

NN : lecture - 1

Introduction to Neural

Networks

# Logistics

~9 lectures

2 hrs, 10 mins, 5 min, 5m break, 11 AMA

Quiz in the next class ✅

Current lecture titles \*

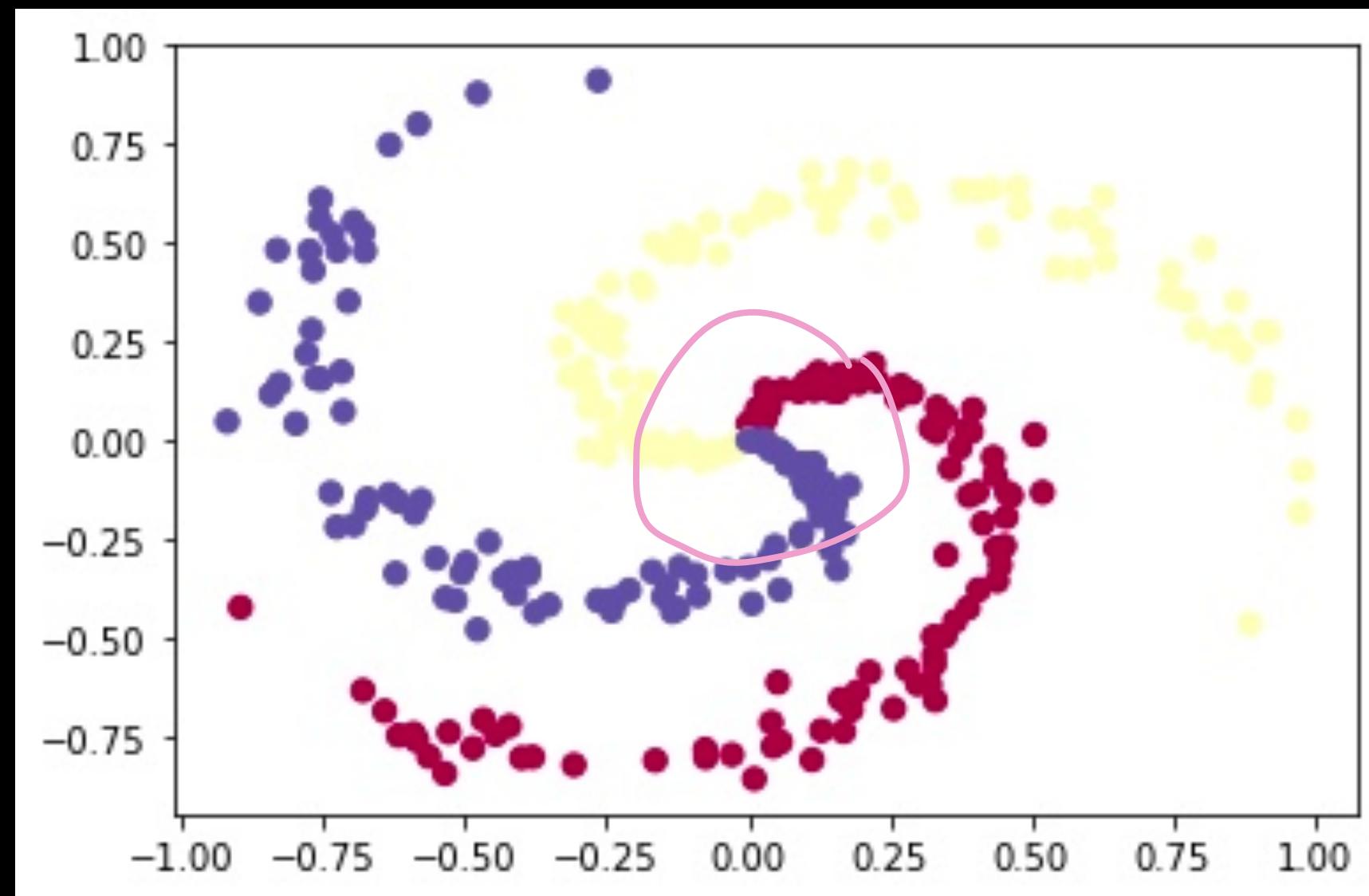
1 Business case \*

Starting next weekend - Doubt session

# Agenda

- ML-I Refresher. ✓
- NN daily life 0-
- Inspiration of NN (LogR is a mini NN) 0
- NN vs DL - are they diff? History of NN 0
- First NN model X
- Fund. and Backward prop. X

# Pulse Check :



① Non-Linear Decision Boundary

② Multi-class classification

Evaluate ML algos you know

logReg

KNN

DT/ Ensemble of Trees\* - RF, Boosting, GBDT, XGBoost

SVM

~~Naive Bayes~~

# Evaluate ML algos you know

① hogReg

Multicoll?

Default ✗

O-vR-all/O-vIS-R ✓

Non-Linear?

Default ✗

Polynomial hogReg ✓

Other issue?

Manually creator of FE  
Handling those features.

different

Evaluate ML algos you know

② KNN

Multi-class? ✓

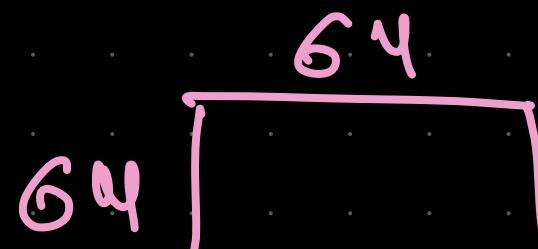
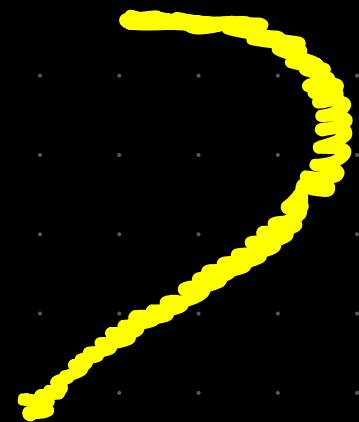
Non-linear? ✓ Sensitive to distance metric  
↑ Inference Time

Other issue? "Non-parametric model"  
Curse of dimensionality

Evaluate ML algos you know

③ Tree based models - Ensembles.

