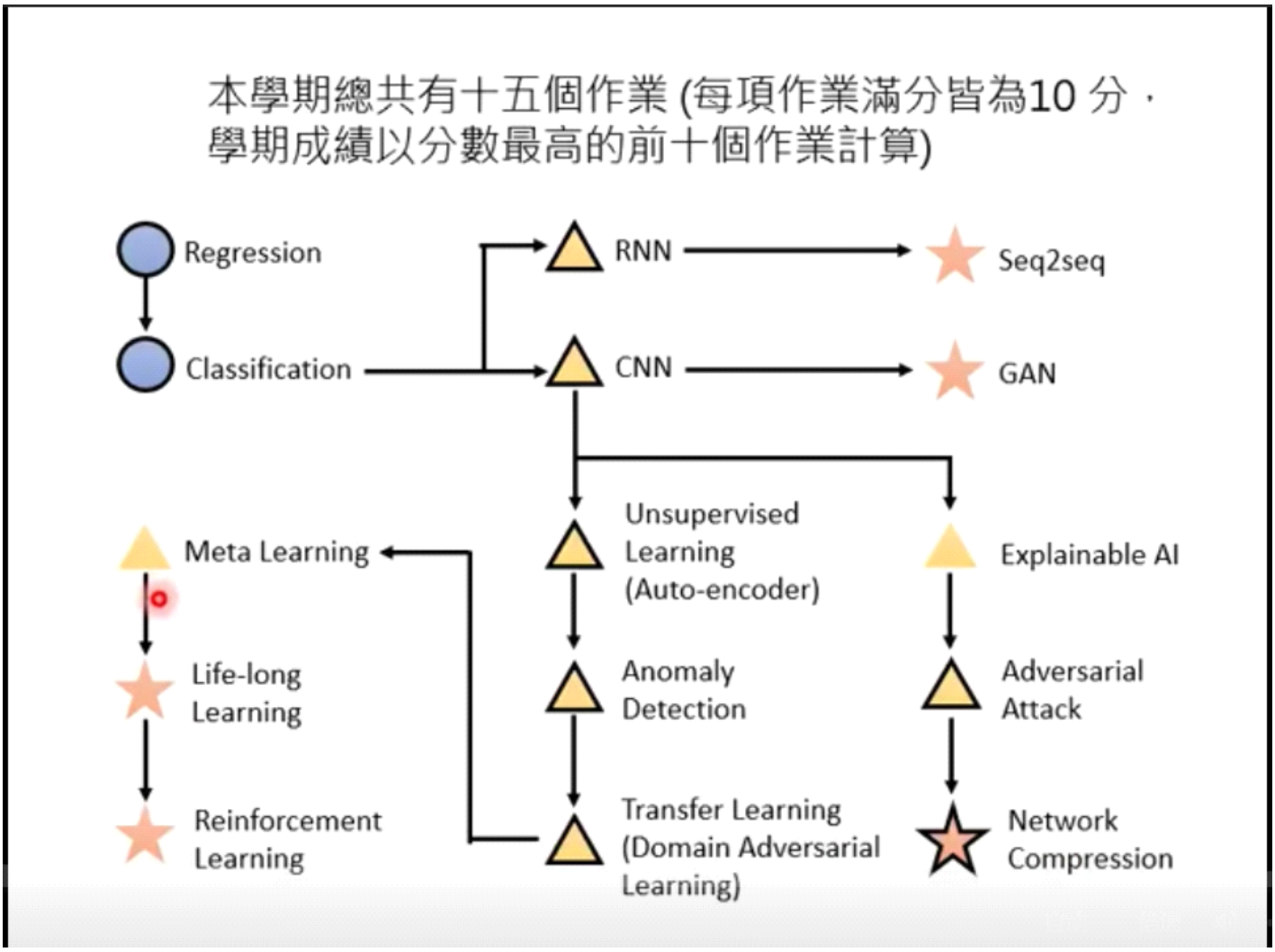
李宏毅2020机器学习

2020年7月22日 16:22



机器学习就是自动找函数

Speech recognition 语音辨识

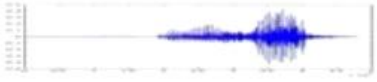
Image recognition 图像辨识

Player Go 下围棋

对话系统

機器學習就是自動找函式

- Speech Recognition

$f($  $)=$ “How are you”

- Image Recognition

$f($  $)=$ “Cat”

- Playing Go

$f($  $)=$ “5-5” (next move)

