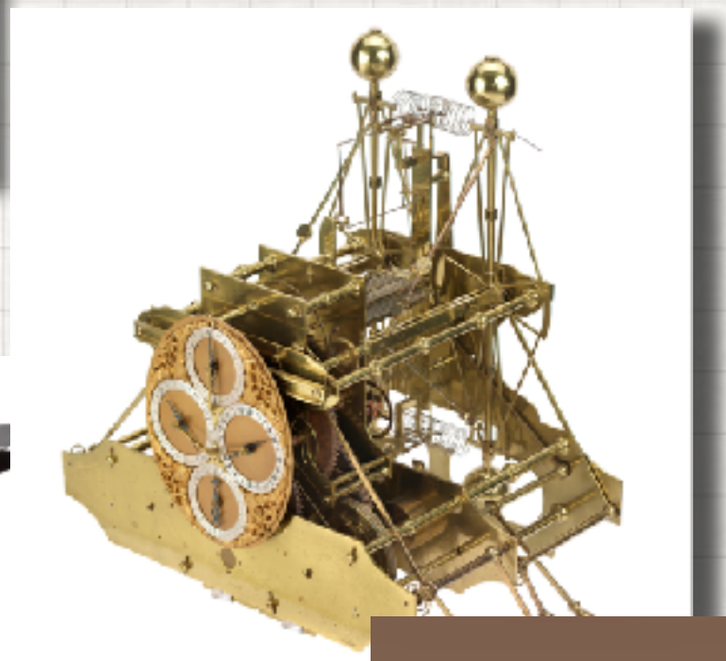
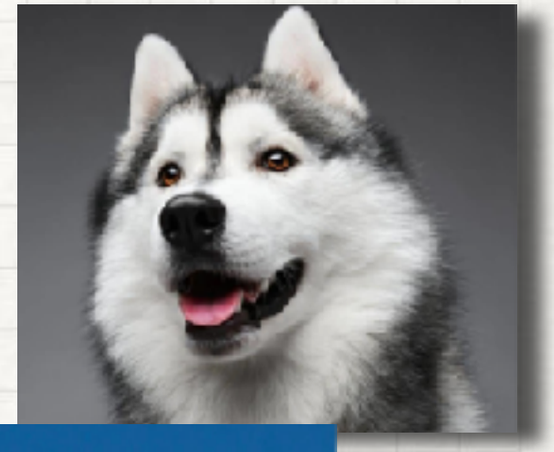
MACHINE LEARNING