Multicore? ✓



$$\# \text{64} \times 64 =$$

# mu.↑

Non-Linear? ✓ ↗

Image / Text / Sparsity



high-dimensional.

Other issue?

# Use Trees for all data except ↗

Evaluate ML algos you know

③ SVM Image/Text/Spam/Engd ✓

Multiclasses?

Deficient ✗

OVR > OVRB ✓



Non-linear?

Deficient ✗

Kernels ✓

Large Datasets.

Perform poorly  
badly.

Other issue? (Kernel Matrix)

# Evaluate ML algos you know

- ① **log R** - Manual Feature Eng More Powerful?
- ② **KNN** - Inference Time **X** Interpretable
- ③ **Trees** - High-d / Image / Text / Sparse Already Done
- ④ **SVM** - Kernel, big datasets Flexible  
Scalable.  
No model until now does good "end-to-end"

# Agenda : Make hogR powerful

Task 1)

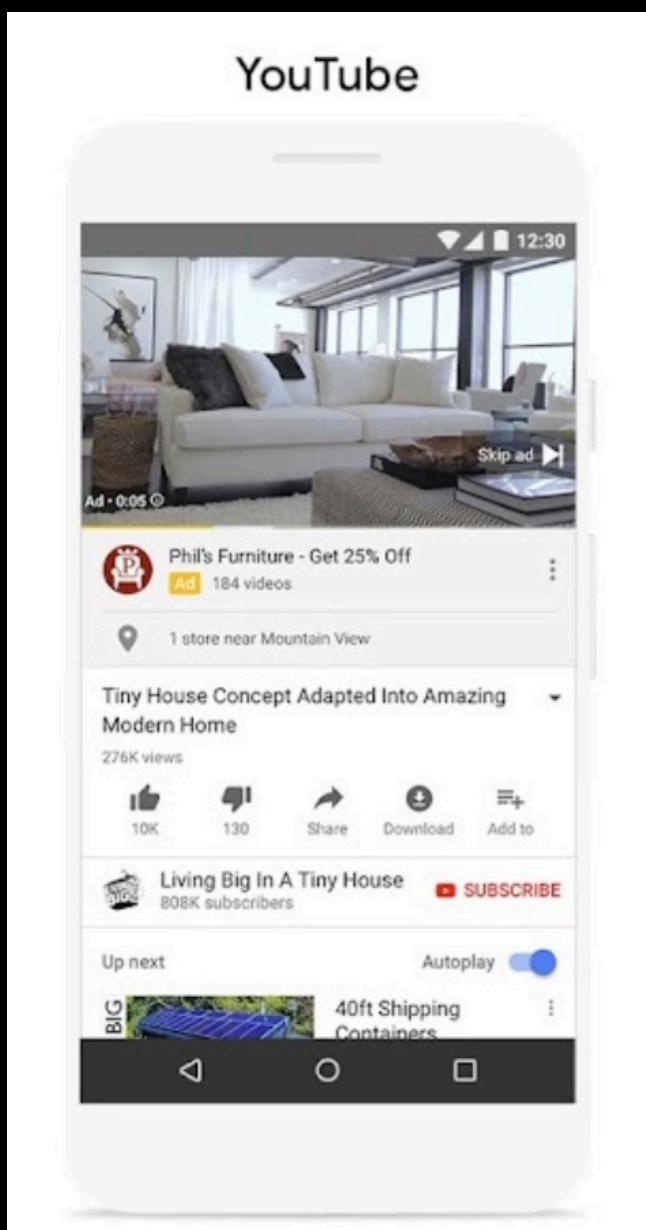
Adapt hogReg model to work  
with multi-class classification

Task 2)

Automate "generating complex  
features / Model should do FE

NN - "Rich Representation of features 2 layers"

# Impact of NN in daily lives



“  
Google Ad - Responsive Ads”

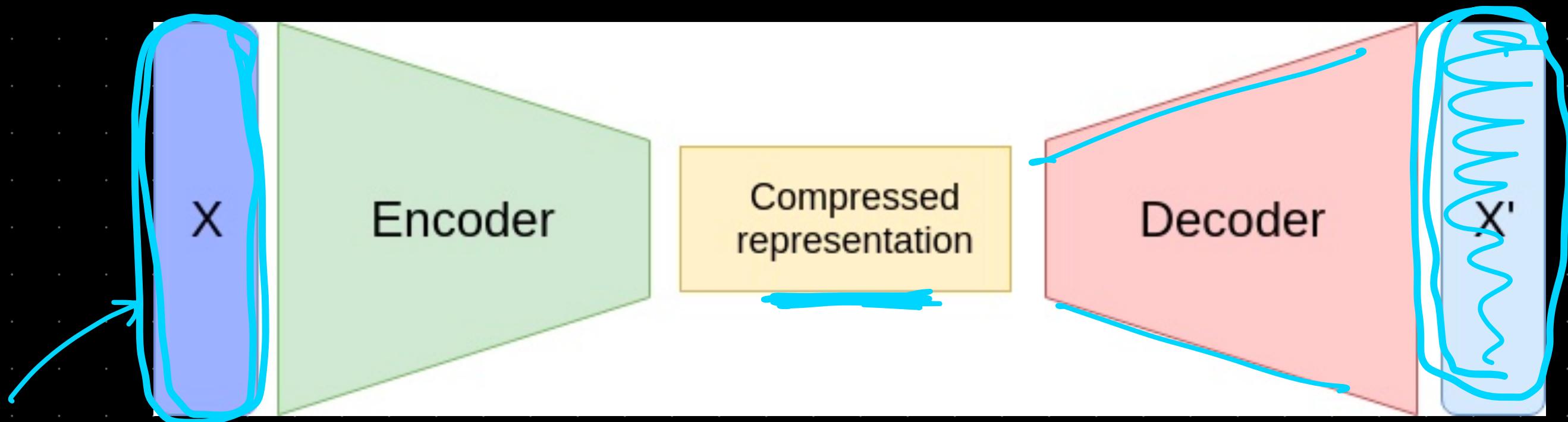
Search: Data Science / ML

Suggestion: Scaler / Upgrad

Search: Recipes .