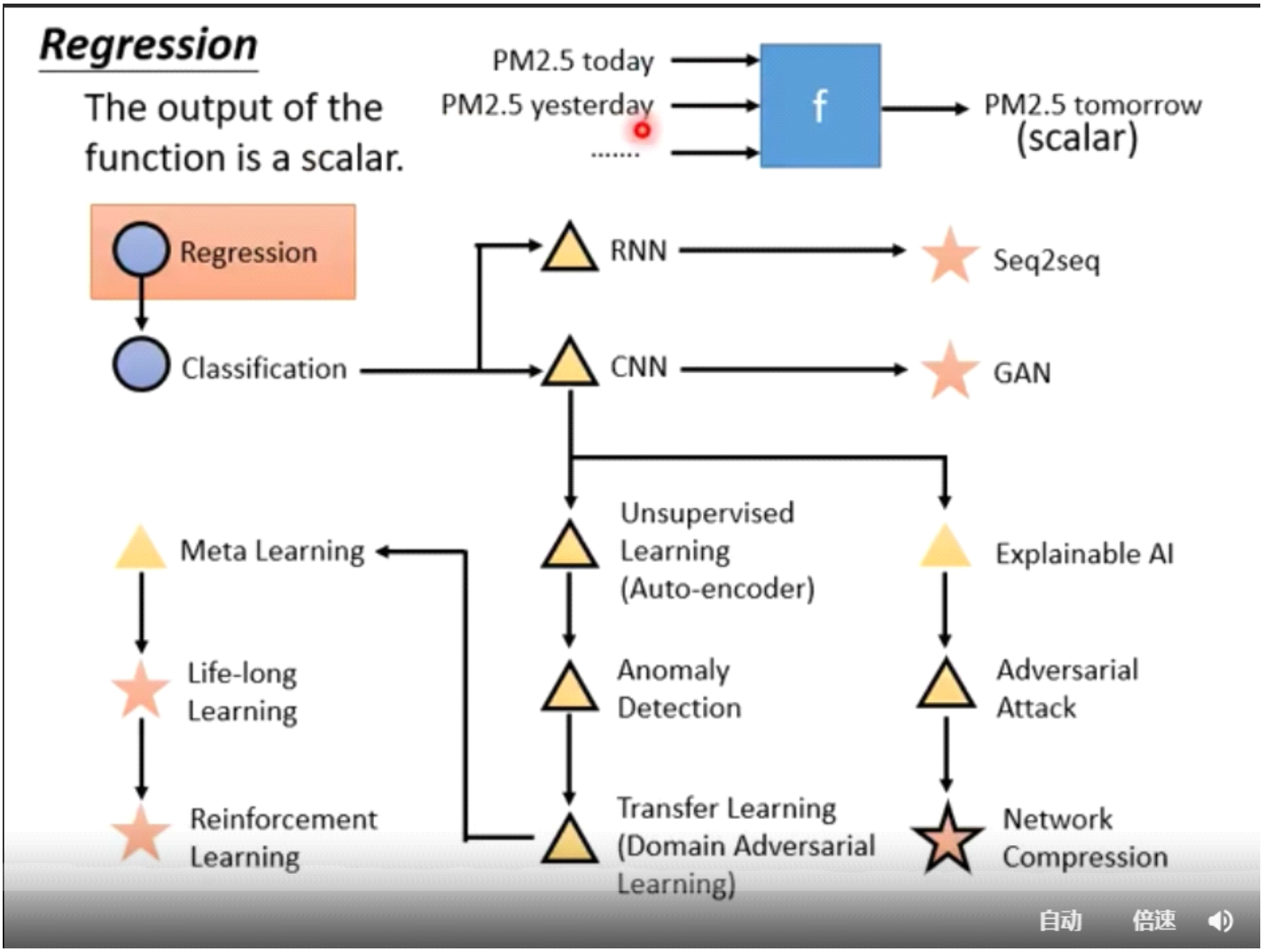
- Dialogue System

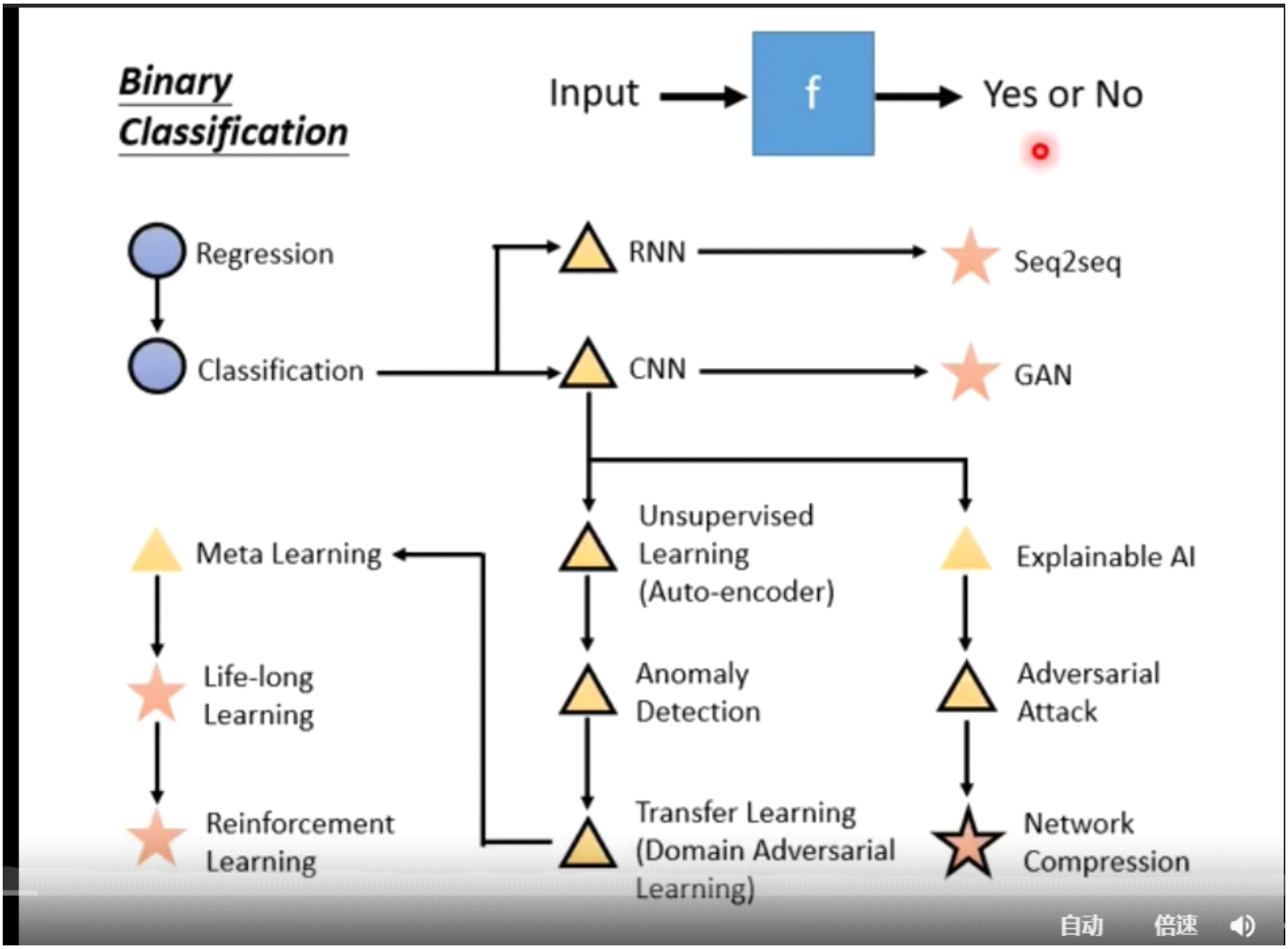
$f($ “How are you?” $)=$ “I am fine.”

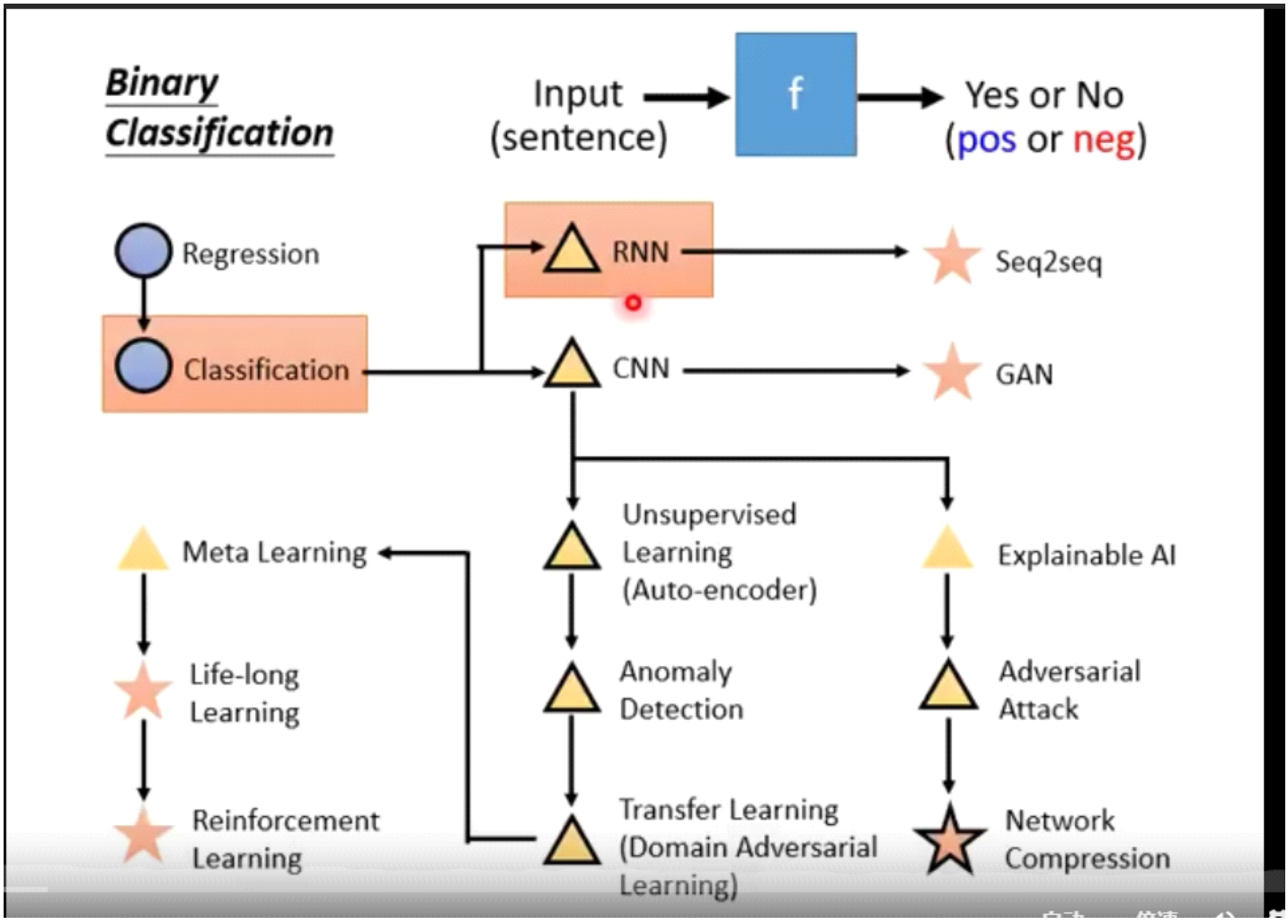
(what the user said) (system response)

