

Machine Learning in Pharmaceutical Industry and PhUSE Machine Learning Project

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at Clindata Insight



The Agenda

- Why Machine Learning?
- Introduction of Machine Learning – Supervised, Unsupervised, Deep Neural Network
- Machine Learning implementation
- PhUSE Machine Learning Working Group
- Questions and Discussion



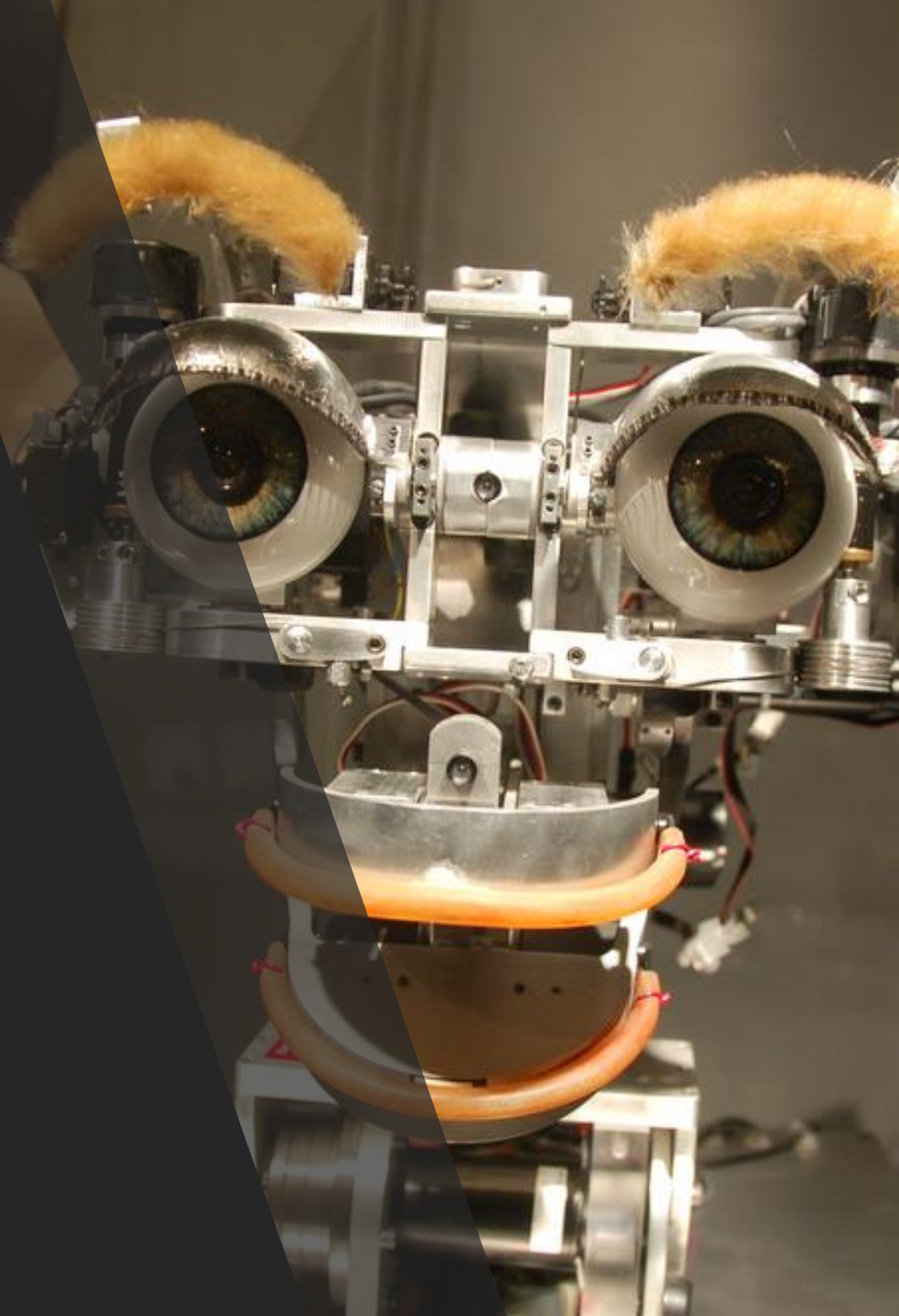
Honey, do
you know
about
Machine
Learning?

Why did people ask / expect me if I know about **Machine Learning?**

- Programming
- Statistics / modeling
- Working with data all the times

What is ML?

An application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience **without being explicitly programmed.**

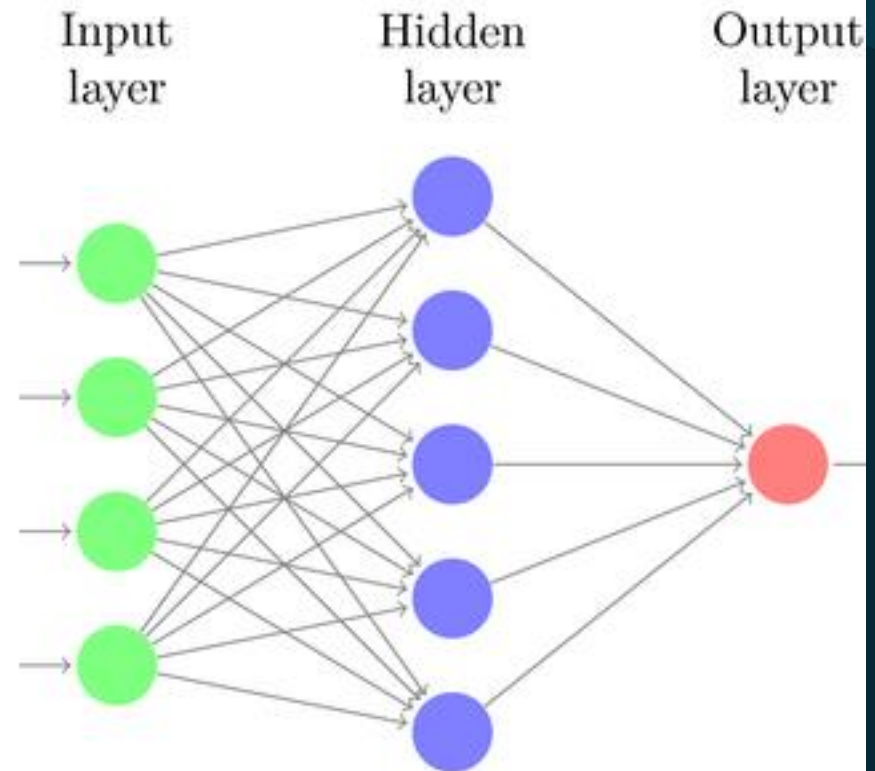


```

** Derivation of 1st Age group **;
if age < 65 then do;
    agegr1n=1; agegr1="<65";
end;
if 65<=age<=69 then do;
    agegr1n=2; agegr1="65 - 69";
end;
else if 70<=age<=74 then do;
    agegr1n=3; agegr1="70 - 74";
end;
else if 75<=age<=79 then do;
    agegr1n=4; agegr1="75 - 79";
end;
else if 80<=age<=84 then do;
    agegr1n=5; agegr1="80 - 84";
end;
else if age ge 85 then do;
    agegr1n=6; agegr1=">=85";
end;

```

Explicit programing



Machine Learning



How does Human Learn?
- Experience

How does Machine learn?

Test Data (cats)



Algorithm

cat

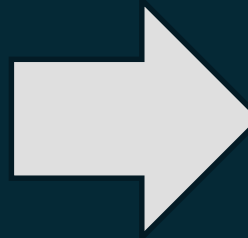
Real Data



How does Machine Learning work?