Suggestion: Tomato / Smirky  
/ Big Basket  
/ Disount Near by .

Impact of NN in daily lives Network  
Social / Digital media - data generated.



"Autoencoders!"  
unsupervised  
self-supervised

# Impact of NN in daily lives

of  
Computer Vision

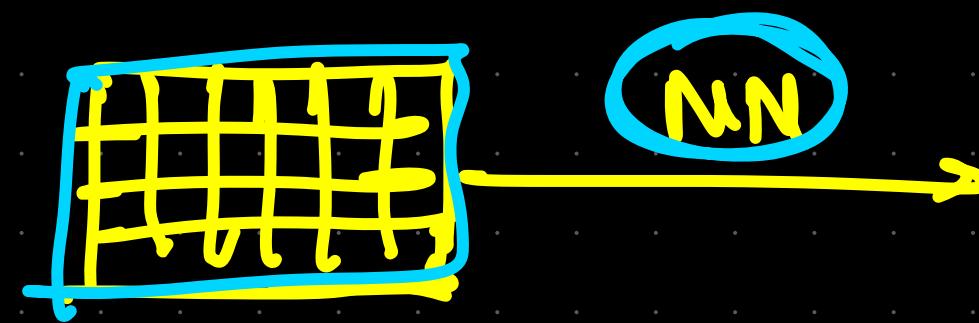
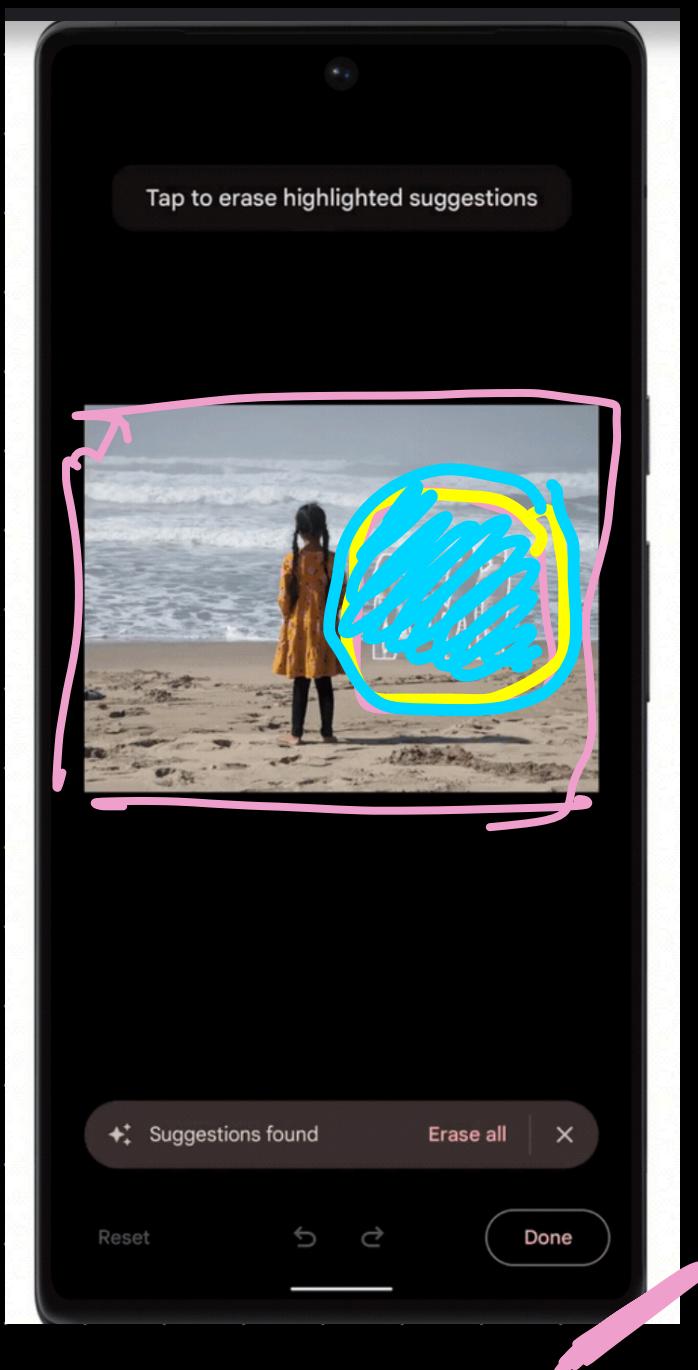