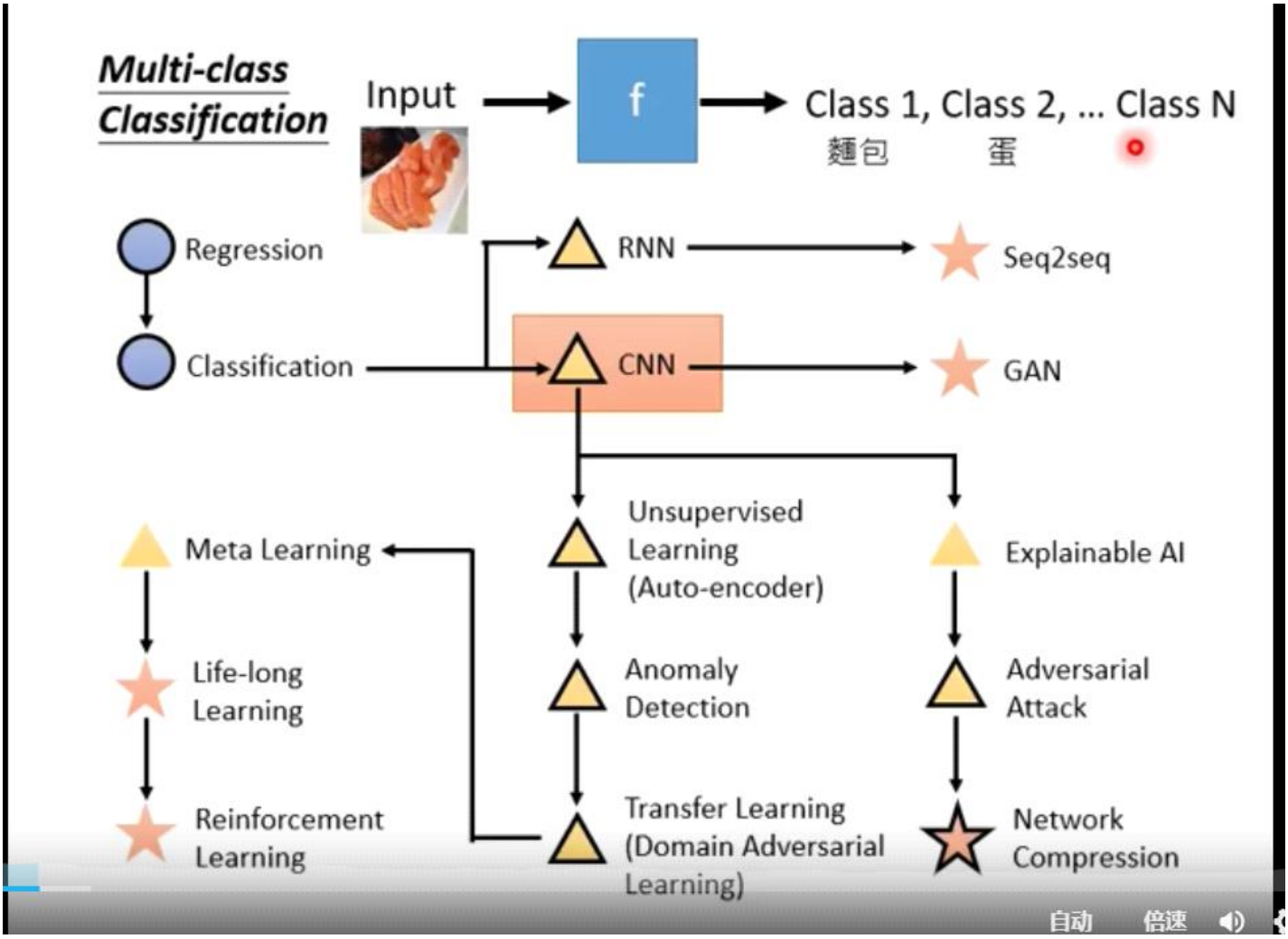
自动 倍速

你想找什麼樣的函式？

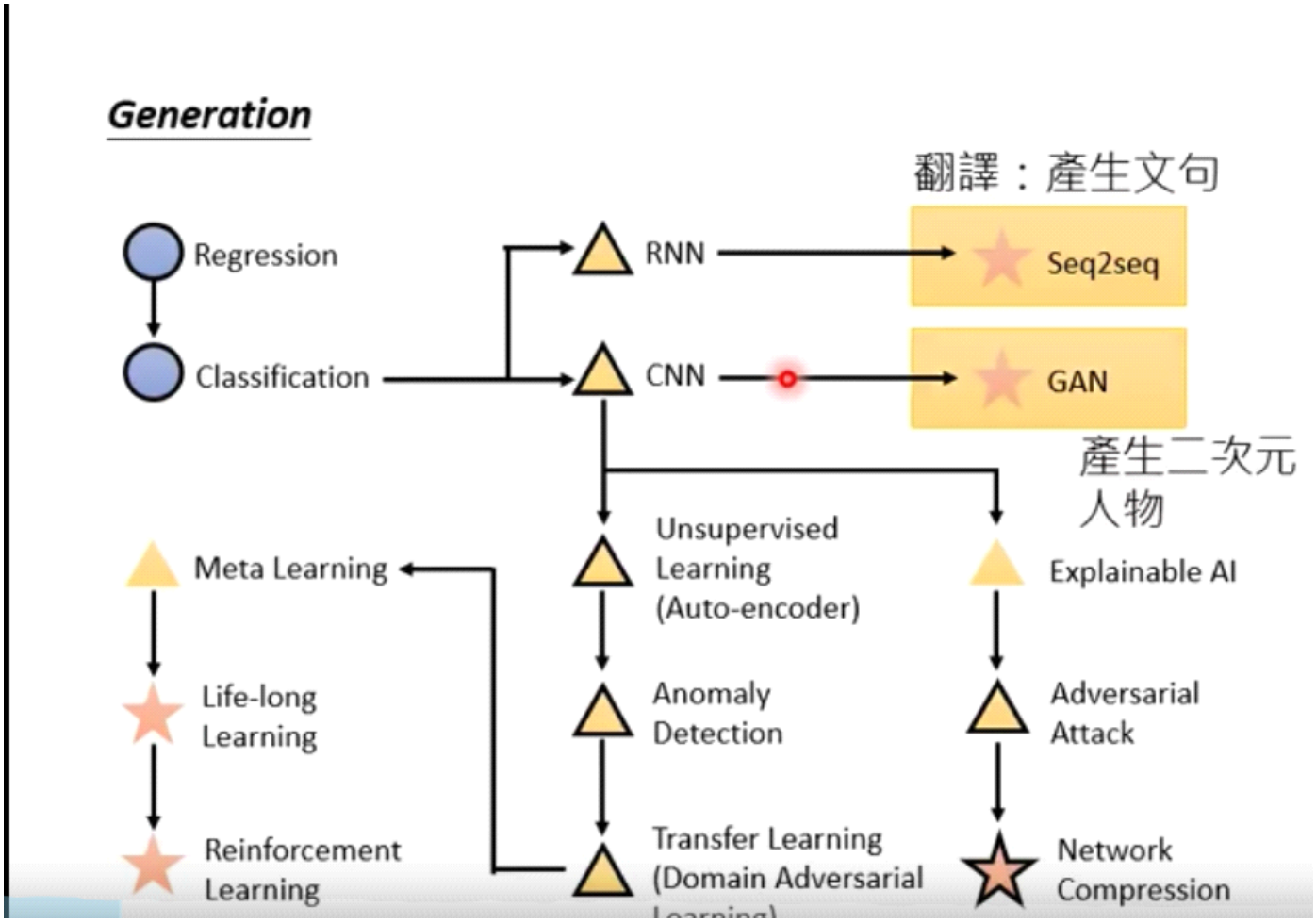

Regression
The output of the function is a scalar.
PM2.5 today
PM2.5 yesterday
.....
f
PM2.5 tomorrow
(scalar)
Regression
Classification
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression
自动
倍速


Binary Classification
Input
f
Yes or No
Regression
Classification
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression
自动
倍速


Binary Classification
Input (sentence)
f
Yes or No (pos or neg)
Regression
Classification
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression


Multi-class Classification
Input
f
Class 1, Class 2, ... Class N
麵包
蛋
Regression
Classification
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression
自动
倍速

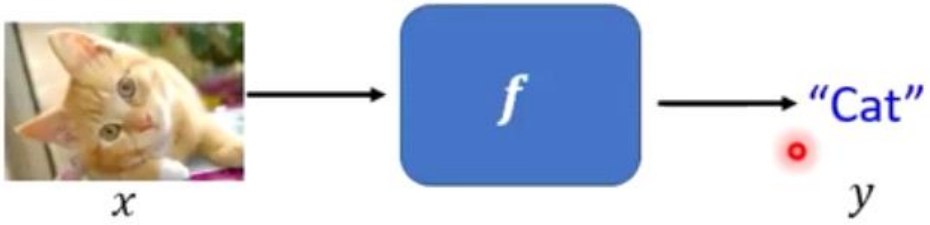

Generation (生成)
產生有結構的複雜東西
(例如：文句、圖片)
Regression,
Classification


Generation
翻譯：產生文句
Regression
Classification
RNN
CNN
Seq2seq
GAN
產生二次元人物
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial
Explainable AI
Adversarial Attack
Network Compression