Input data

X0	X1	X2	...	Xn	Y
0	17	250		29	1
34	134	22		57	0
72	169	167		89	0
22	34	220		9	0
52	227	235		69	1

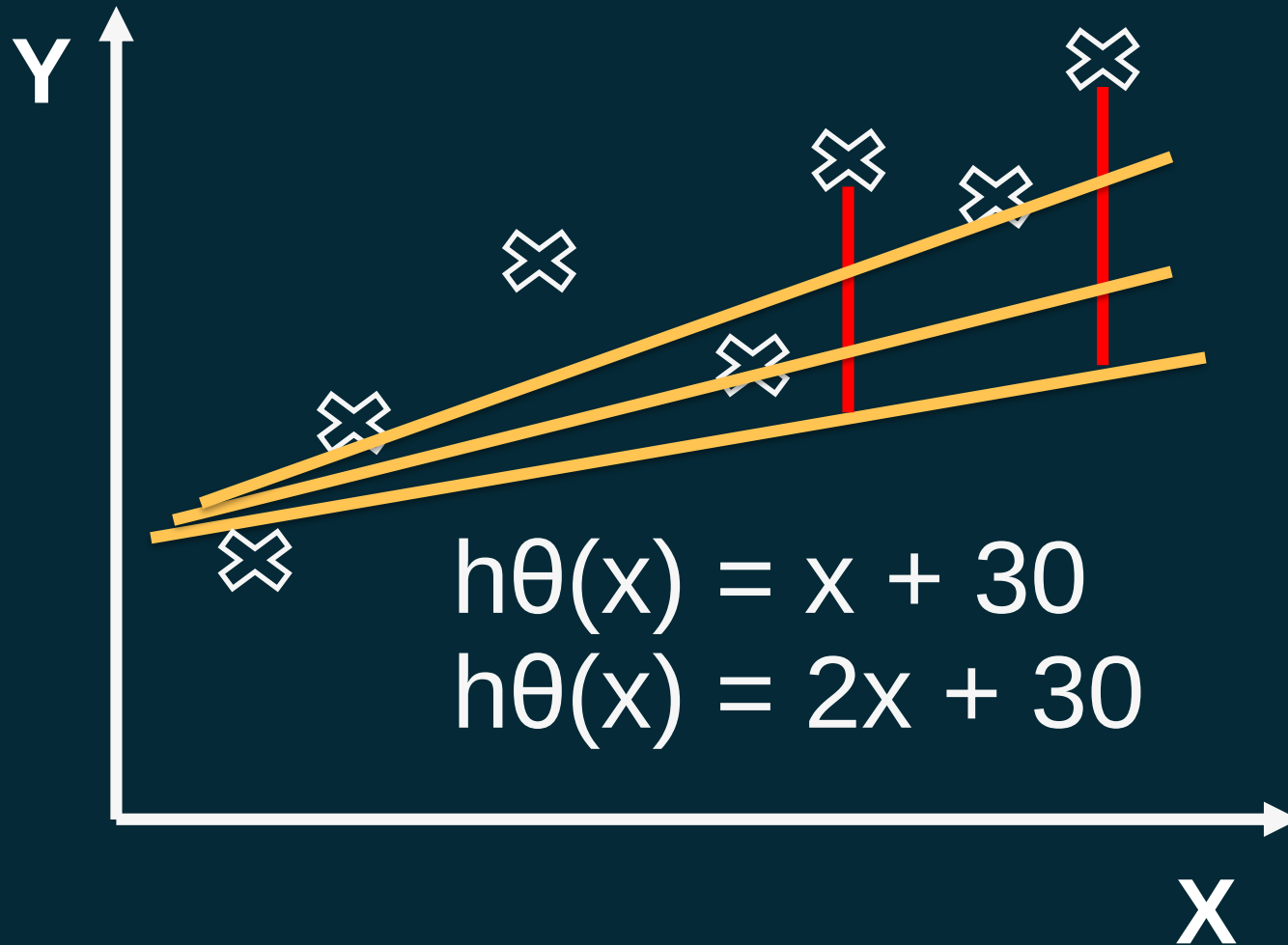


Algorithm

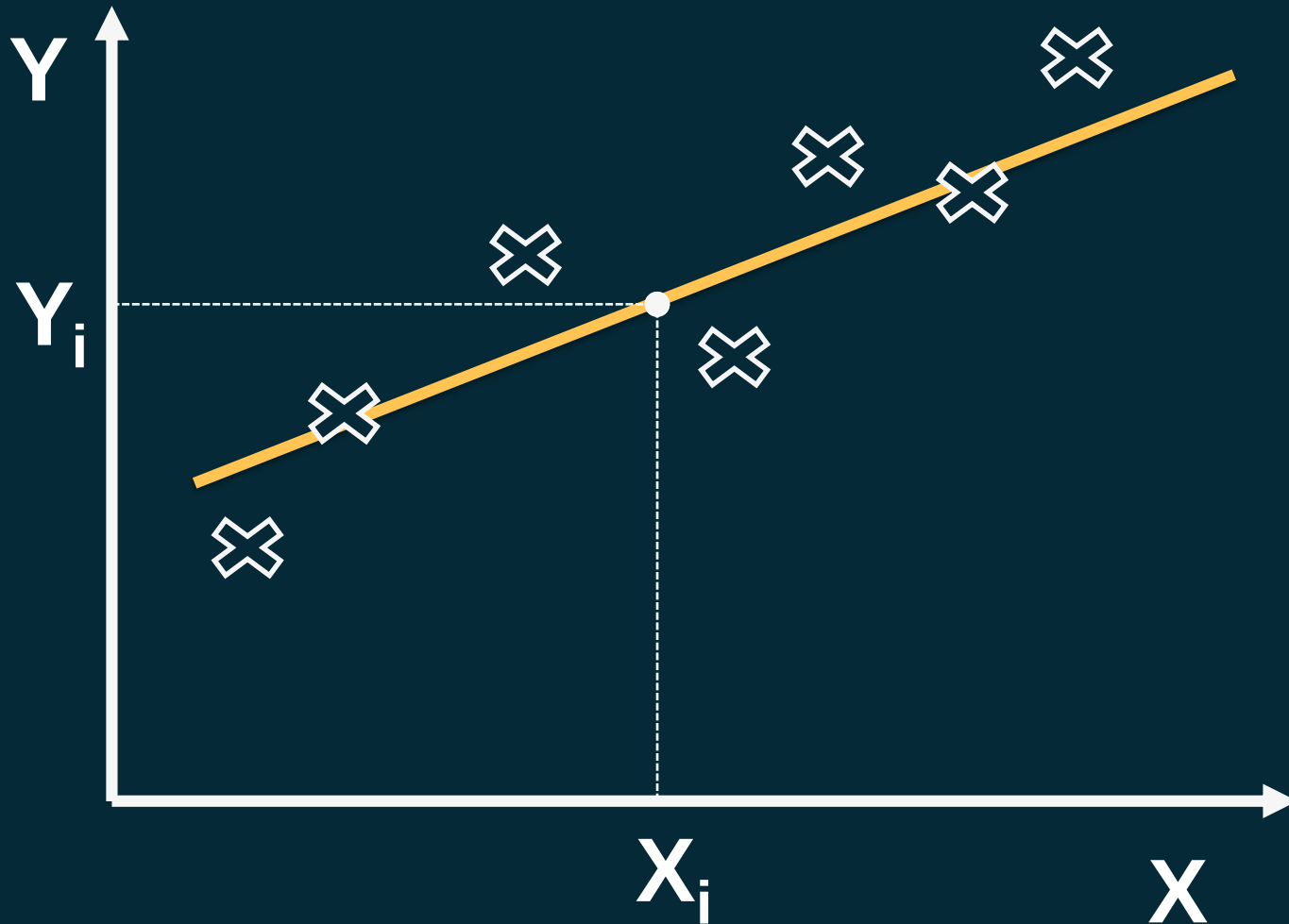
- Hypothesis Function - $h_{\theta}(x) = \theta x + b$
- Minimize Cost Function, $J(\theta) = h_{\theta}(x) - Y$, using Gradient Descent