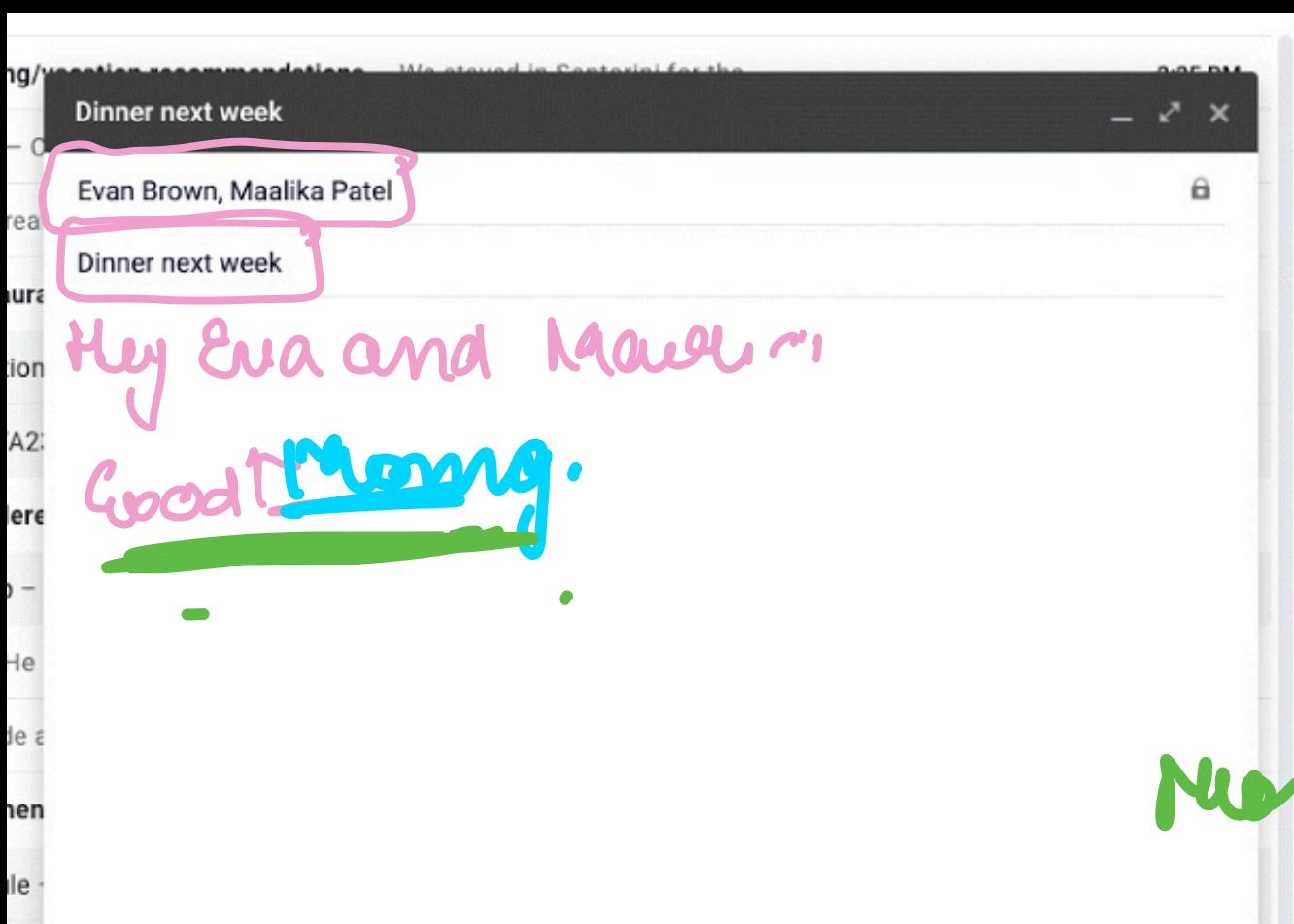
Image Segment



Object of particular class  
from image

# Impact of NN in daily lives

NLP -

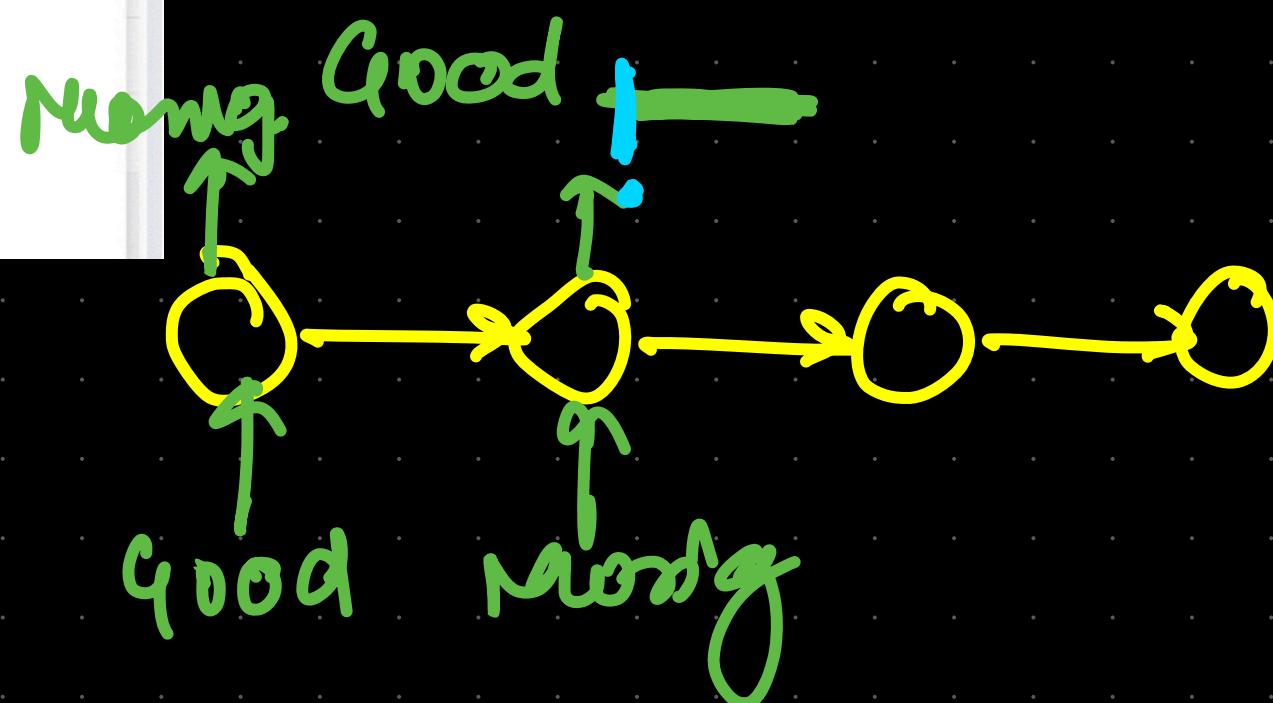


Image, Text, Audio

