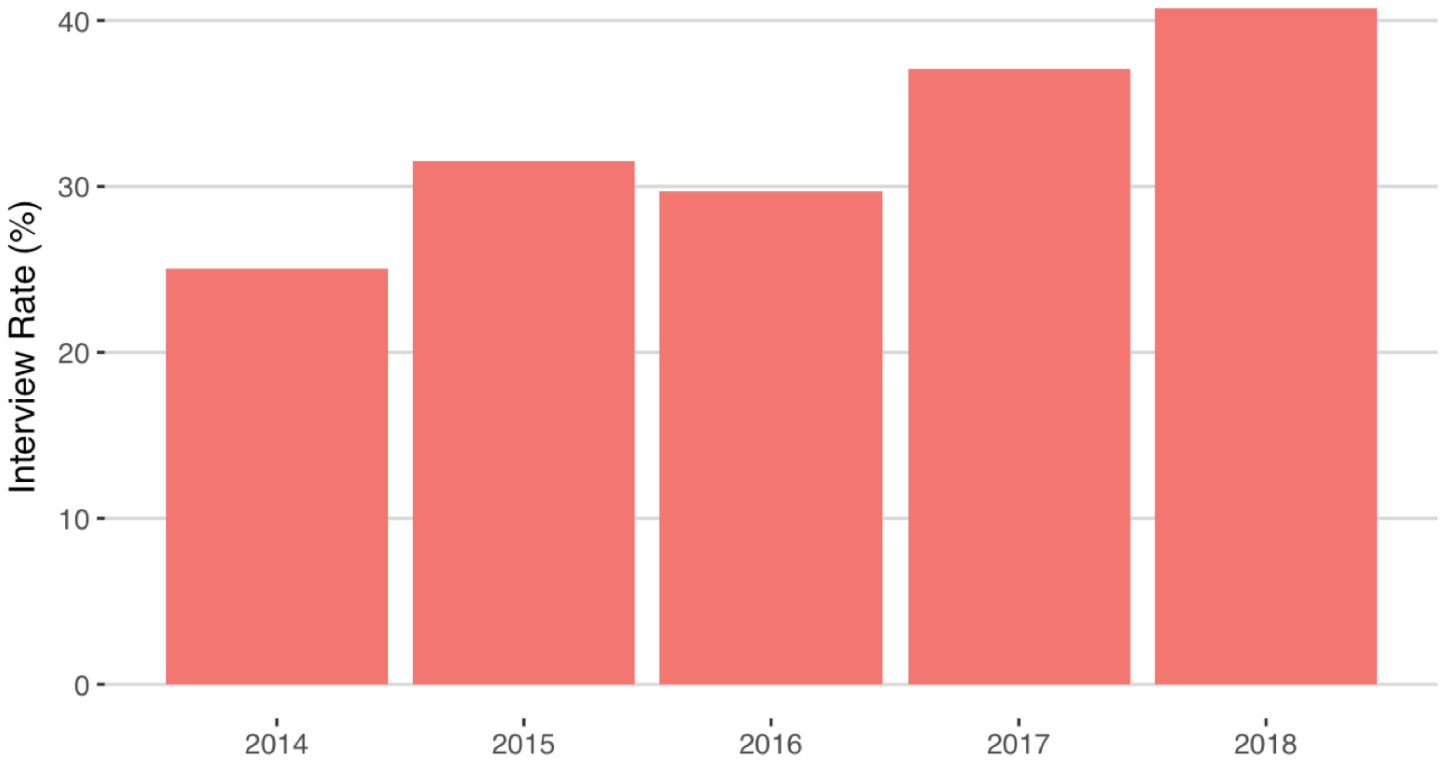
Interview Rate (%)
40
30
20
10
0
2014
2015
2016
2017
2018