Machine finds best model using input data

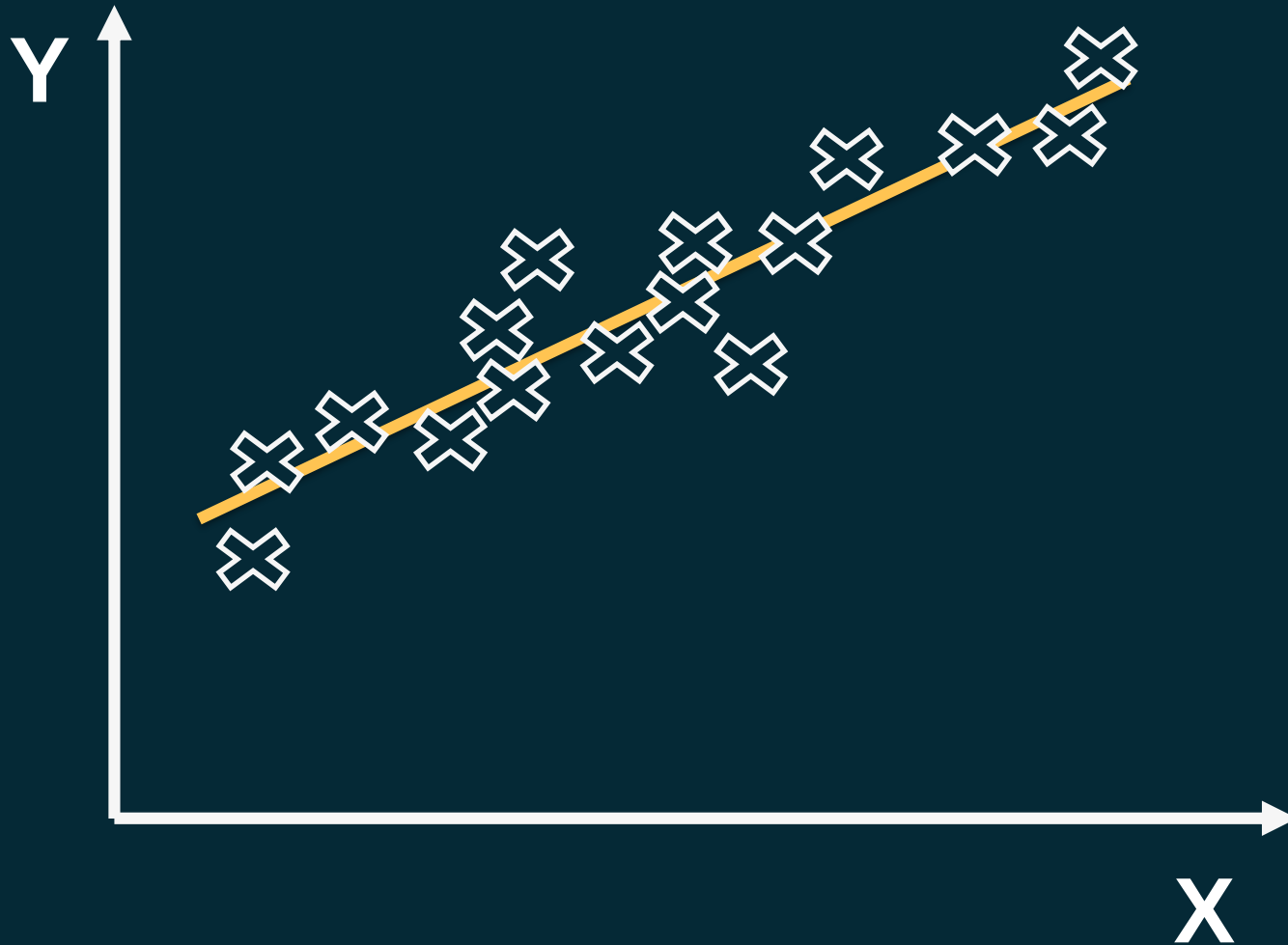
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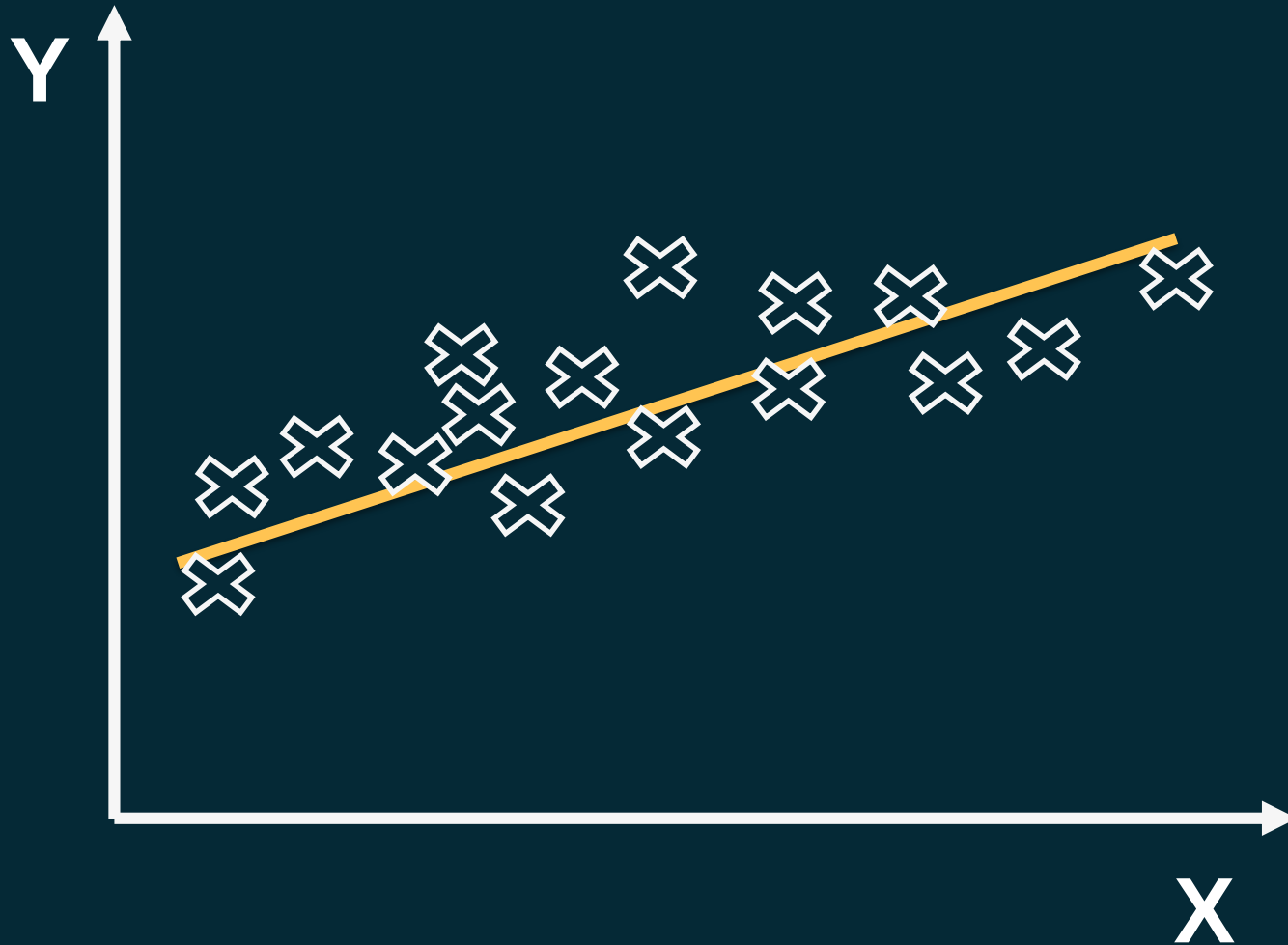
Best model provide best predicted value.



More data, the better model



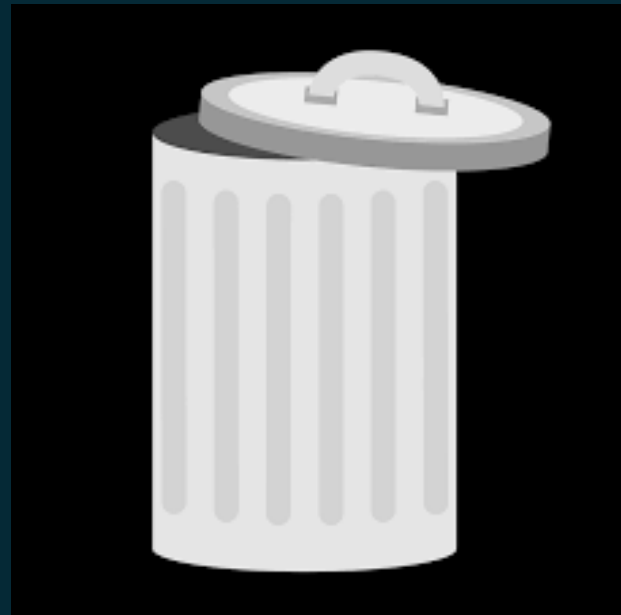
Different data, different model



Data Quality in Machine Learning



Garbage in



Garbage out



The Economist - The world's most valuable resource is no longer oil, but DATA.

Machine Learning Type

- Supervised - we know the correct answers
- Unsupervised – no answers
- Artificial Neural Network



Supervised Machine Learning

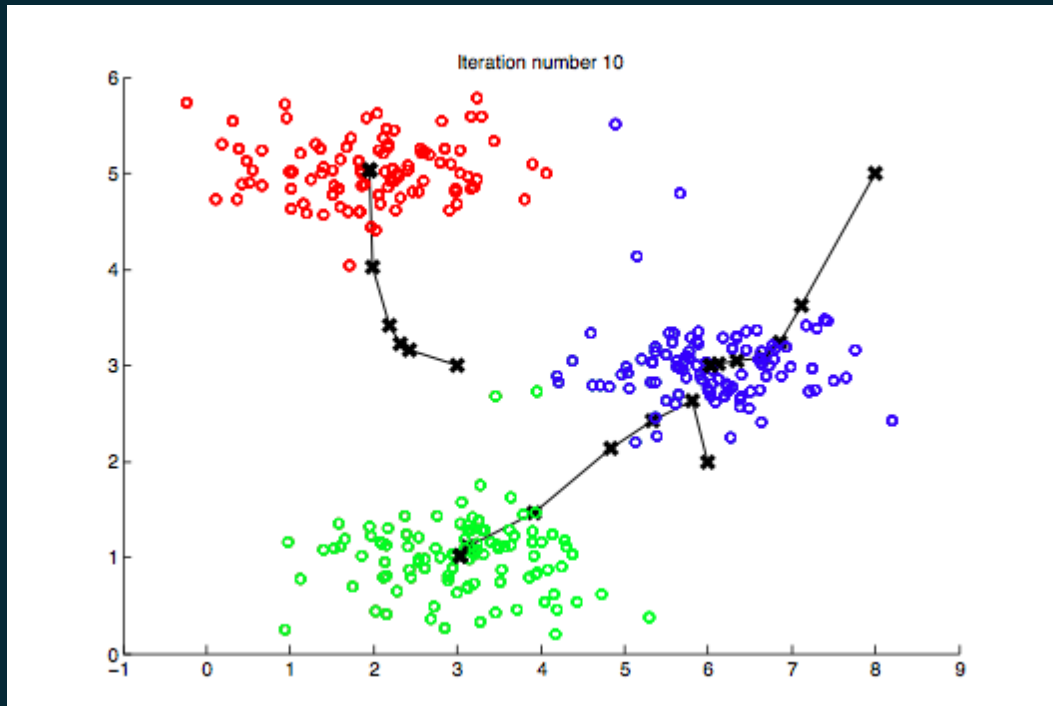
- Input data labeled – has correct answers