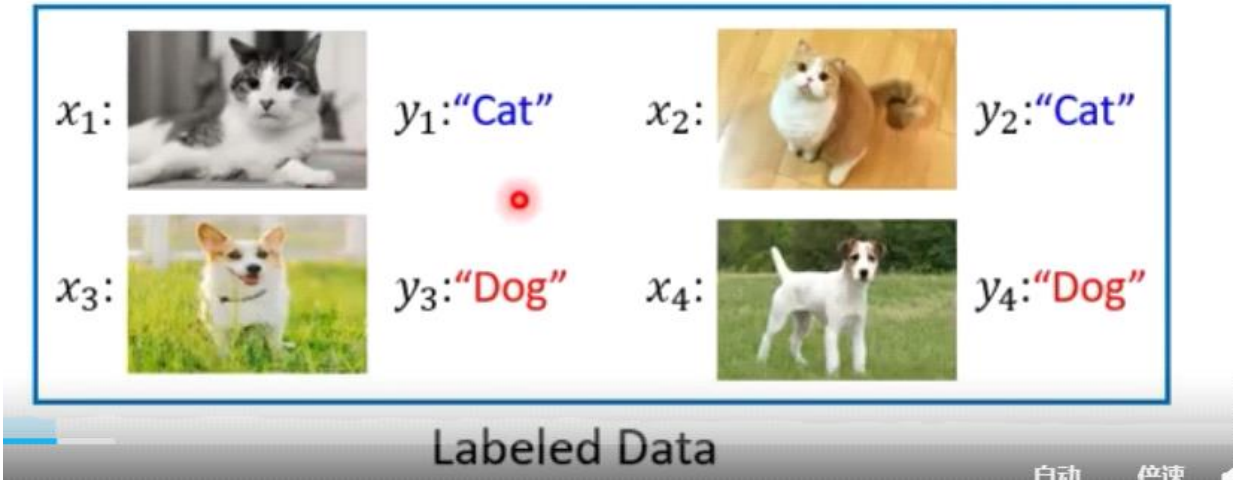
怎麼告訴機器
你想找什麼樣的函式？

怎么告诉机器，你想找什么样的

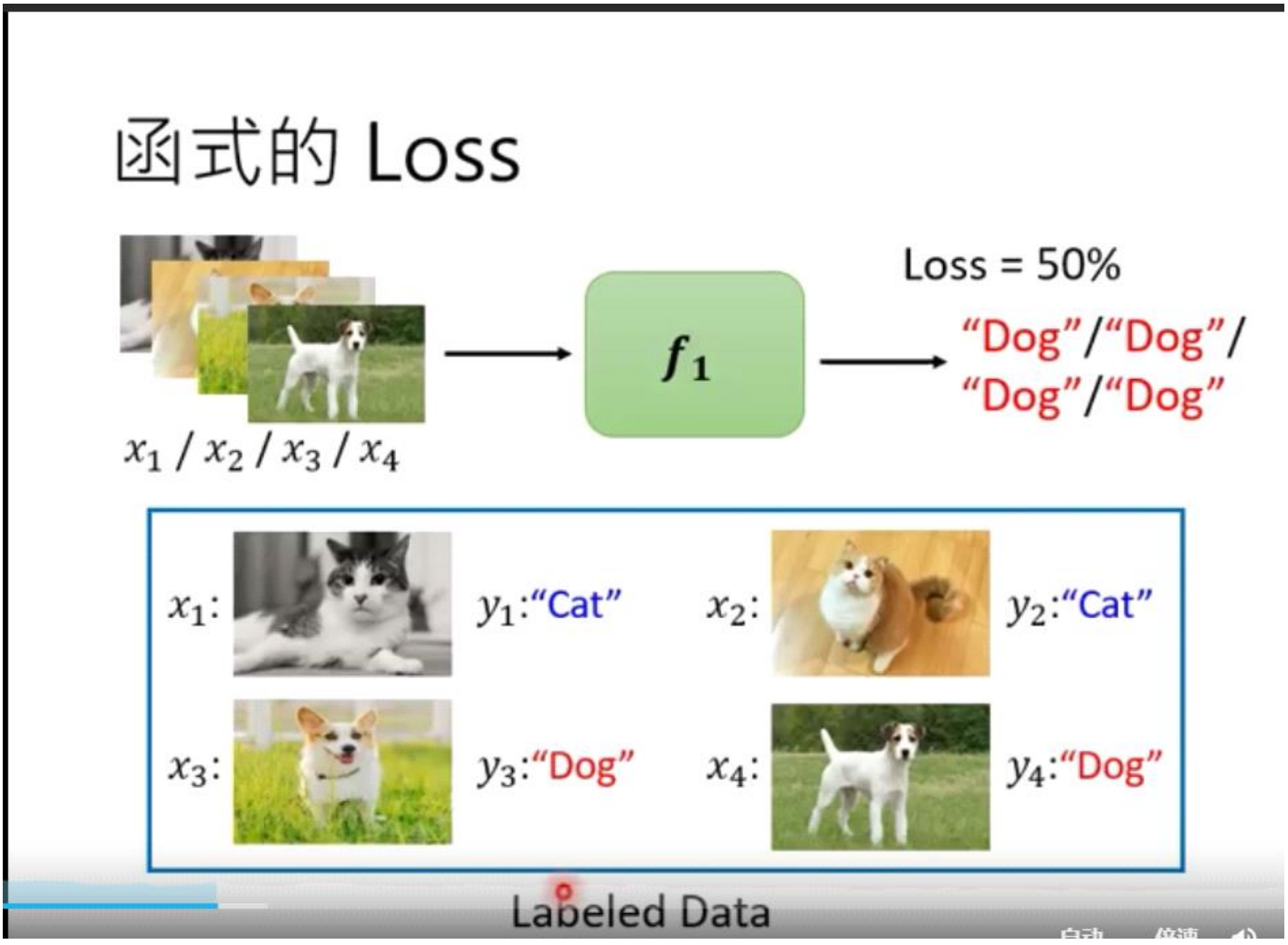
Supervised Learning

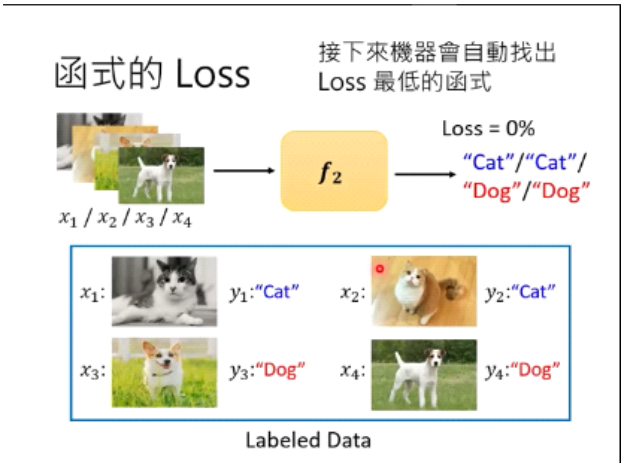


训练资料

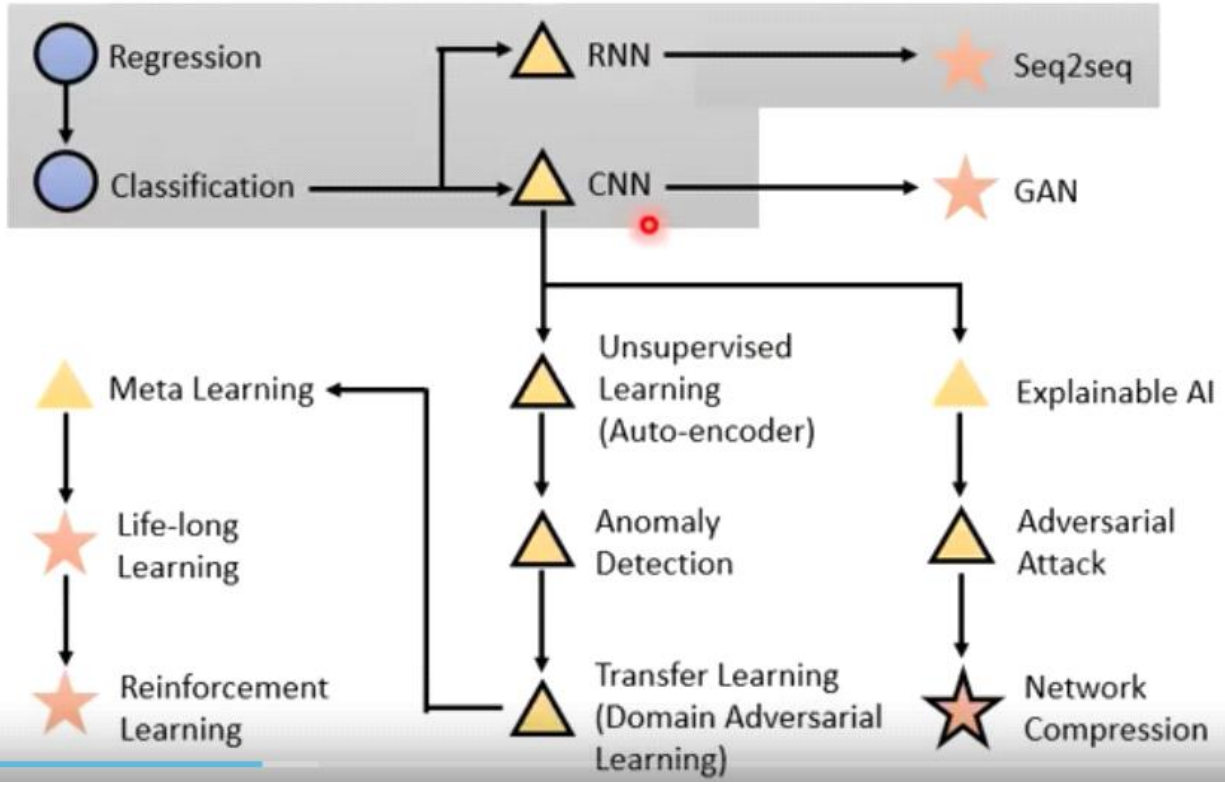


告诉机器 那个函数 的理想输出


函式的 Loss
x_1 / x_2 / x_3 / x_4
f_1
Loss = 50%
"Dog"/"Dog"/
"Dog"/"Dog"
x_1: y_1:"Cat"
x_2: y_2:"Cat"
x_3: y_3:"Dog"
x_4: y_4:"Dog"
Labeled Data


函式的 Loss
接下來機器會自動找出
Loss 最低的函式
x_1 / x_2 / x_3 / x_4
f_2
Loss = 0%
"Cat"/"Cat"/
"Dog"/"Dog"
x_1: y_1:"Cat"
x_2: y_2:"Cat"
x_3: y_3:"Dog"
x_4: y_4:"Dog"
Labeled Data

Supervised Learning

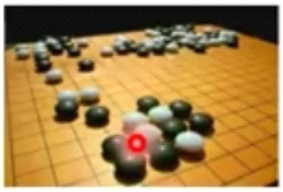


Reinforcement Learning

Supervised v.s. Reinforcement

- Supervised:

Next move: "5-5"



Next move: "3-3"