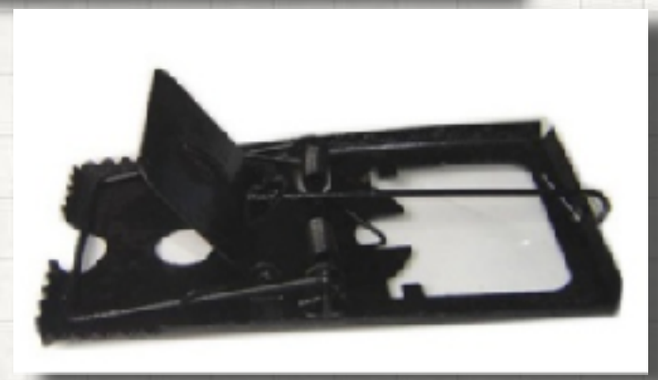
REVIEW AND REFLECT

MOD1: REVIEW

Artificial **Intelligence**







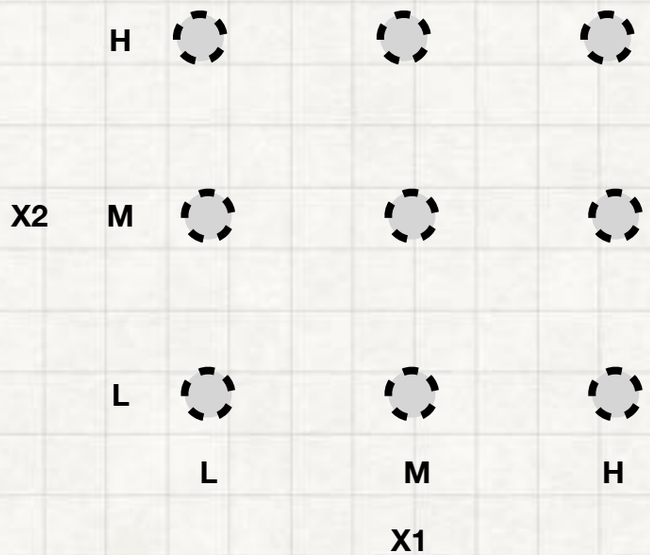
Learning

Intelligence Essential—Extract Knowledge from Data

W1

A complete table of all possible hypotheses

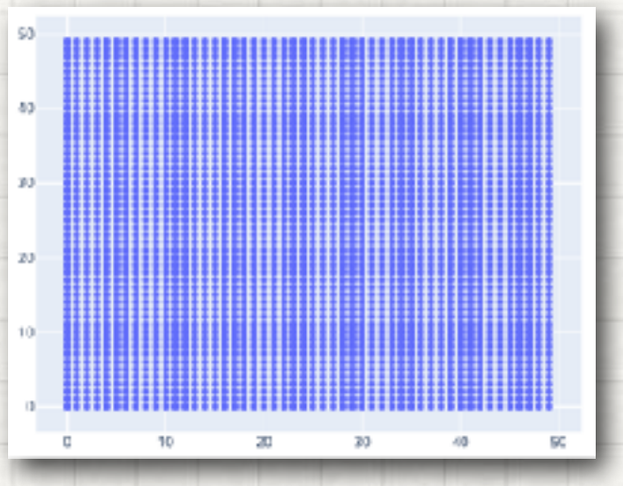
	X1	L	L	L	M	M	M	H	H	H
Y|X	X2	L	M	H	L	M	H	L	M	H
q0		0	0	0	0	0	0	0	0	0
q1		0	0	0	0	0	0	0	0	1
q2		0	0	0	0	0	0	0	1	0
q3		0	0	0	0	0	0	0	1	1
q4		0	0	0	0	0	0	1	0	0
q5		0	0	0	0	0	0	1	0	1
q6		0	0	0	0	0	0	1	1	0
q7		0	0	0	0	0	0	1	1	1
…										



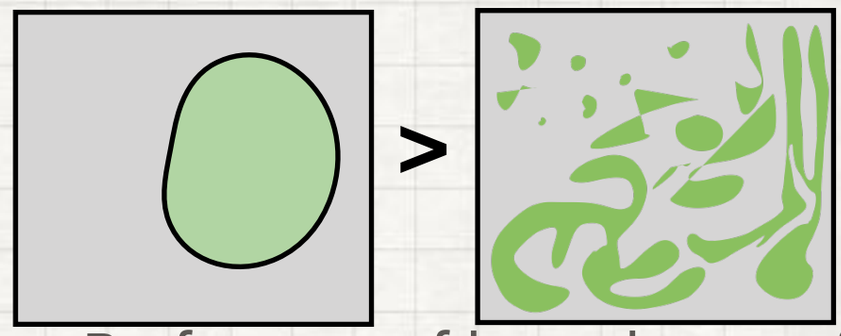
$2^{2500}=$

375828023454801203683362418972386504867736551759258677056523839782231681498337708535732725752658844333702457749526057760309227891351617765651907310968780236464694043316236562146724416478591131832593729111221580180531749232777515579969899075142213969117994877343802049421624954402214529390781647563339535024772584901607666862982562567918622647636160208877365834950163790188523025744050739038203218889238610990586970870143243921198482212075444022433366554788655938968958563812658237722403772170223914414660261857526515029364722809111818200320375496336749951569521541850441741758440662952796718726052857925526601307[illegible]99821833474935632167746952968255178[illegible]58267502715894007887727250070780350262952377214028842297486263597879792176338220932619489509376