x0	x1	x2	...	xn	Y

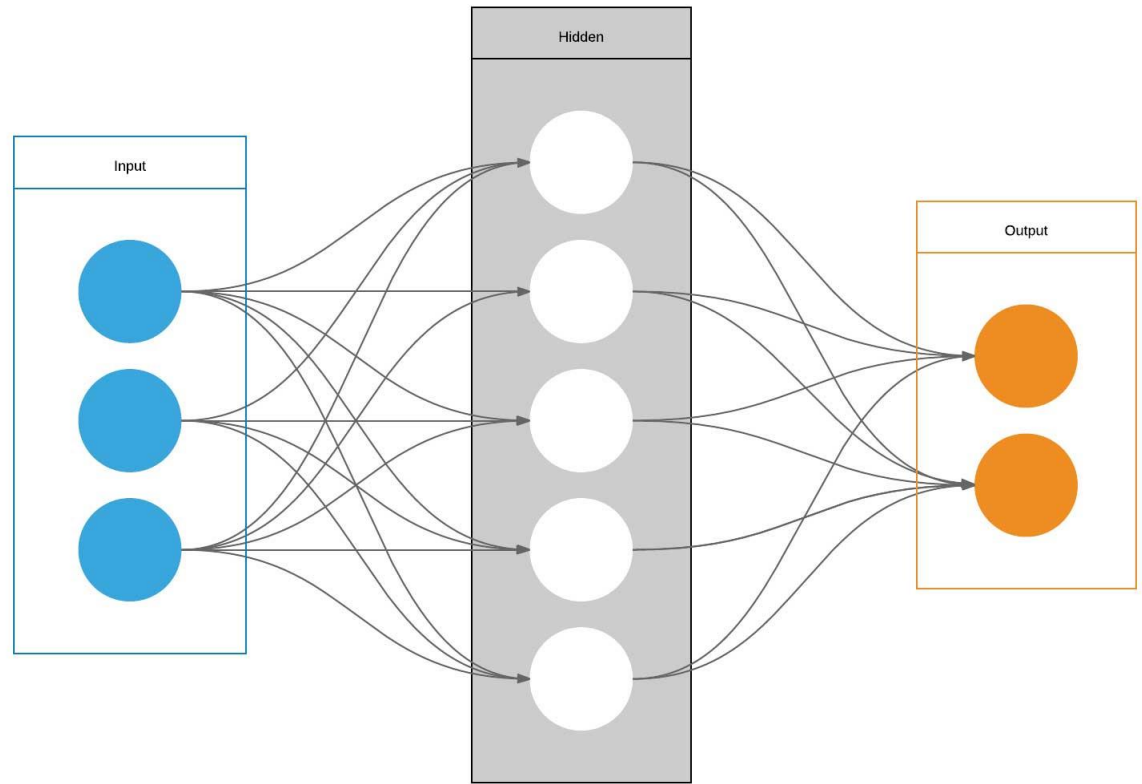
- Specific purpose
- Types
 - Classification
 - Regression
 - Support Vector Machine
 - Decision Tree

Unsupervised Machine Learning 18

- Input data not-labeled – no correct answers
- Exploratory
- Clustering – the assignment of set of observations into subsets (clusters)

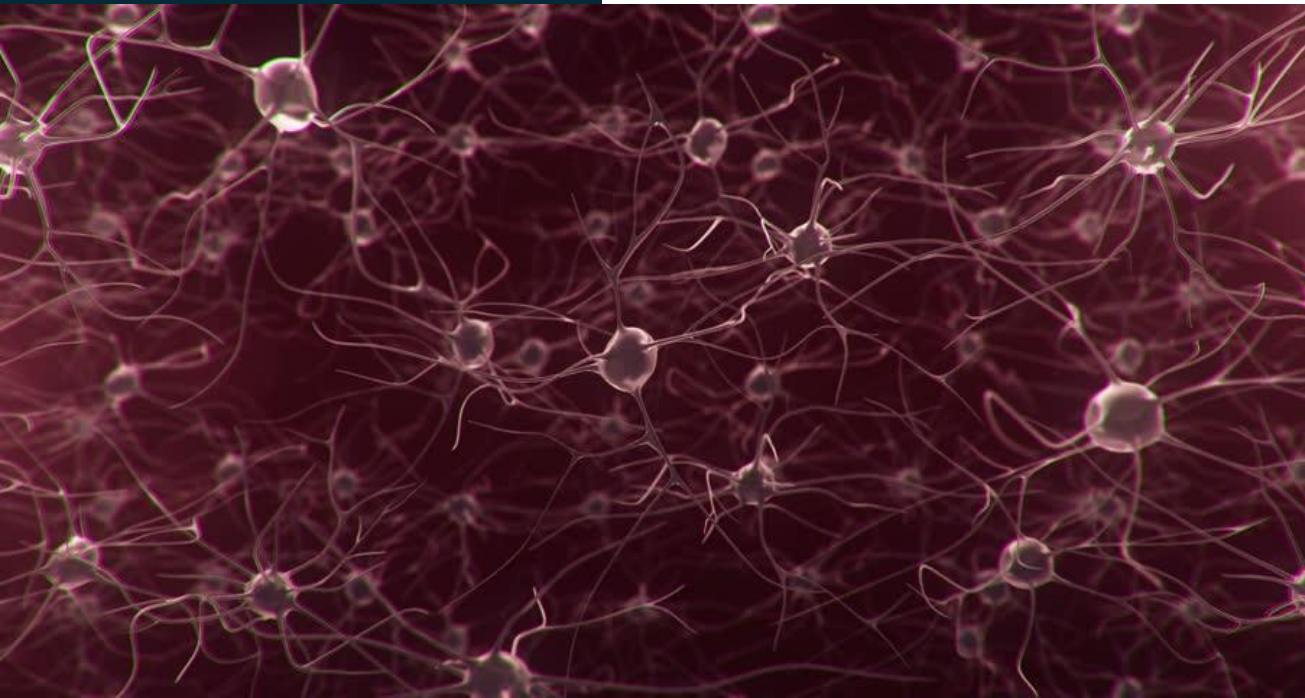
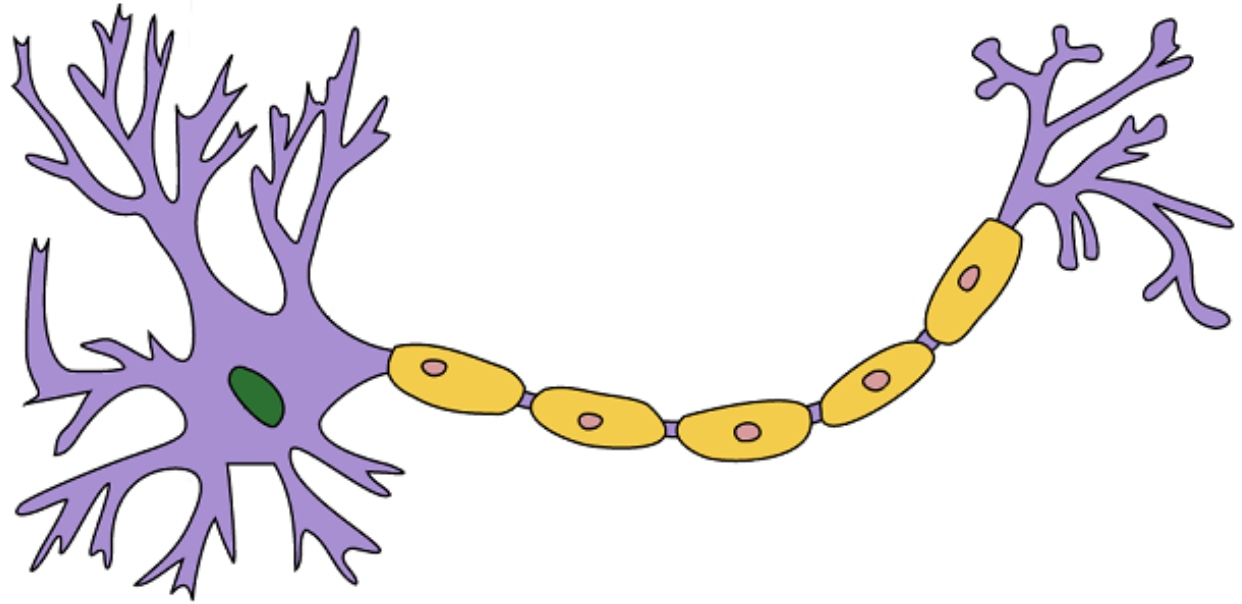


Artificial Neural Network (ANN)



- Most powerful ML algorithm
- Game Changer
- Works very much like human brain – Neural network
- DNN, CNN, RNN