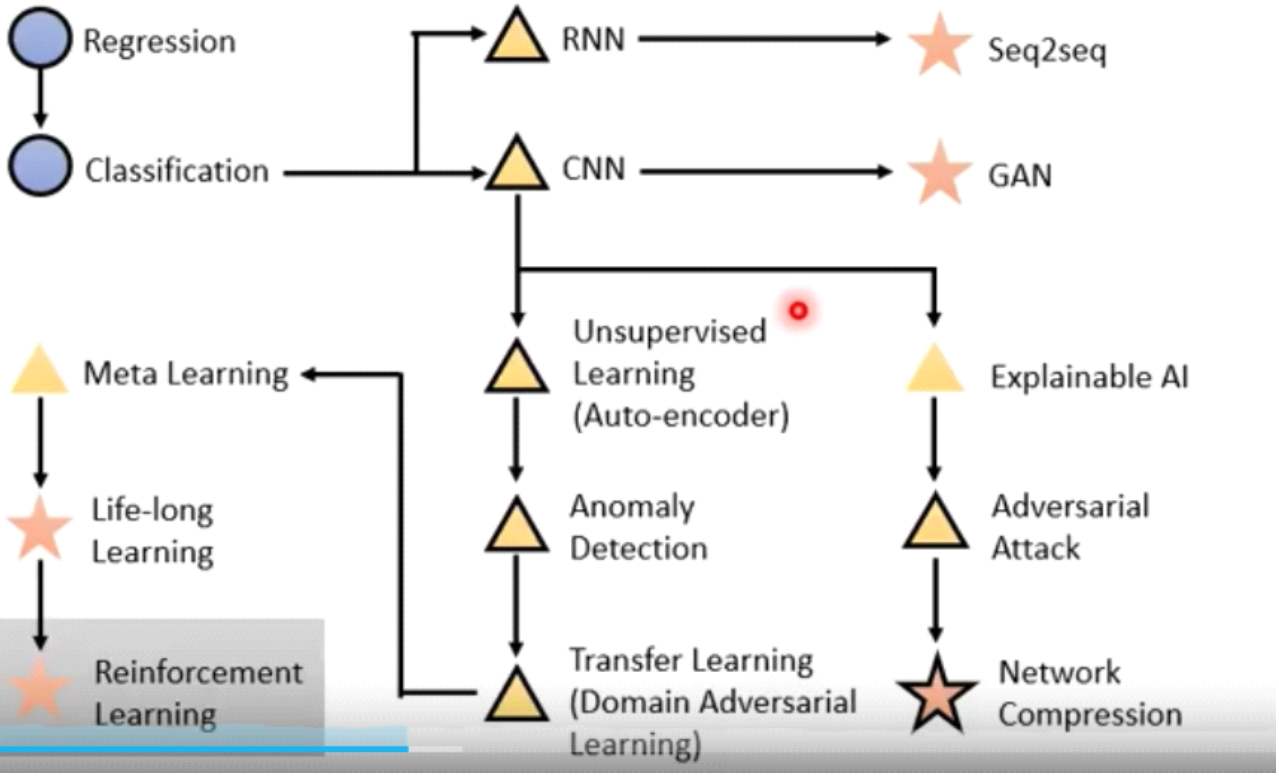
- Reinforcement Learning

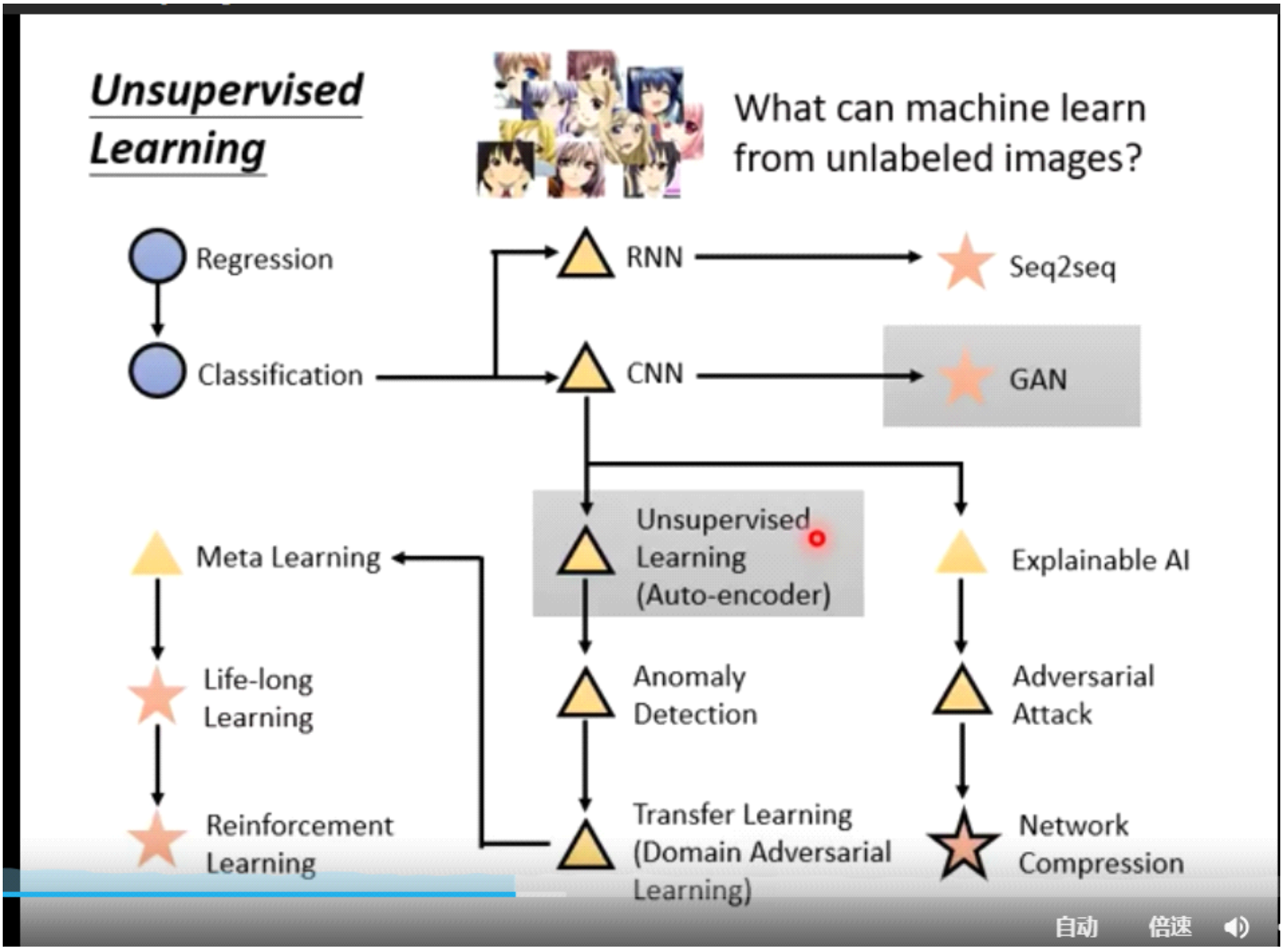
(Reward)

First move → ..... many moves ..... → Win!