Doesn't work



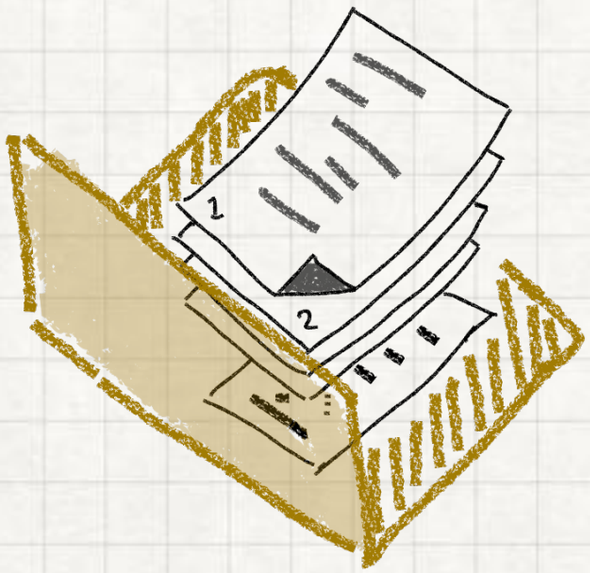
Regularity Needed

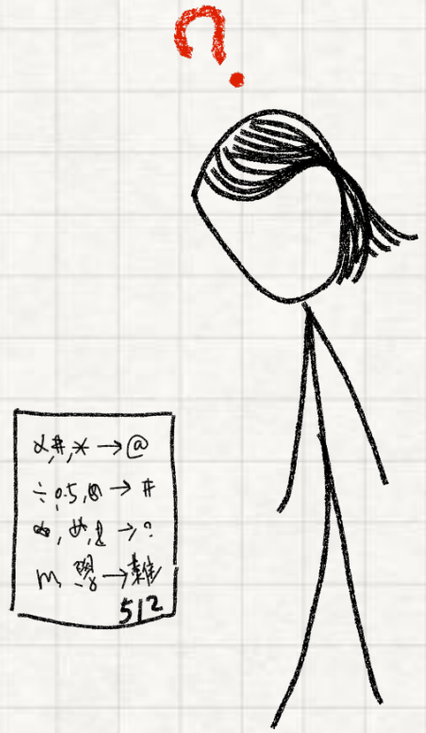


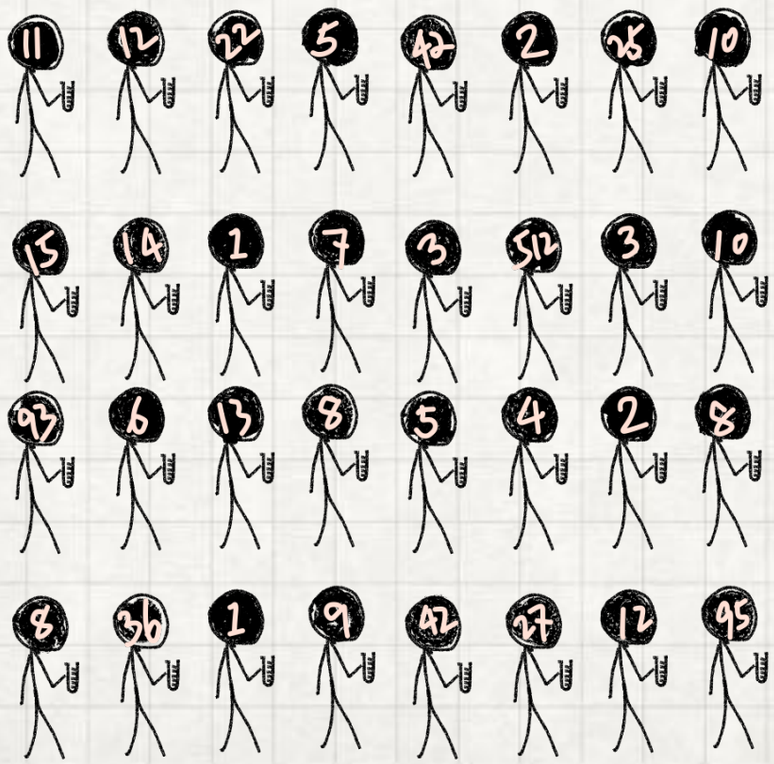
Preference of hypotheses of "regular" data-target relationship