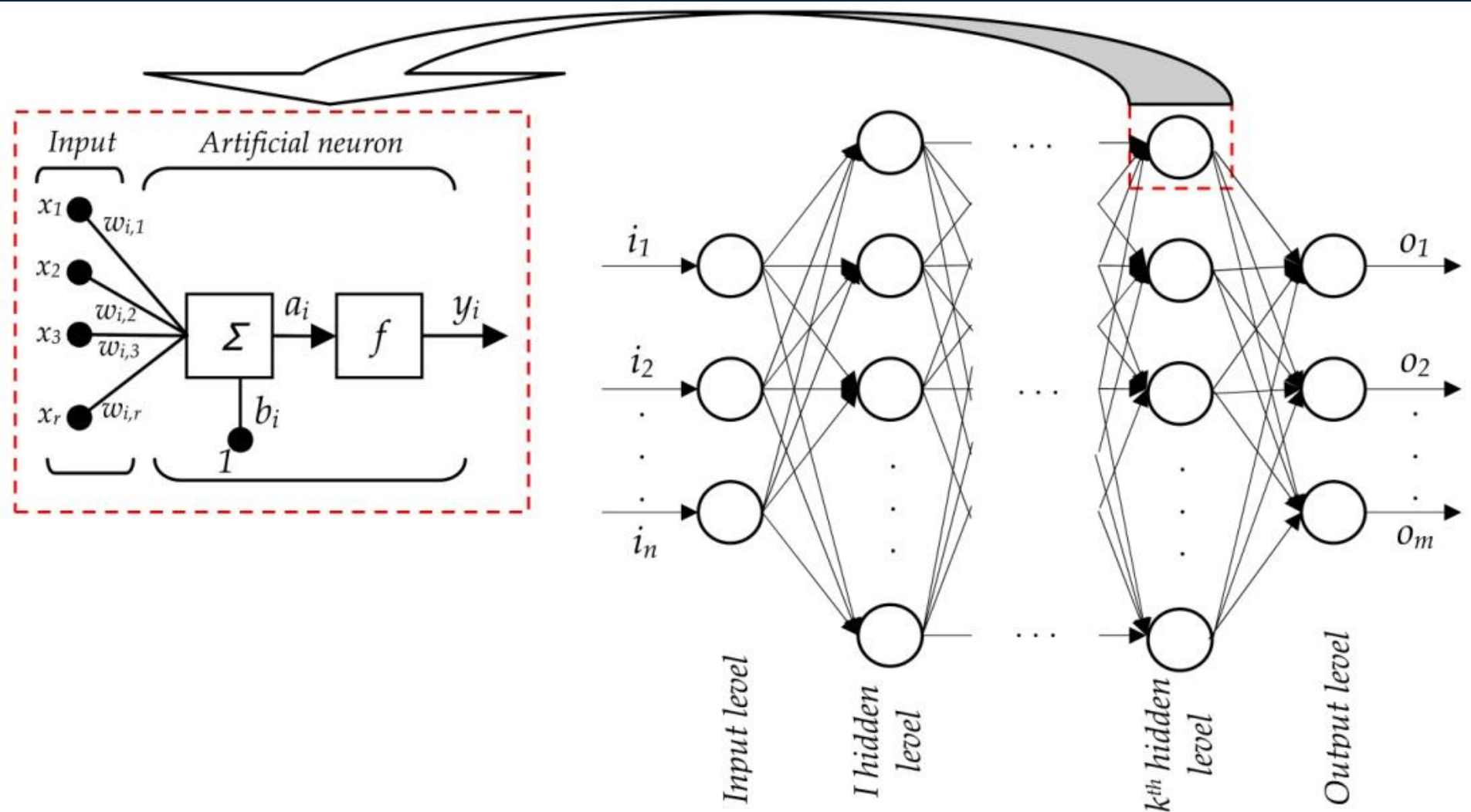
Human Neuron



**Neural
Network
– 100
billions**

Artificial Neural Network (ANN)

Introduction



Python codes for DNN

```
#import ANN - TensorFlow  
Import tensorflow as tf
```

```
X = tf.placeholder(..)
```

```
Y = tf.placeholder(..)
```

```
hidden1 = tf.layer.dense(X, 4, activation=tf.nn.relu)
```

```
hidden2 = tf.layer.dense(hidden1, 2, activation=tf.nn.relu)
```

```
logits = neuron_layer(hidden2, 2)
```

```
....
```

```
loss = tf.reduce_mean(...)
```

```
optimizer = tf.train.GradientDescentOptimizer(0.1)
```

```
training_op = optimizer.minimizer(loss)
```

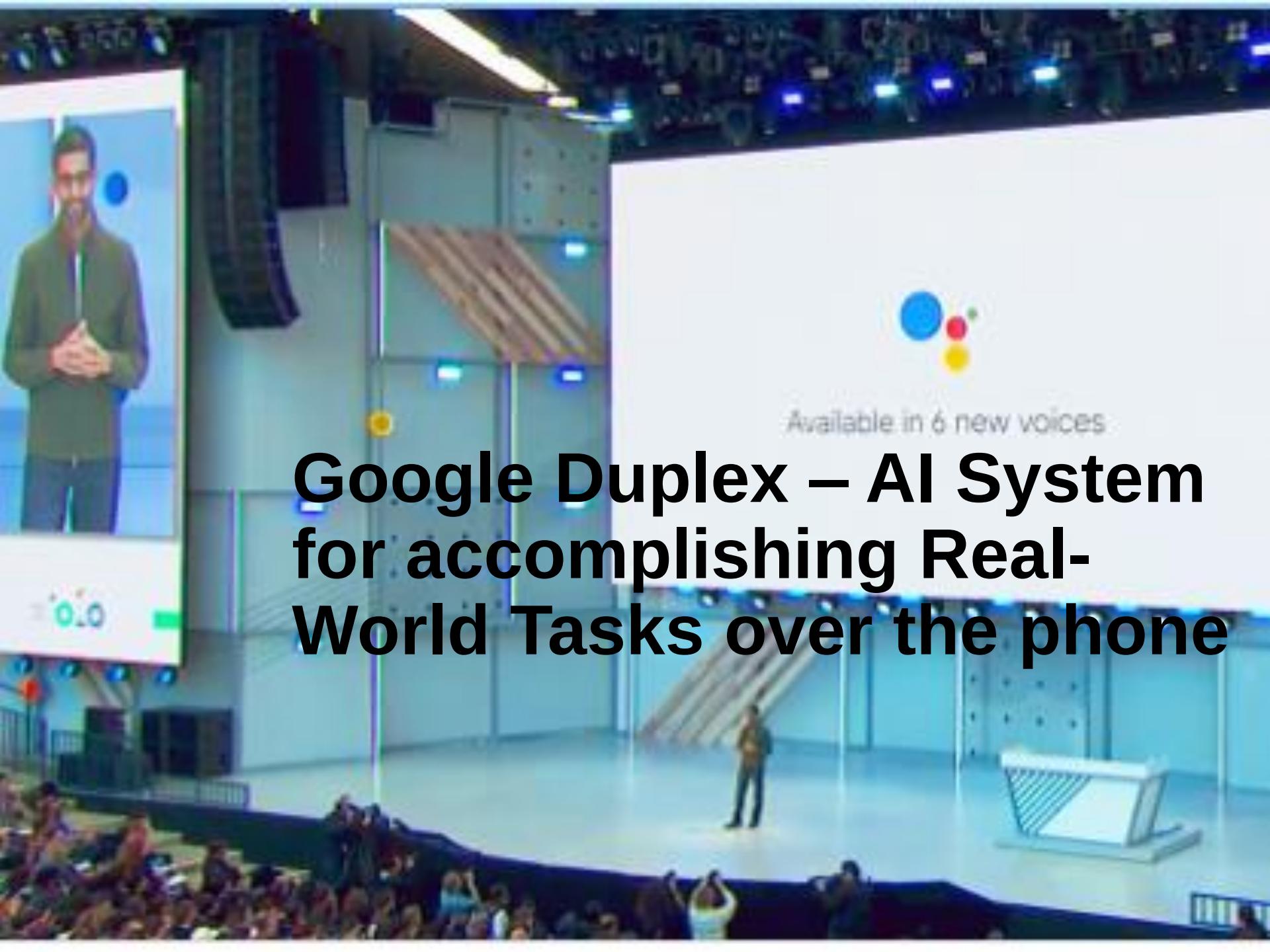
```
tf.Session.run(training_op, feed_dict={X:x_train, Y:y_train})
```



How Machine Learning is being used in our daily life



**HEY
SIRI**



Google Duplex – AI System for accomplishing Real- World Tasks over the phone

Recommendation

- Amazon
- Netflix
- Spotify

Just one more step to find
movies you'll ❤️

STEP 1 STEP 2 STEP 3
4

Rate more so Netflix can get smarter about your movie preferences.