Auto completion of text

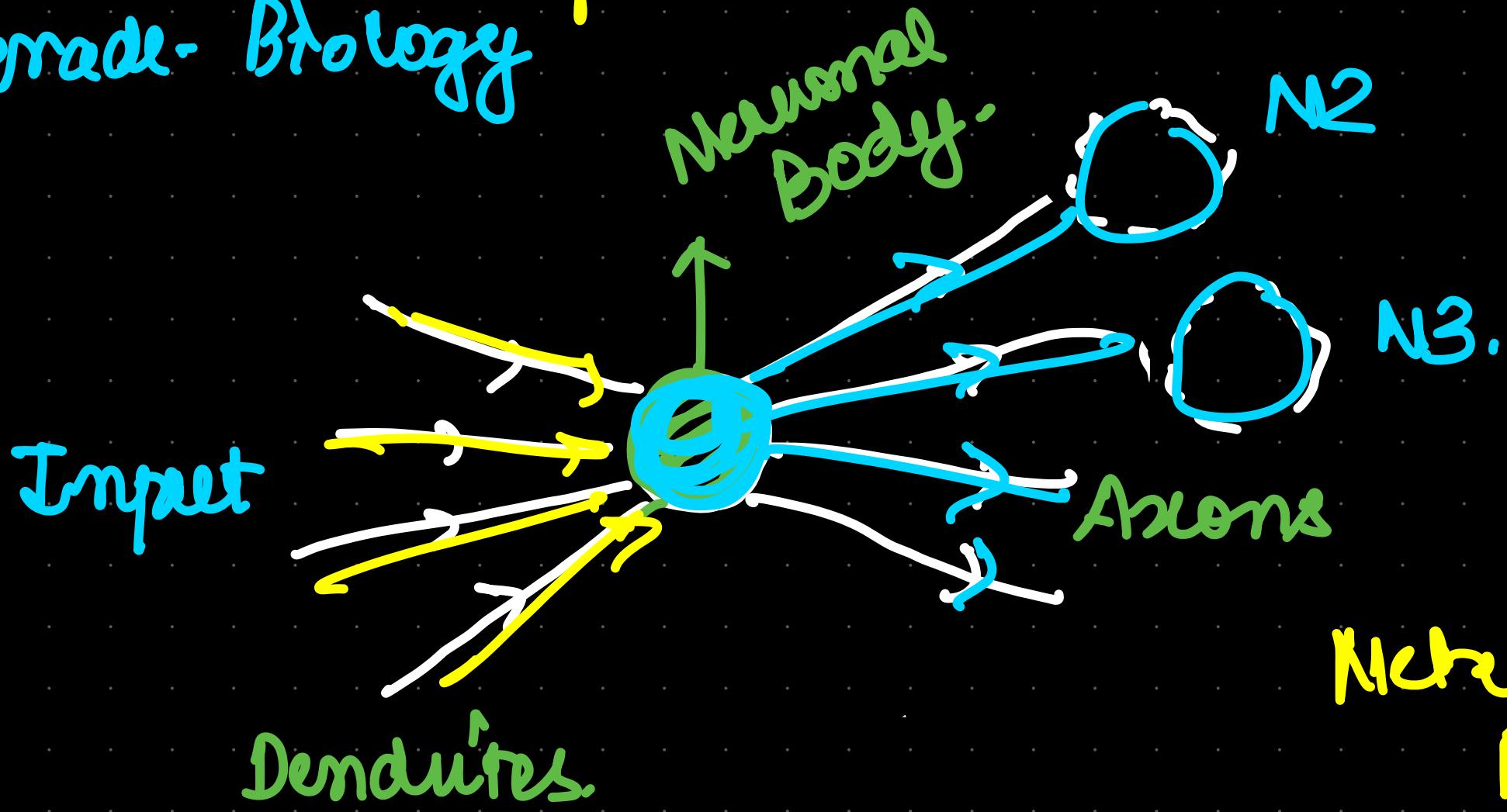
Flexible

Time Series Problem



# Inspiration from Biology

10<sup>th</sup> Grade - Biology



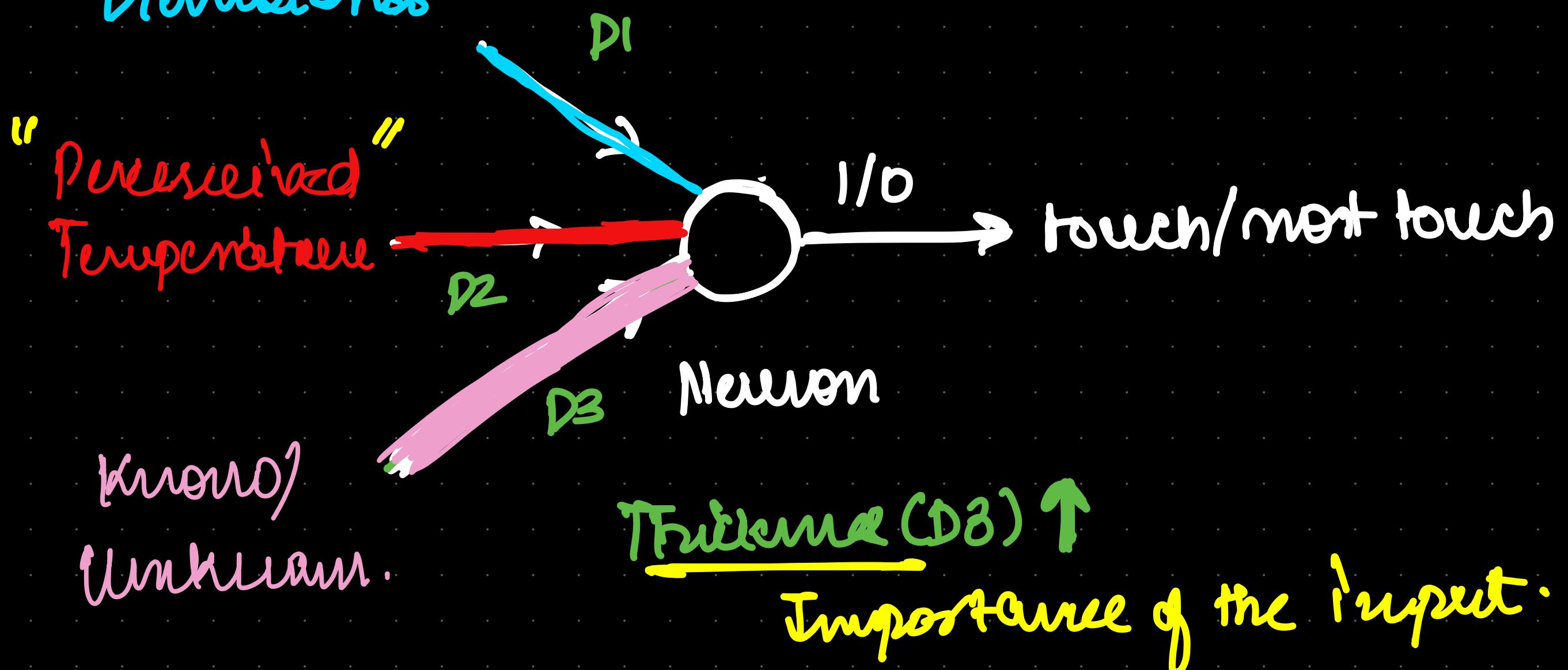
"Neuron."