W2

RISK EXPLOSION FOR LEARNED h FROM A LARGE $\mathscr{H}$







$$P(\sup_{h \in \mathscr{H}} |E_{in}[h] - E_{out}[h]| > \epsilon)$$

$$\leq 4 m_{\mathscr{H}}(2N) e^{-\frac{1}{8}\epsilon^2 N}$$

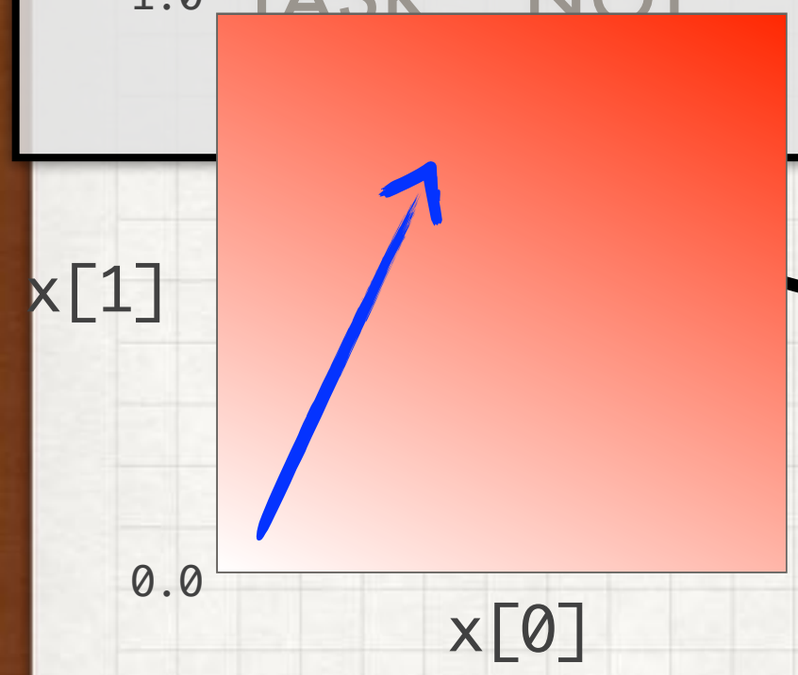
W3

$x \to y$

$\{(x_1, y_1), (x_2, y_2), \dots\}$