It Happened One Summer



Barbra



Don't Say a Word



Deeper to the Border



Before Add



Forever (Season 1 (4-Disc Set))



Wild at Heart

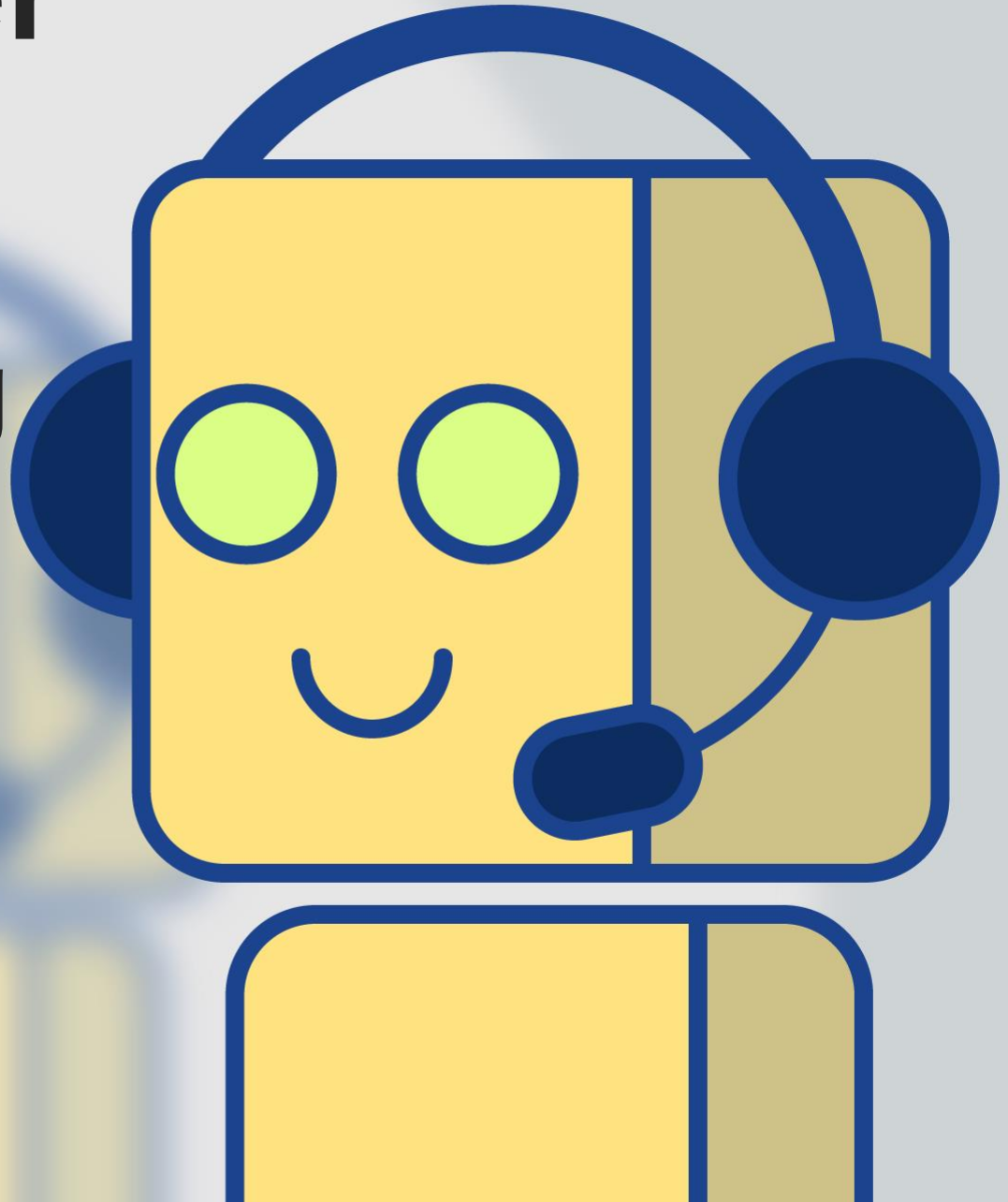


Miss Congeniality



Customer Service

- Online Chatting
- Call
- Chatbot



Amazon Go – Cashless Shopping

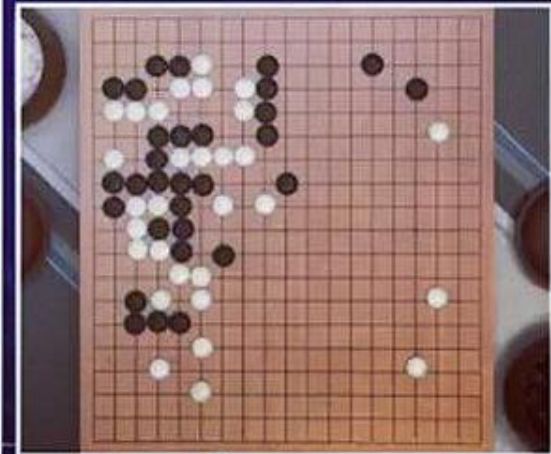


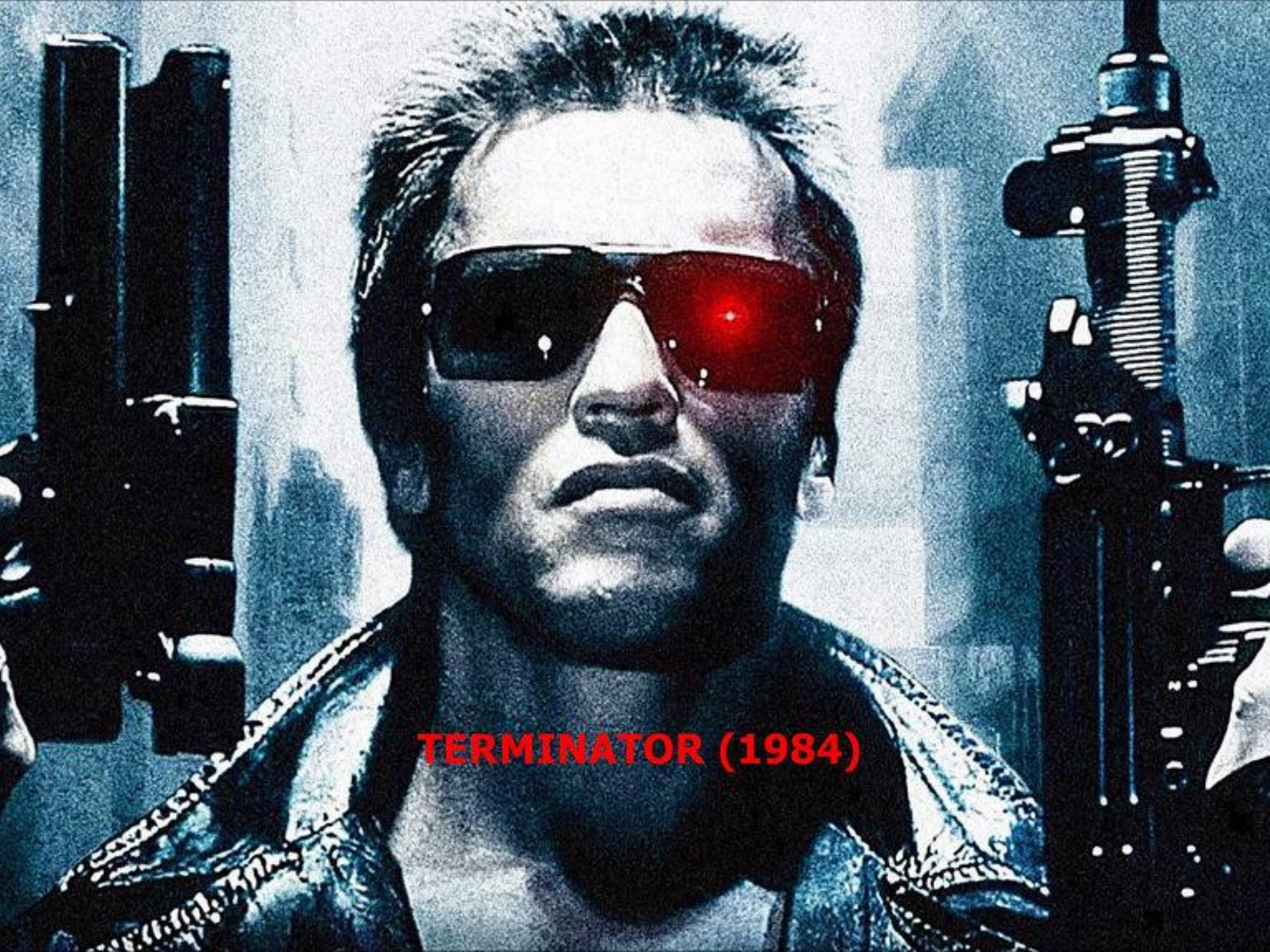
AlphaGO



● ALPHAGO
01:27:15

● LEE SEDOL
00:45:18





TERMINATOR (1984)