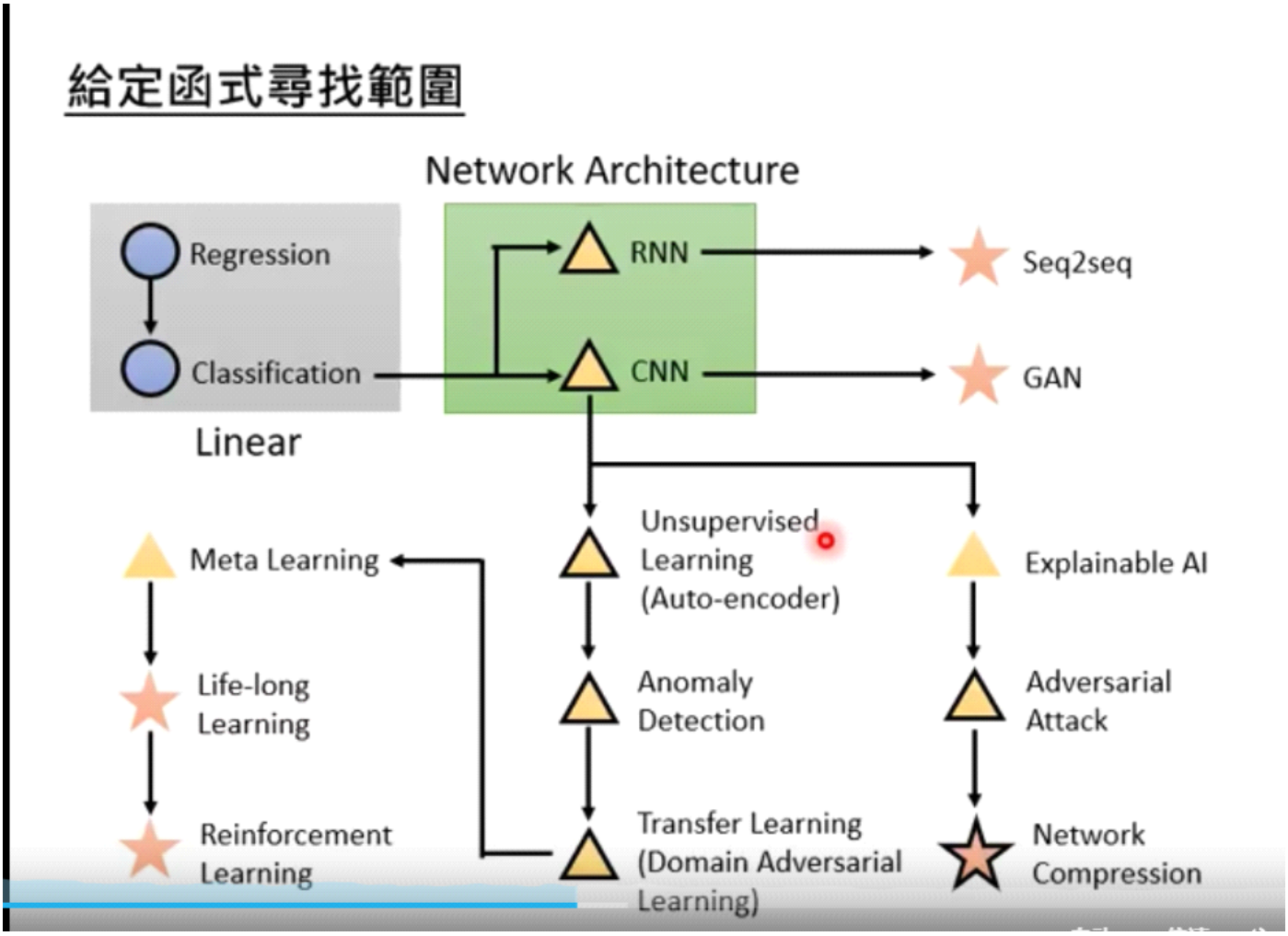
Alpha Go is supervised learning + reinforcement learning.