DEFINING THE "TASK" NOT

SOURCE OF RANDOMISATION



$h^* \in \mathcal{H}$

Algorithm

FINAL DELIVERABLE TO DEPLOY AND TO TAKE RISK

SELECTION/ LEARNING PROCESS – THIS LECTURE

$\mathcal{H} : \{h_1, h_2, \dots, \} : x \to y$

DATA MODEL (FAMILY) MAIN FACTOR UNDER CONTROL

- $a = w_1 x_1 + w_2 x_2 + \dots + w_p x_p + b$

W4

$D_{train} : \{(x_1, y_1), (x_2, y_2), \ldots\}$

feed

LOSS

LEARNING ALGORITHM

$\mathscr{A}$

CANDIDATE H

$\mathscr{H}$

produce

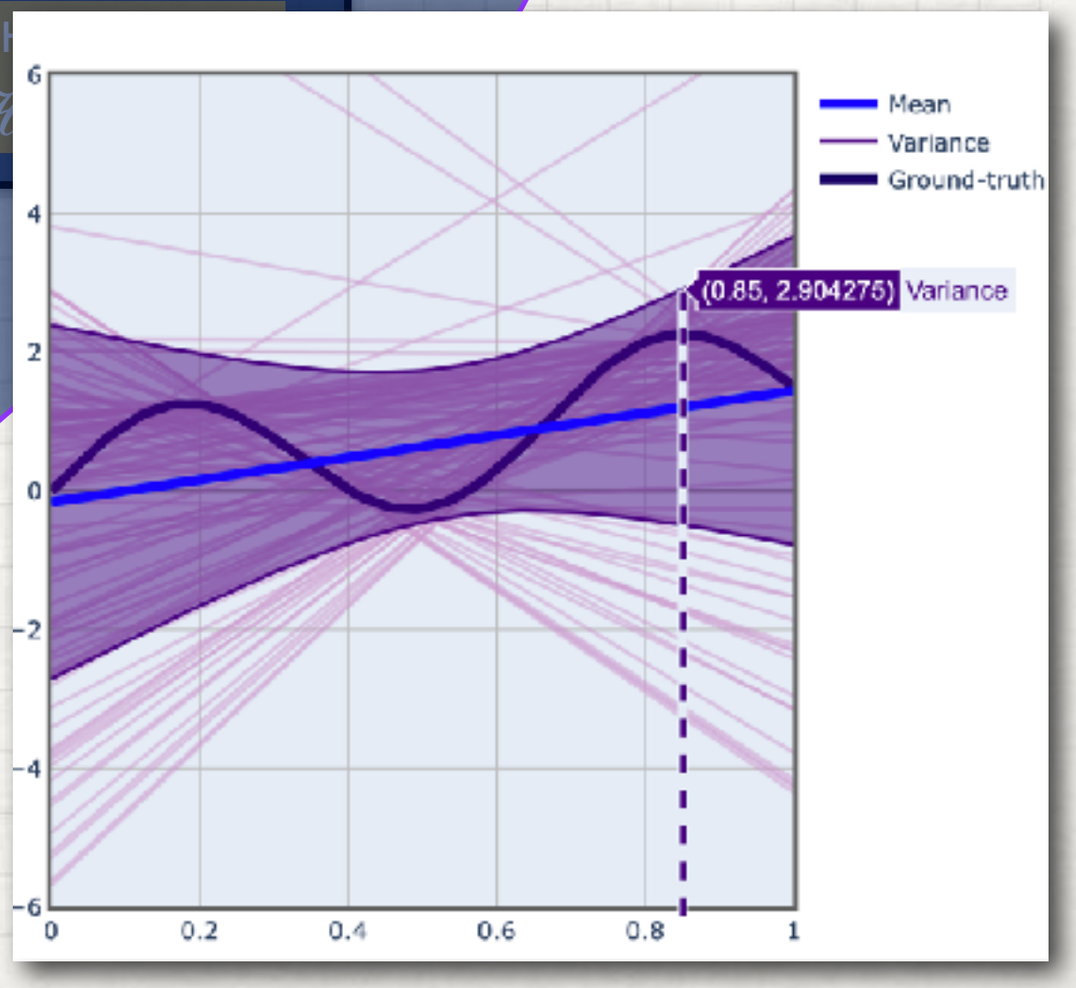
h^*

apply

x_{test}

produce