NN: "loosely" inspired by neural model.

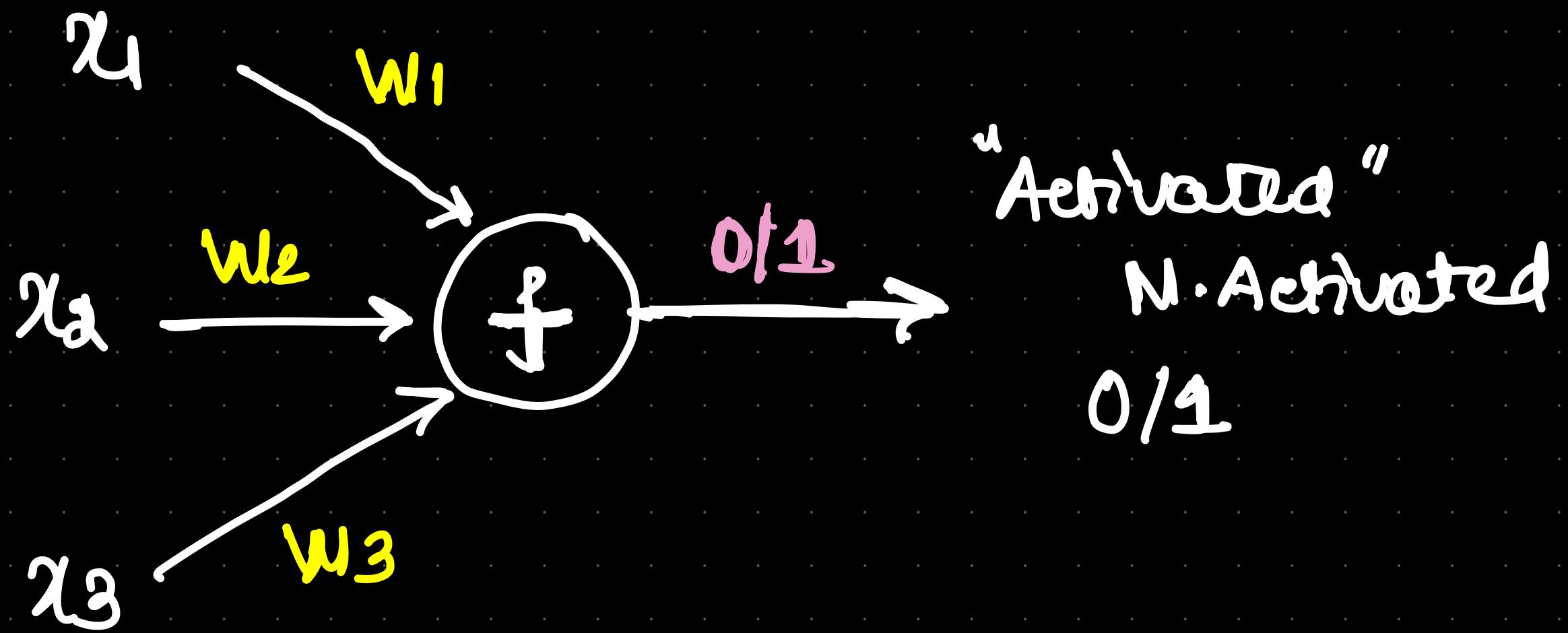
Task: whether to touch an object

Biology: Neuron (decides whether to touch an object)