Reinforcement Learning

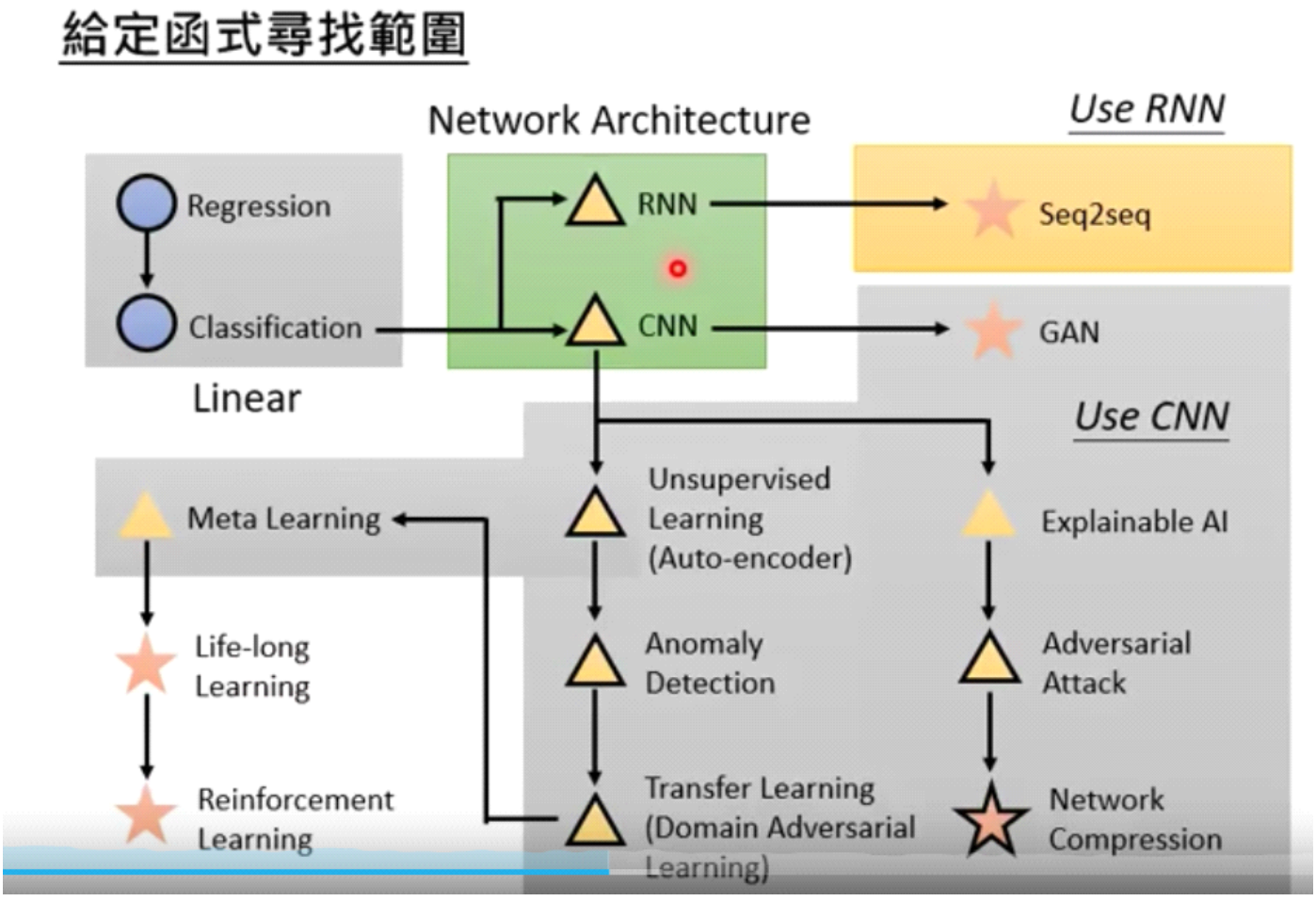


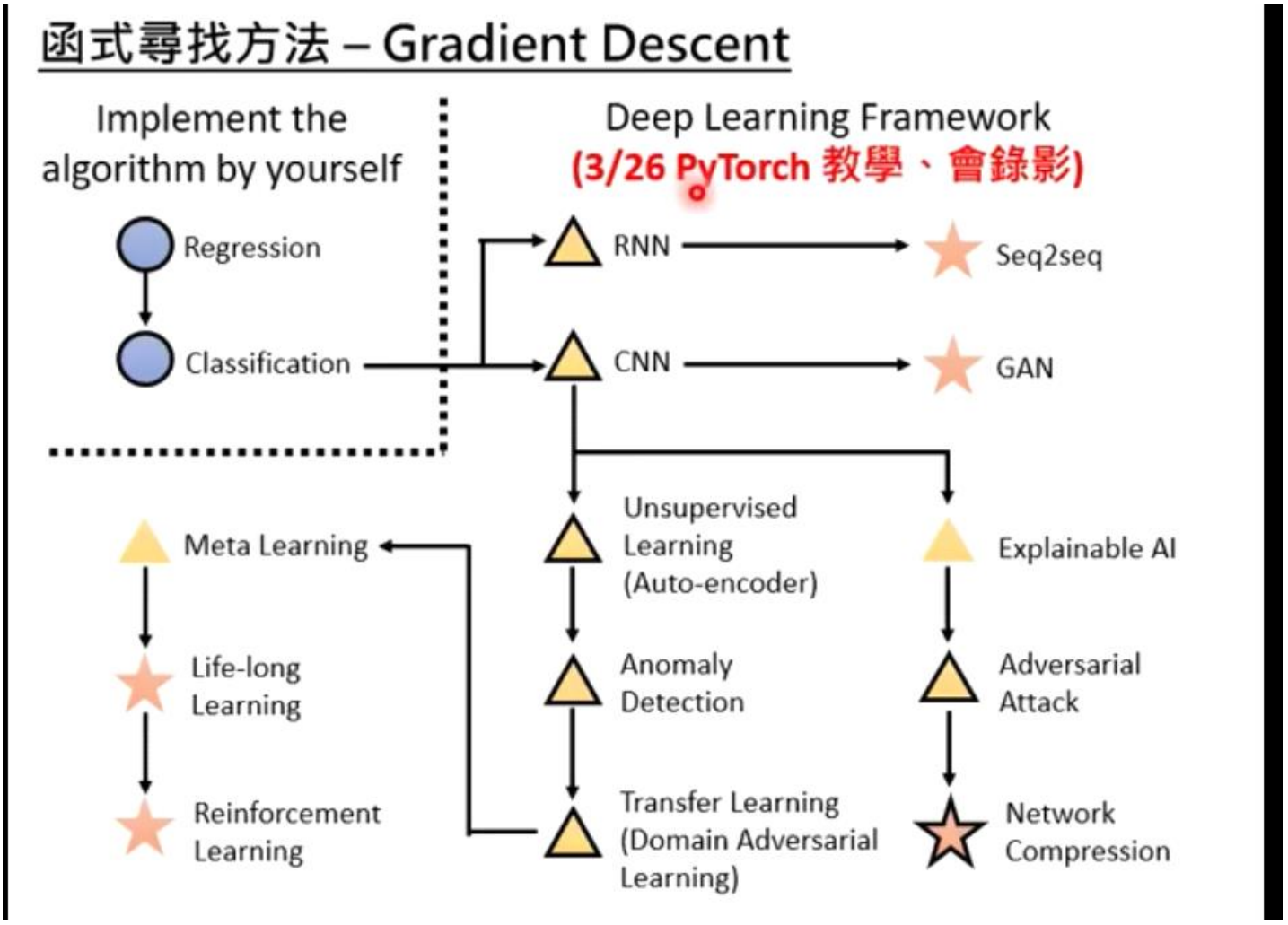


機器怎麼
找出你想要的函式？