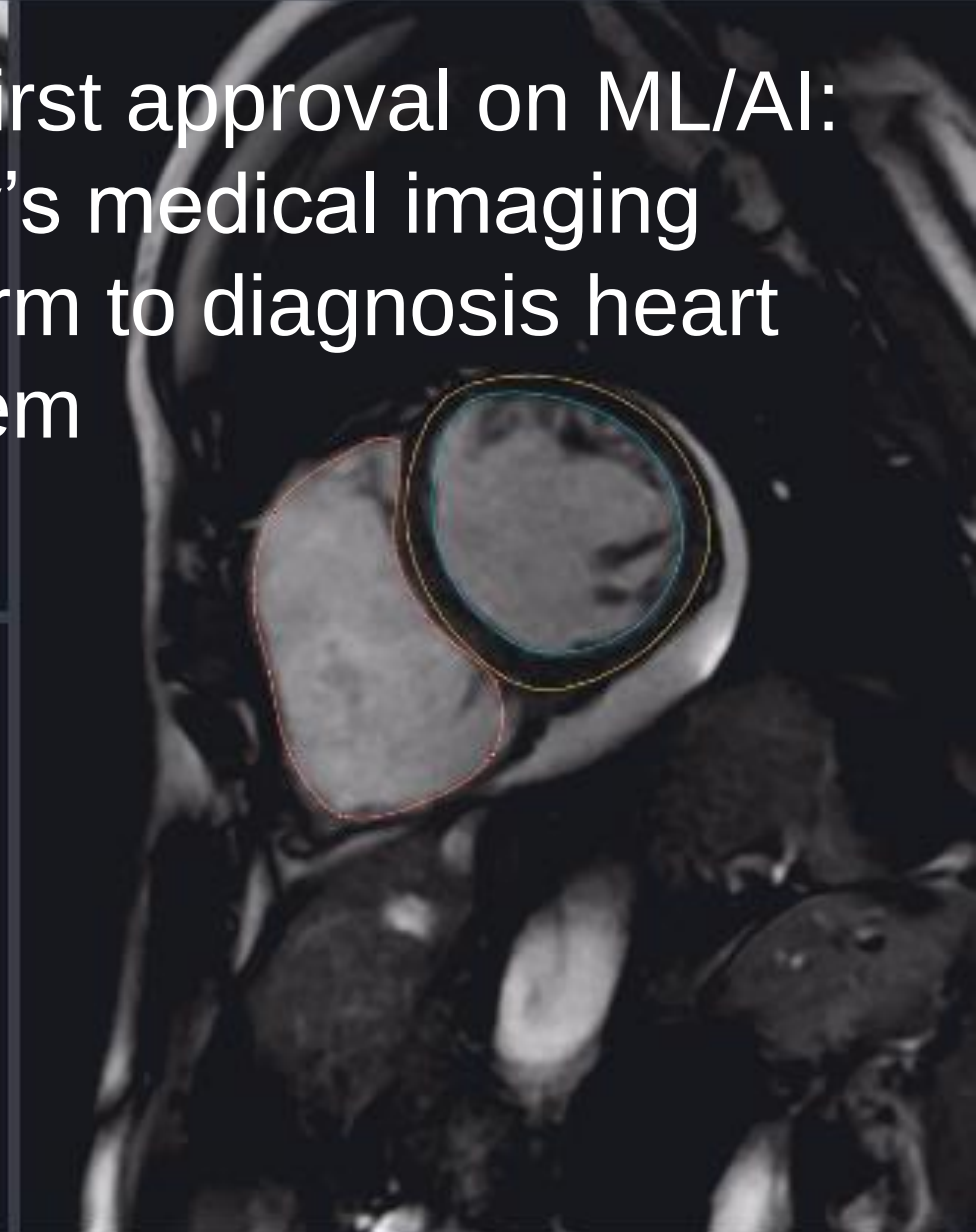
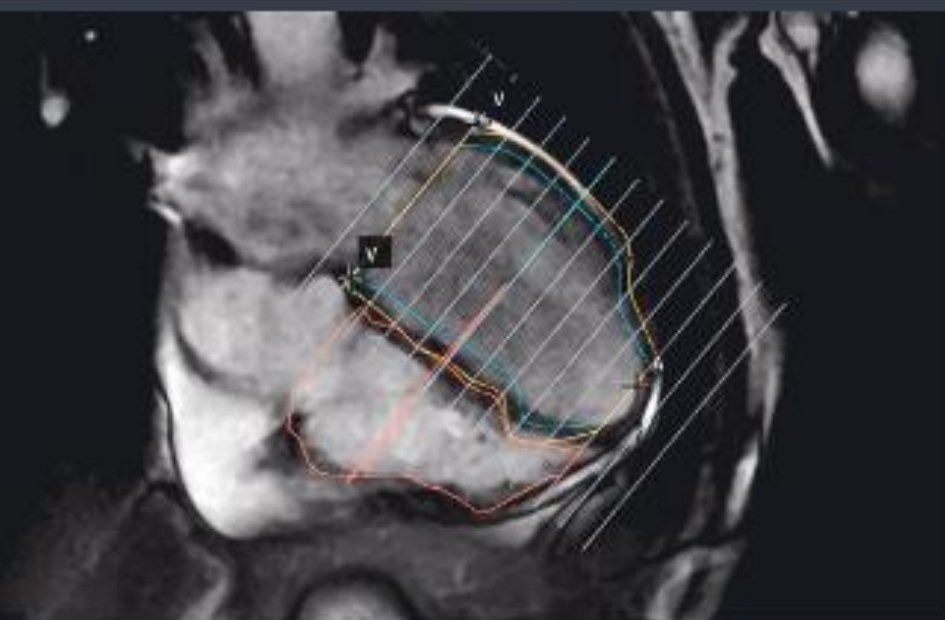
Why is AI(ML) so popular now?

- Cost effective
 - Automate a lot of works
 - Can replace or enhance human labors
 - “Pretty much anything that a normal person can do in <1 sec, we can now automate with AI” Andrew Ng
- Accurate
 - Better than humans
- Can solve a lot of complex business problems

ML application in Pharma Industry

- Drug discovery
- Drug candidate selection
- Clinical system optimization
- Medical image recognition
- Medical diagnosis
- Optimum site selection / recruitment
- Data anomaly detection
- Personalized medicine
- SDTM, ADaM, TFL?

FDA first approval on ML/AI:
Artery's medical imaging
platform to diagnosis heart
problem



510K clearance by FDA on Artery's Oncology AI Suite

ARTERY'S



CARDIO AI

CT Marked, PET cleared



LUNG AI

FDG cleared



LIVER AI

FDG cleared

Now, how Pharma goes into AI/ML market

- GSK sign \$43 million contract with Exscientia to speed drug discovery
- J&J (Surgical Robotics) – partners with Google. Leverage AI/ML to help surgeons by interpreting what they see or predict during surgery
- Roche - With GNS Healthcare, use ML to find novel targets for cancer therapy using cancer patient data
- Pfizer - With IBM, utilize Watson for drug discovery. Watson has accumulated data from 25 million articles compared to 200 articles a human researcher can read in a year.

New Direction of Drug Companies

“Medicines and Data Science” company.
Novartis CEO Vas Narasimhan

Adoption of AI/ML in Pharma

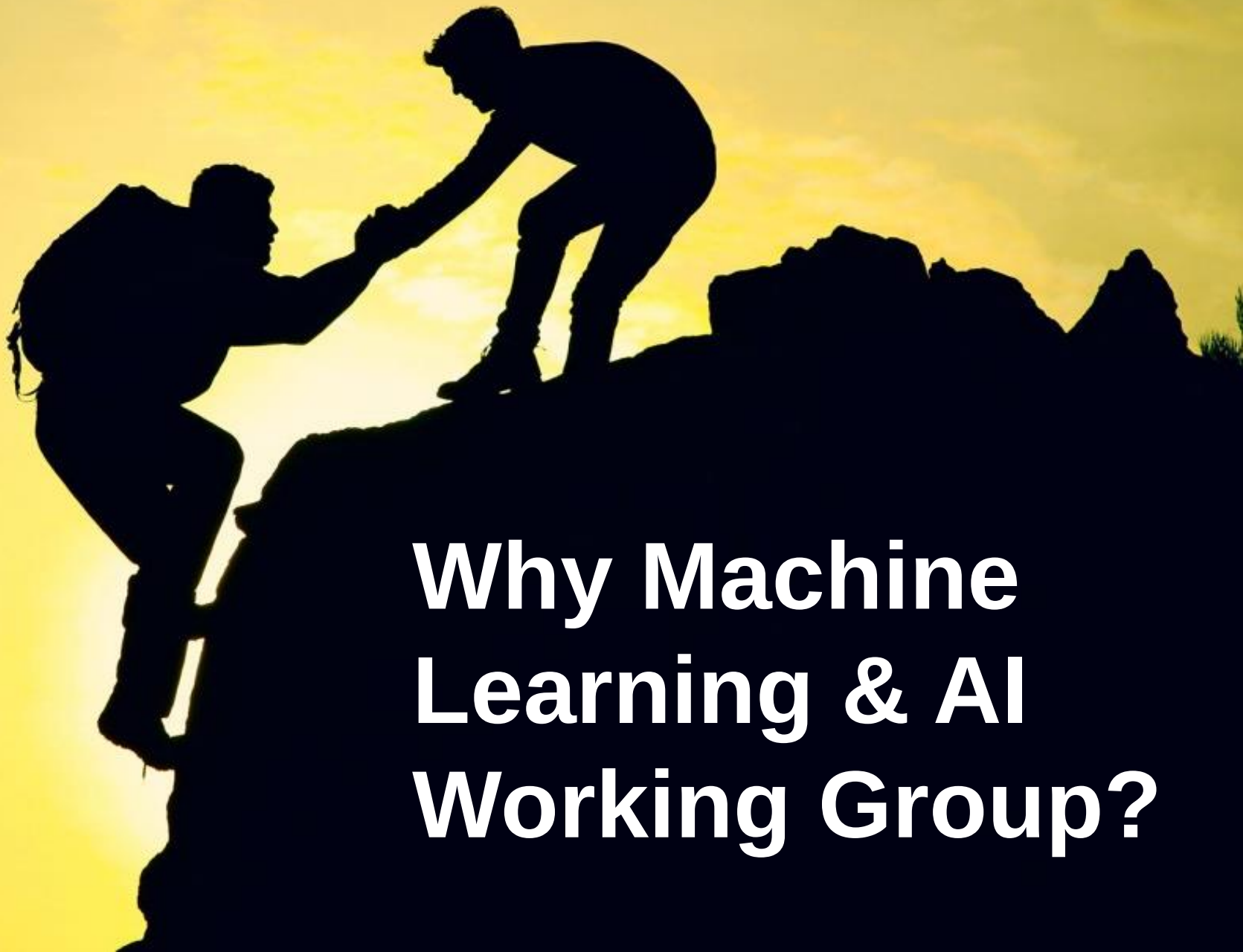
- Slow
- Regulatory restriction
- Machine Learning Black Box challenge – need to build ML models, statistically or mathematically proven and validated, to explain final results.
- Cultural status