Dimensions



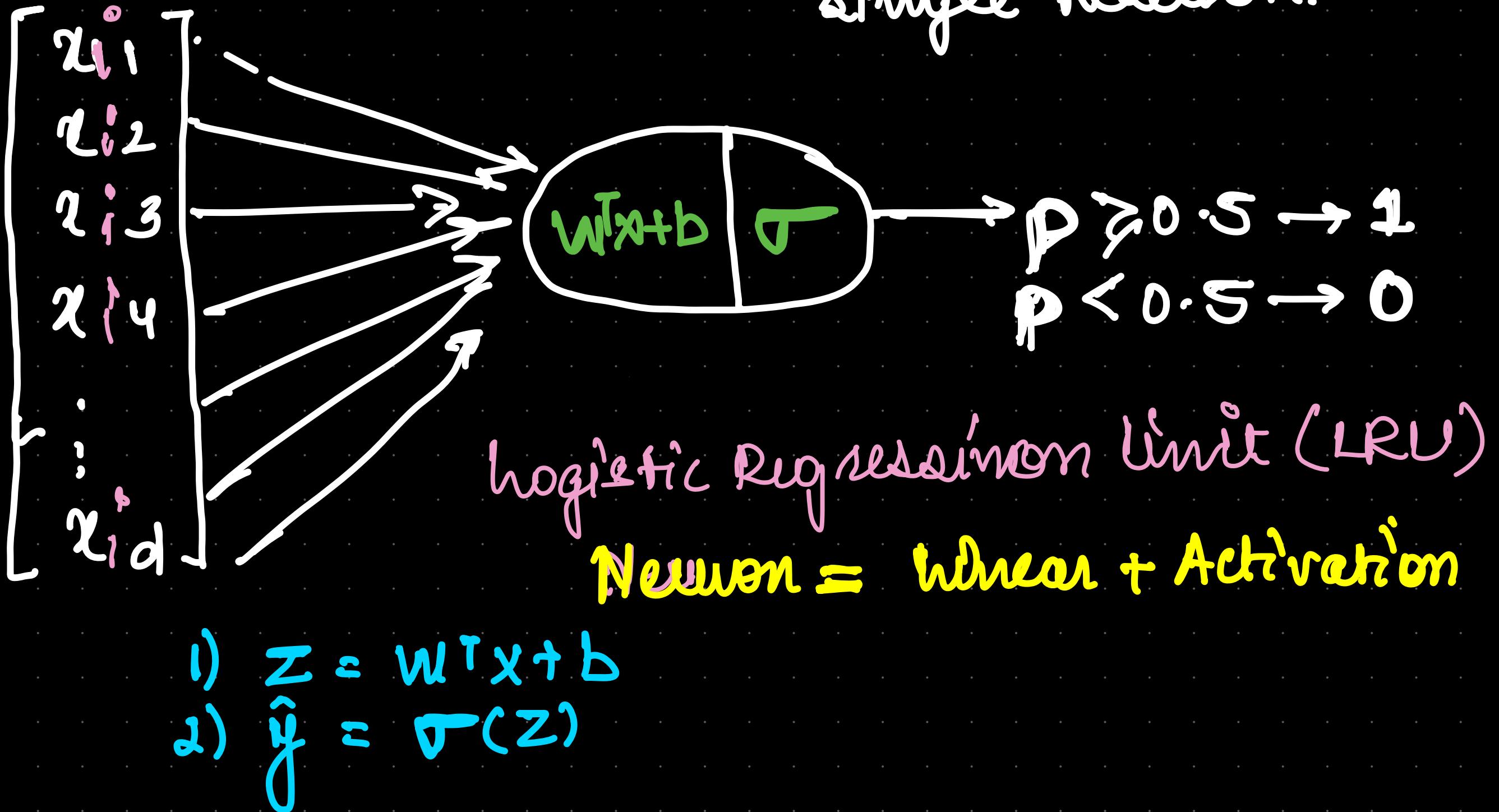
# Mathematical Representation of Neuron



$$y = \sigma(w_1x_1 + w_2x_2 + w_3x_3 + b)$$

# logistic Regression as NN

Single Neuron.



# Other models as NN

SVM as a single neuron NN

$$z = w^T x + b$$

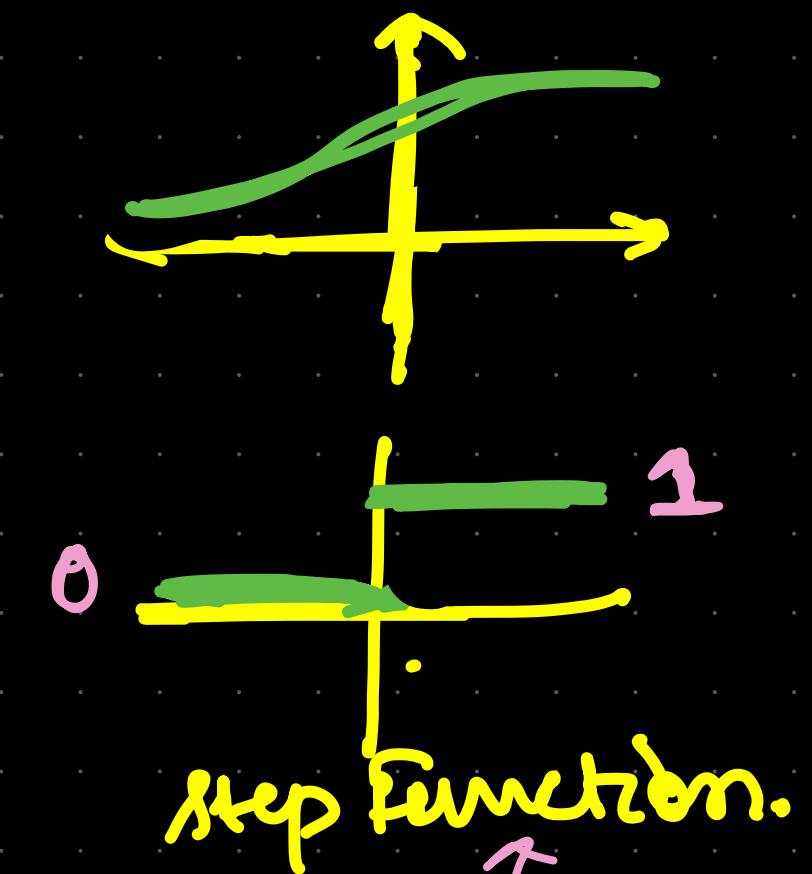
$$\hat{y} = \text{threshold}(z)$$

Hinge loss + LR Regularization.

→ Log Reg as a neuron.

→ SVM as a neuron.

→ Perceptron Model as a neuron.