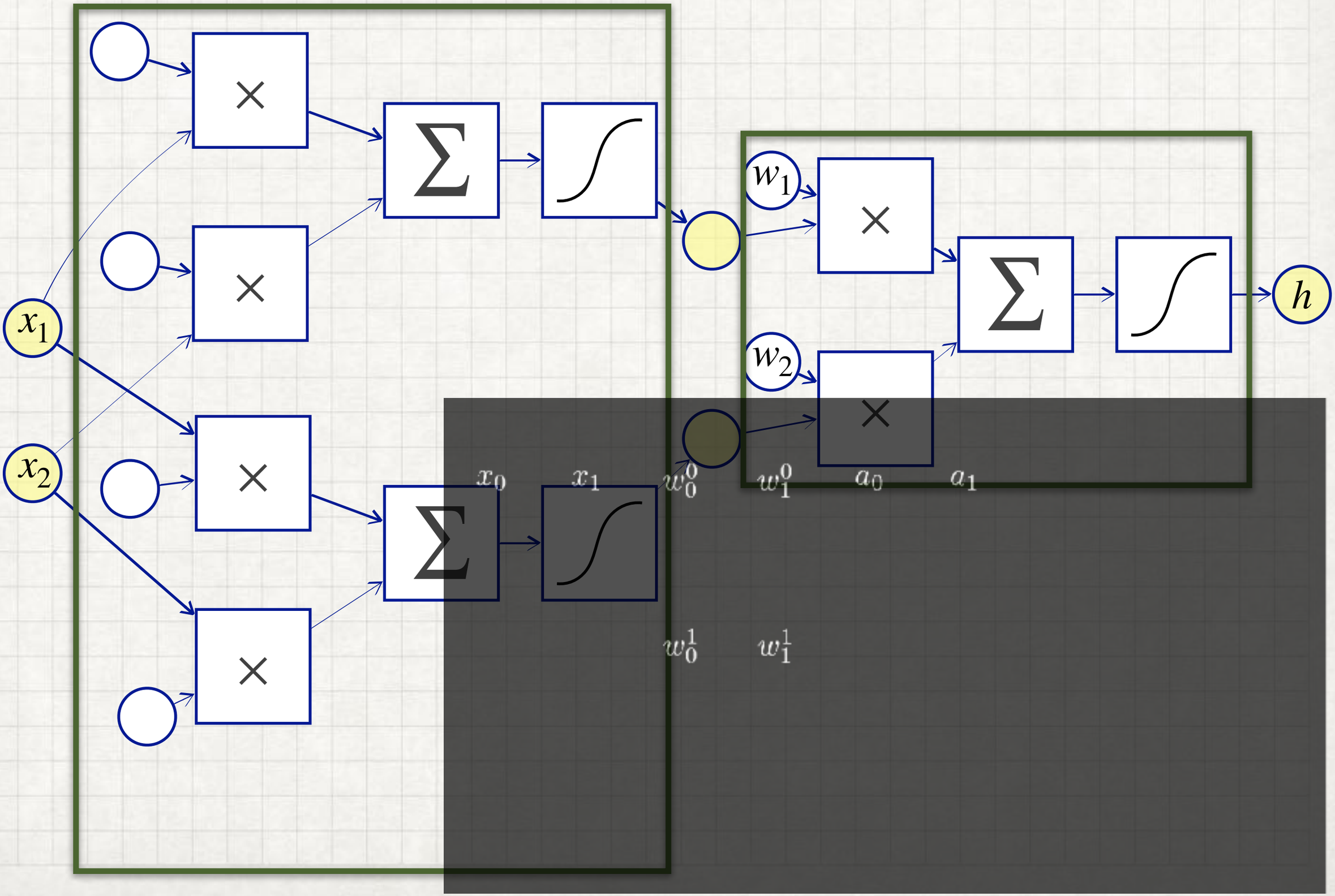
$y^*_{test} = h^*(x_{test})$



W5

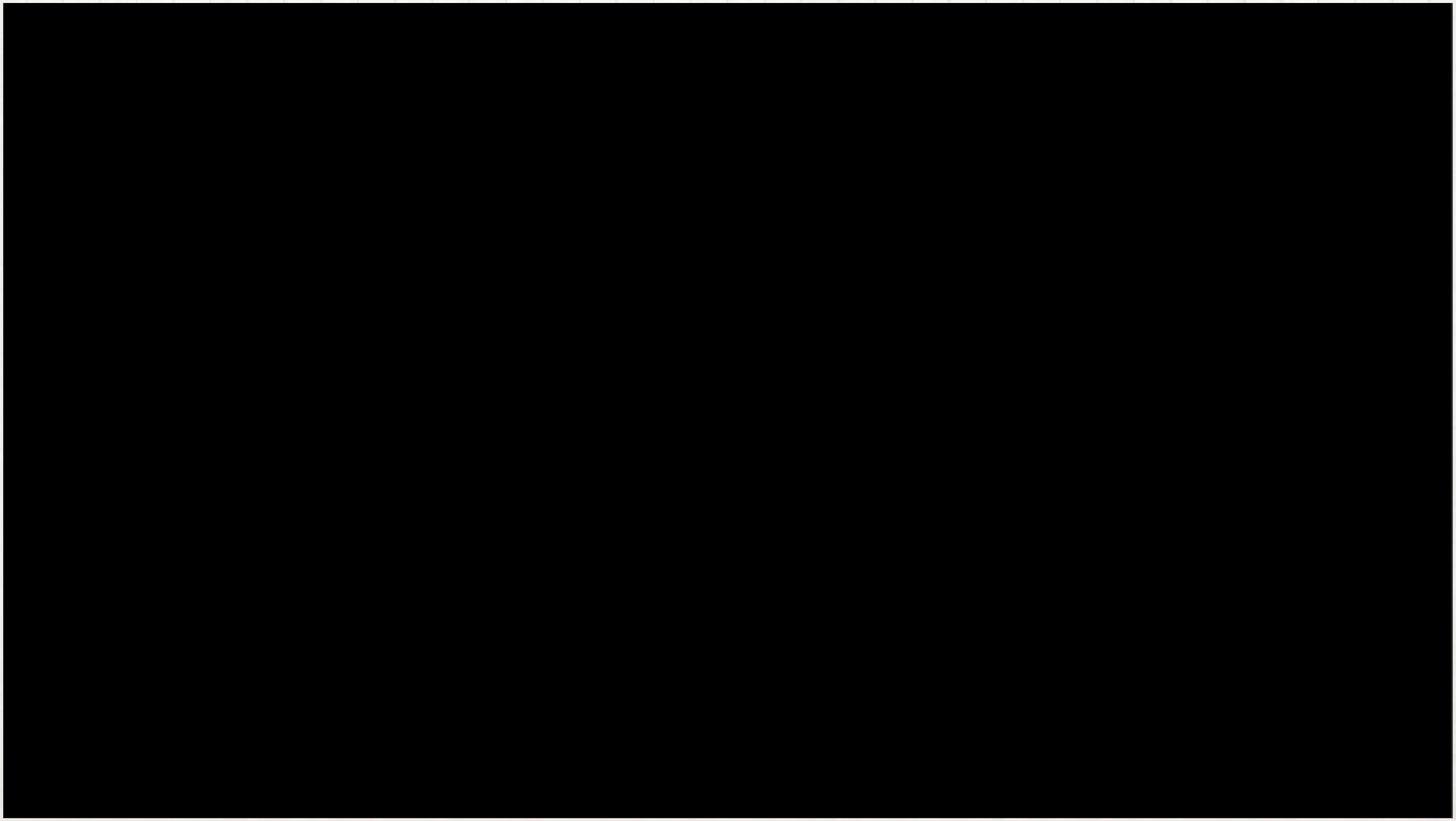
- Array Data Op's
- Real-world Arrays

W7



W8 DEEP ARCHITECTURES

- Convolutional Neural Networks
  - Linear Op: conv. is linear
- ResNet | Dropout | etc.