Healthcare AI/ML market

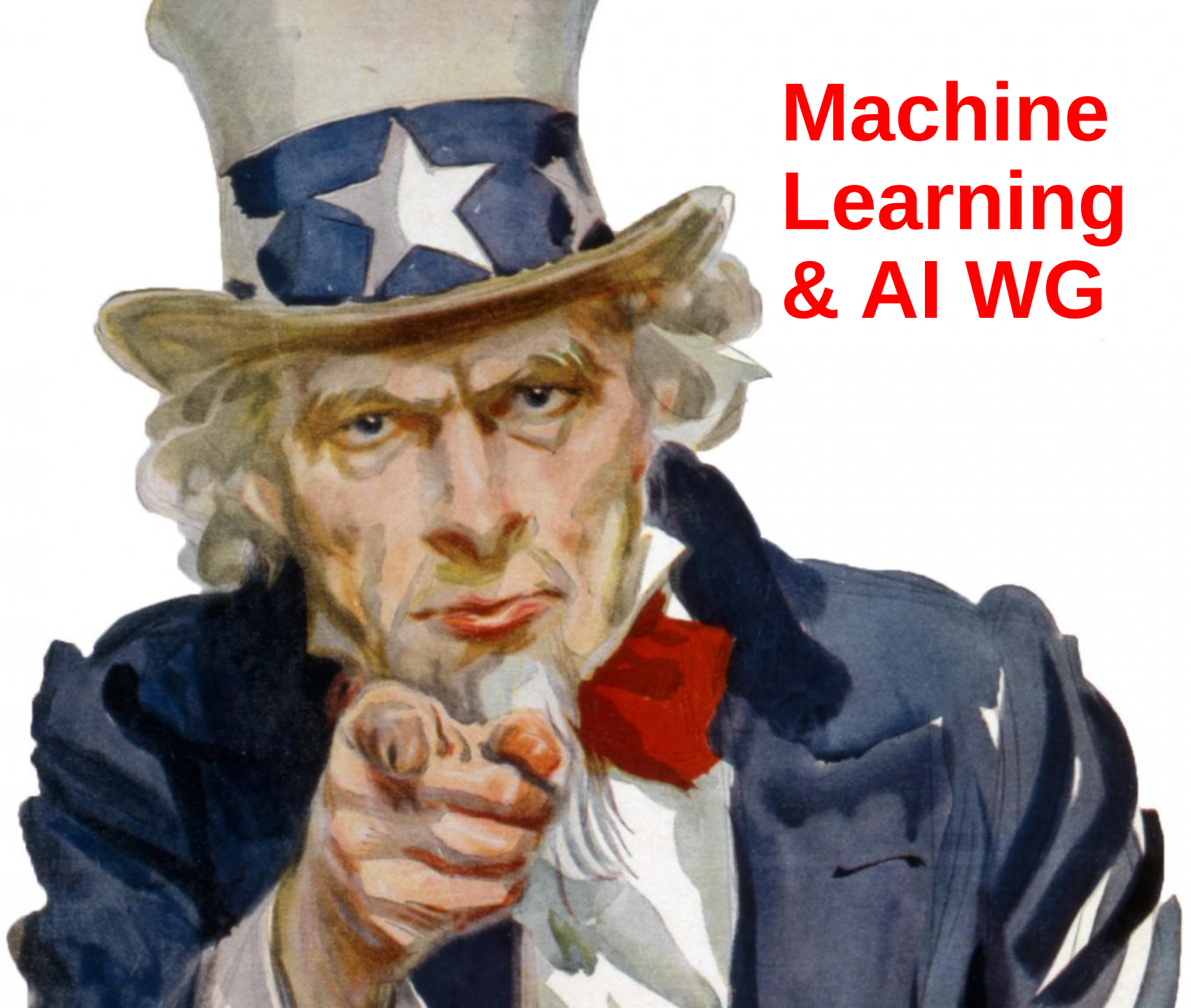
- US - 320 million in 2016
 - Europe – 270 million in 2016
 - 40% annual rate
 - 10 billion in 2024
-
- Short in talents
 - Great opportunities

Machine Learning & AI Team Goals

- To raise awareness in Machine Learning in Pharma Industry
- To Introduce Machine Learning Education
- To curate Machine Learning Materials
- White papers
- Projects
- For our own careers



**Why Machine
Learning & AI
Working Group?**



Machine Learning & AI WG

How to Volunteer

- Nicolas Dupuis at ndupuis@protonmail.com
- Kevin Lee at kevin.kyosun.lee@gmail.com or kevin.lee@phuse.com
- Wendy Dobson at wendy@phuse.com

Do you know
about
**Machine
Learning?**



Contact Us!

Contact Clindata Insight to learn more about Big Data and Machine Learning.

Email us at
klee@clindatainsight.com
consulting@clindatainsight.com
<http://www.clindatainsight.com/>



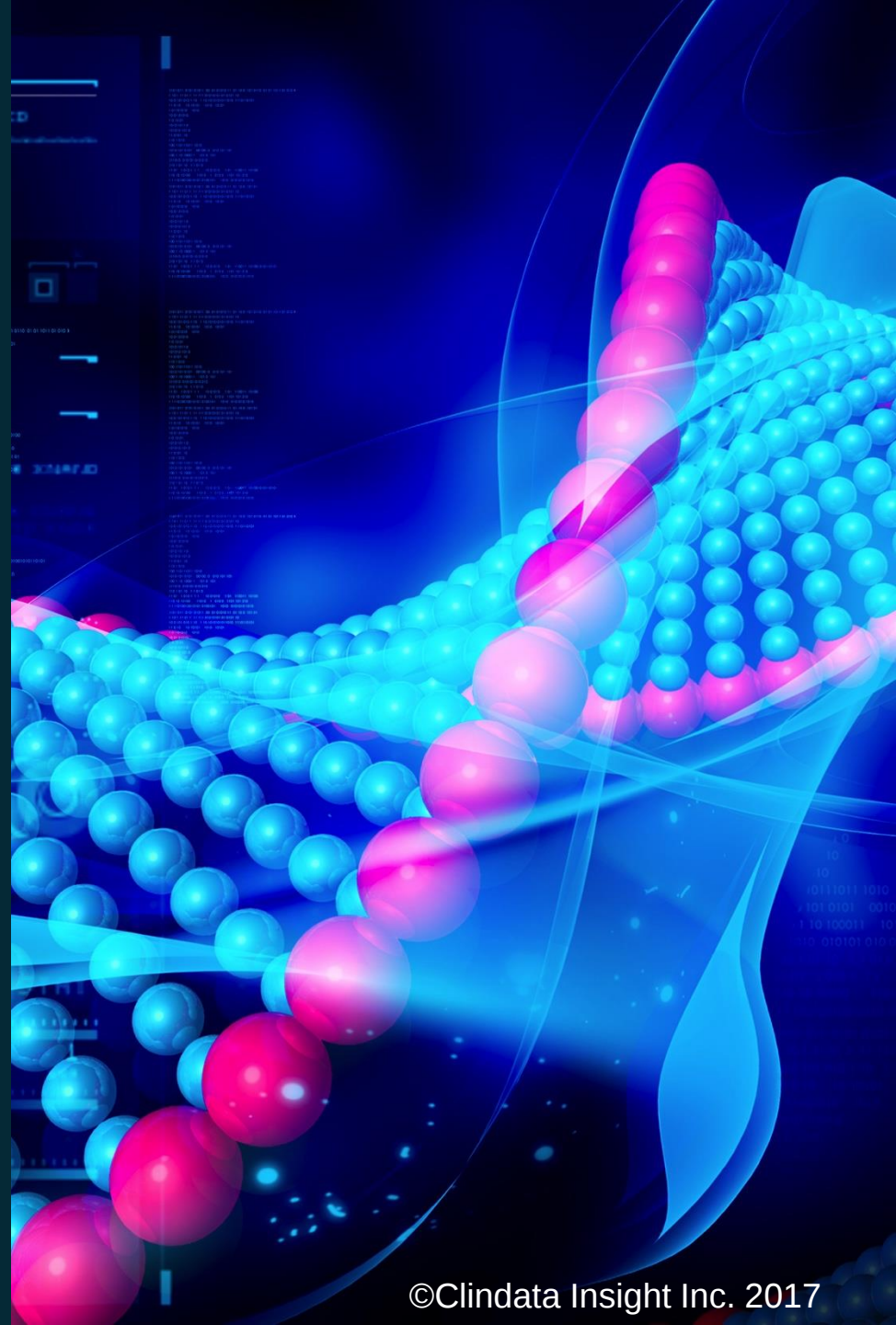
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WeChat @clindatainsight



THAT'S ALL



THANKS

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