1957

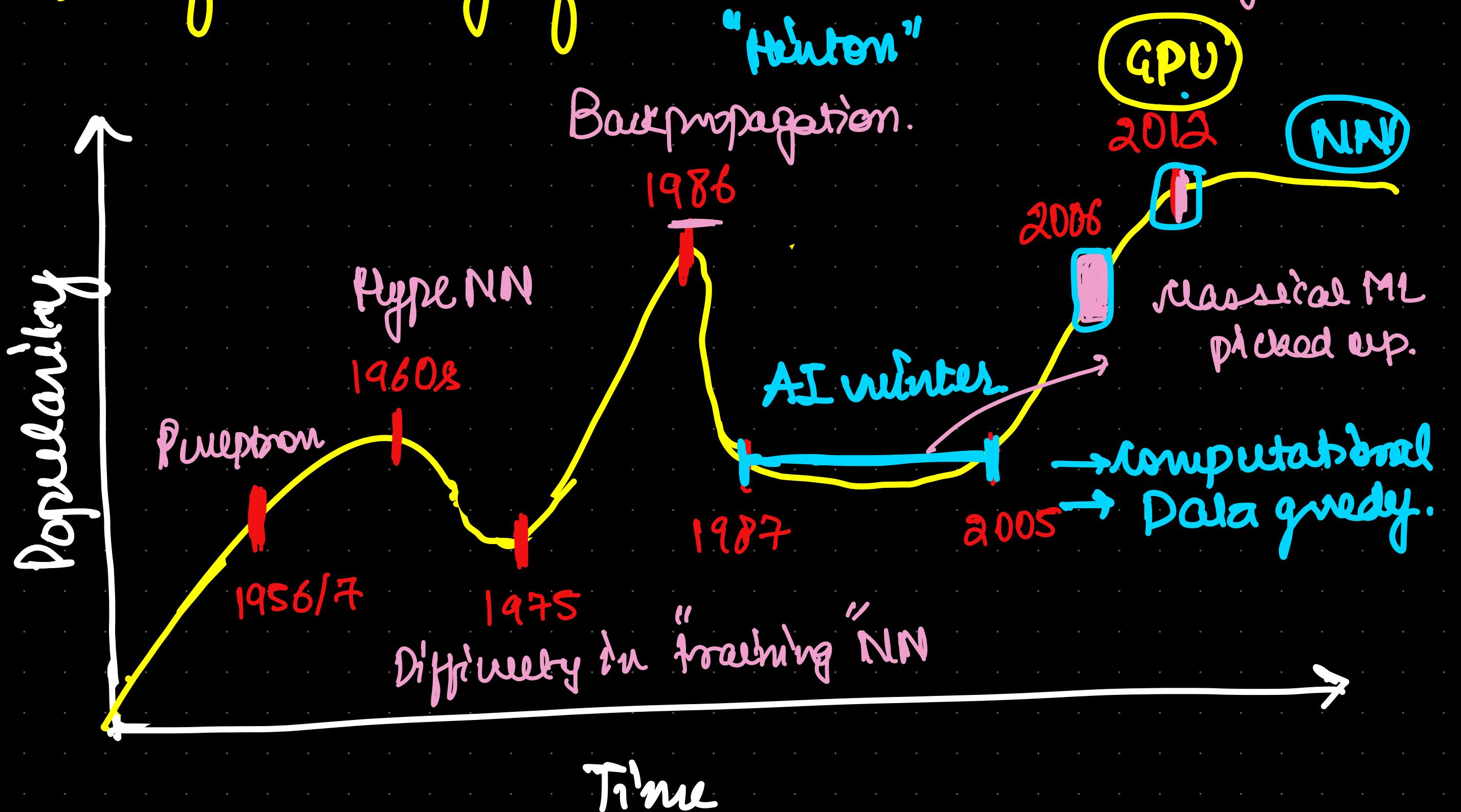
→ →

☰

1990s

"Classical"

# Brief history of NN



What has changed recently?

Why AI Winter?

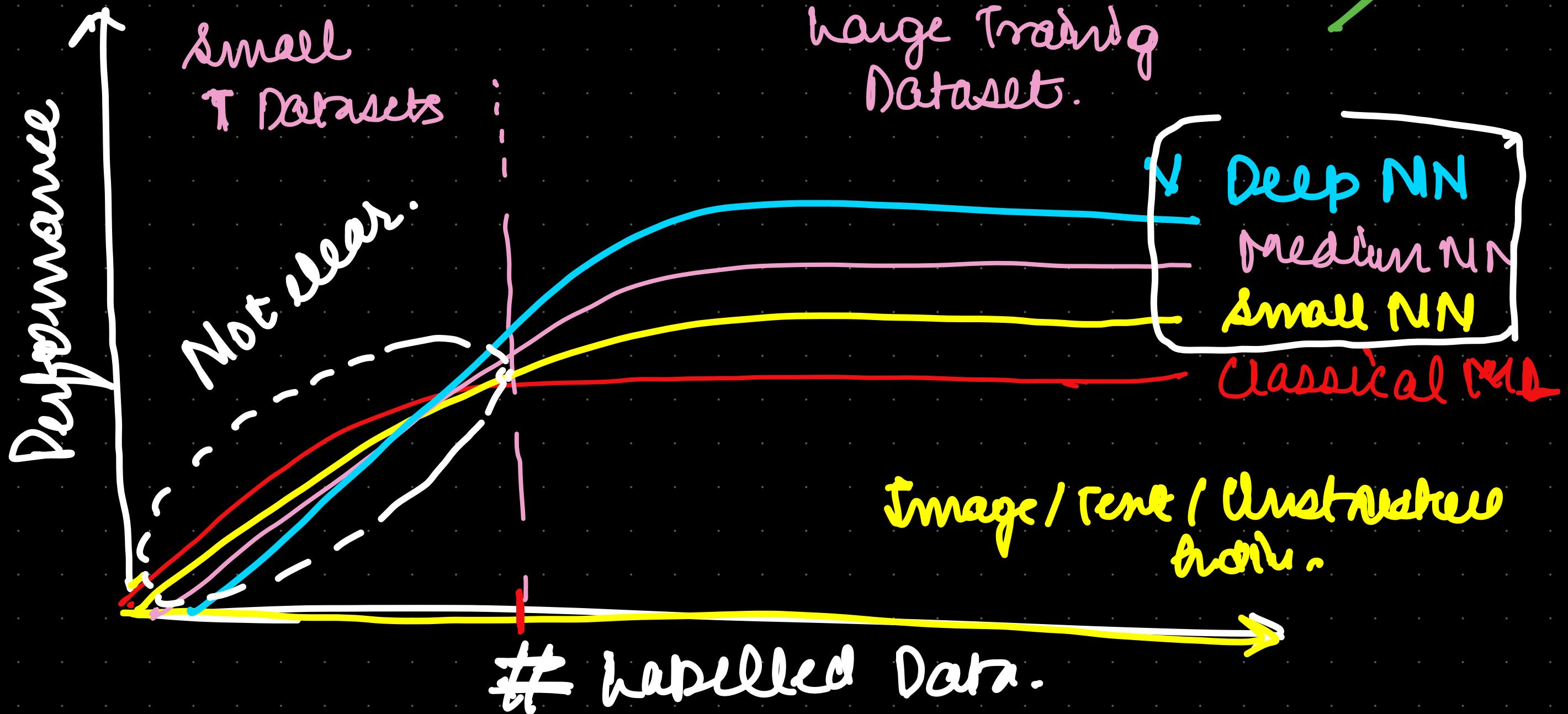
- lack of computational power.
- lack of data

NN  
VLS  
DL

- 1 Newer Processors → GPU / TPU / Neural Engine.
- 2 Data + sensor, IOT
- 3 Research on model training, new algos, more loss fn.

"AI winters" - "Rebrand" - Deep Learning  
NN Training deep NN.

# NN vs Other ML Model



Task 1) Adapt for multi-class.