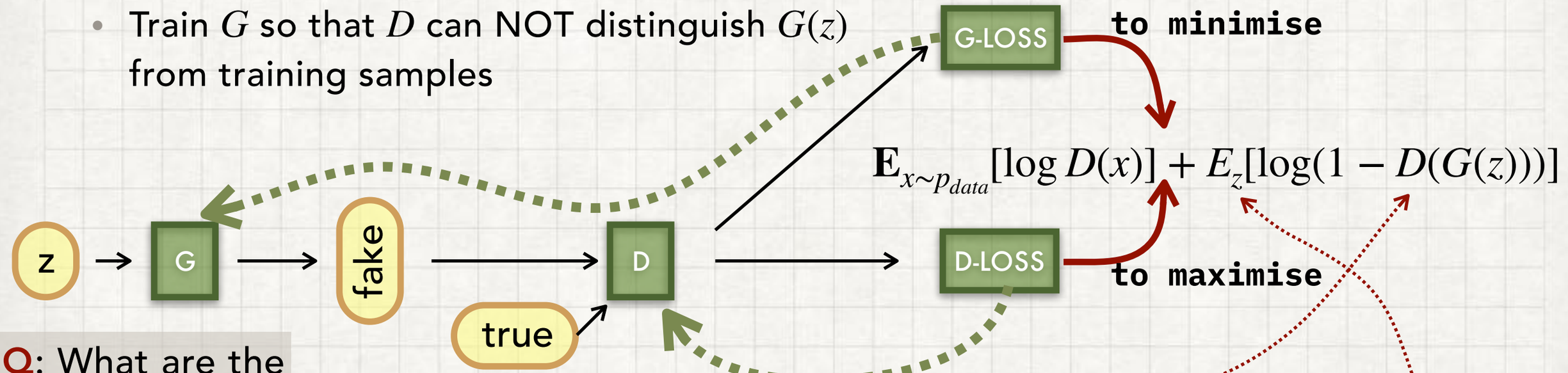
W9: GAN FRAMEWORK

- GAN Framework
  - G generates samples in $\mathcal{X}$ by mapping random noises $G(z)$
  - Train D to distinguish $G(z)$ from training samples (**Remove the density estimation step**)
  - Train G so that D can NOT distinguish $G(z)$ from training samples

Q: G-LOSS?

A. Derive separately.

B. Same expression as D-Loss, min/max flips.



Q: What are the fake samples?

A. z

B. x

C. G(z)

Q: 1-D(G(z)) ?

A. D maximises it, which minimises D(G(z)), which expresses "G(z) is a not true sample"

B. G minimises it, which maximises D(G(z)), which expresses "hey D, this IS a true sample"

Q: z-distribution?

A. Random.

B. Depends on data.

MOD2: RESOURCES – CONTINUE LEARNING

ADVANCED FORUMS

- Machine Learning
  - NeurIPS, ICML, ICLR, UAI, AISTATS, IJCAI, AAAI
  - JMLR, T-PAMI, T-NNLS
- Computer Vision
  - Conferences CVPR / ICCV / ECCV / BMVC
  - IJCV, T-IP
- Natural Language Processing
  - ACL

POPULAR FORUMS

QUALITY CONTROL

- reddit
- medium
- youtube channels (two minute paper, etc.)
- trick
  - $paper-name + github

MOD3: RESOURCES – BECOME PROFESSIONALS AND RESEARCHERS

INTERNSHIP AND SCHOLARSHIP

- APR Intern
  - https://aprintern.org.au
- CSIRO
  - https://jobs.csiro.au/go/Students/990500/
- Google IBM Microsoft (+Research)
- Email Lists
  - Connectionist
  - UAI

1. PhD and Postdoc positions in Frankfurt, Germany (Martin Vinck)
2. Re: Registration is open and 2nd CFP: 2nd Symposium on Advances in Approximate Bayesian Inference (AABI 2019) (Thang Bui)
3. Postdoctoral positions at the University of Trento, Italy (Nicu Sebe)
4. PhD Studentships and the University of Edinburgh (Frank Keller)
5. Seeking two phd students (Serafim Rodrigues)
6. PhD position in Cognitive Robotics (navigation in crowded environments) at Aarhus University, Denmark (Nicol?s Navarro-Guerrero)
7. PhD and Postdoc positions in Frankfurt, Germany (Martin Vinck)
8. [Topic] Algorithms for Personalization Techniques and Recommender Systems (M Elahi)
9. 2 Postdocs and 1 Project Manager on H2020 grant (Michele Giugliano)
10. Data Scientist (KTP Associate), CSEE, University of Essex, UK (Alba Garc?a)

PORTFOLIO BUILDING

- Github Account
- LinkedIn
- Stackoverflow Account
- Kaggle (you must know what you are doing)

MOD4: MOVIES

DATA SCIENCE PROFESSIONAL

READY FOR REAL-WORLD

- CAPSTONE PROJECTS
- RESEARCH PREPARATION

41004, 41029, …

ADVANCED SKILLS

- MACHINE LEARNING
- DATA EXPLORATION
- DEEP NEURAL NETWORKS
- APPLICATIONS

31005, 32146, 31256, 42913, …

MATH THEORY

- LINEAR ALGEBRA
- STATISTICS

37151, 37131, …

COMPUTER TOOLS

- PROGRAMMING SKILLS
- DATA MANAGEMENT

31253, 48024, …

PRODUCT DESIGN

- BUSINESS MODELLING
- DECISION MAKING

31250, …

THE END OF THE BEGINNING