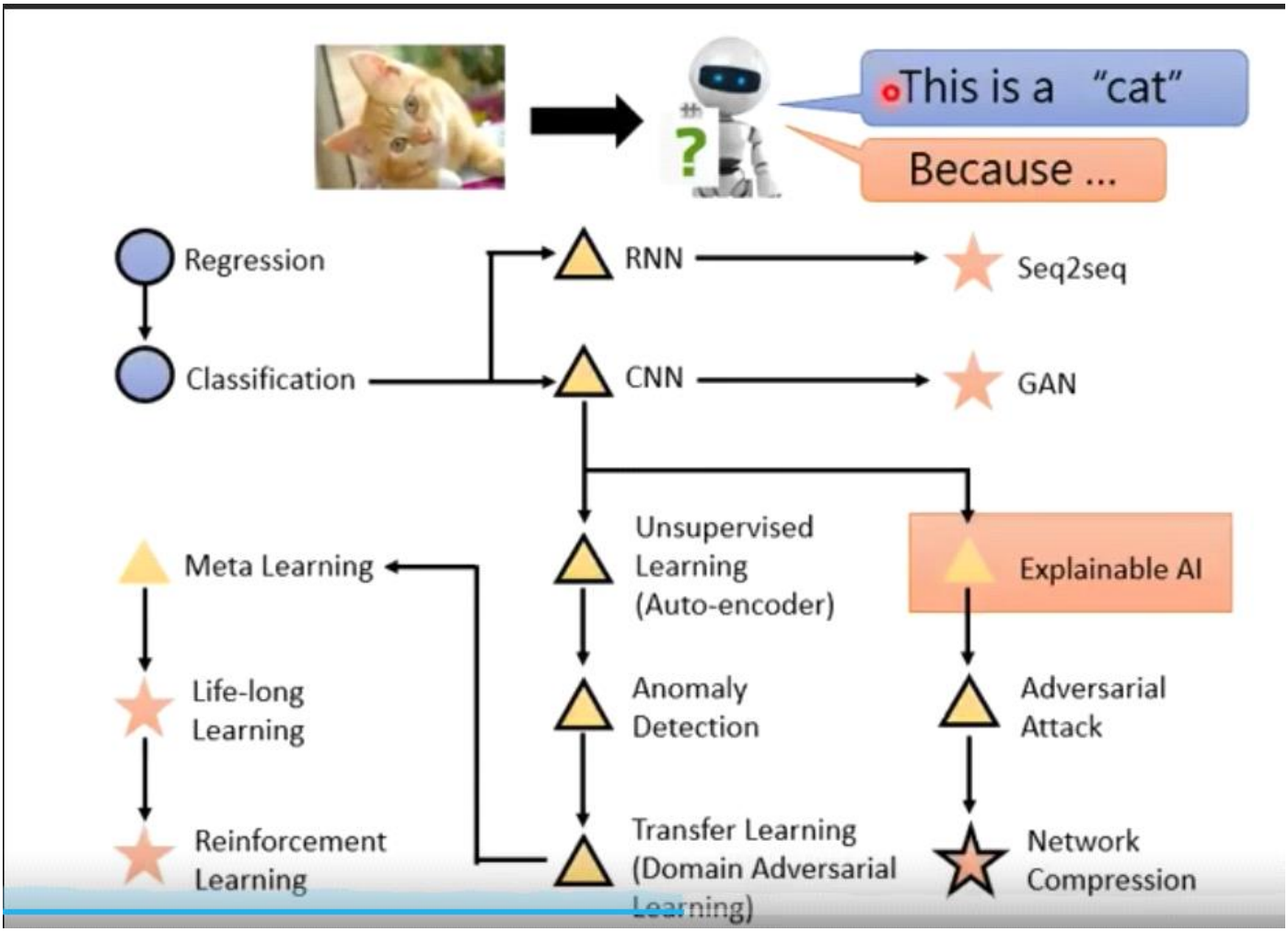

給定函式尋找範圍
Network Architecture
Regression
Classification
Linear
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression

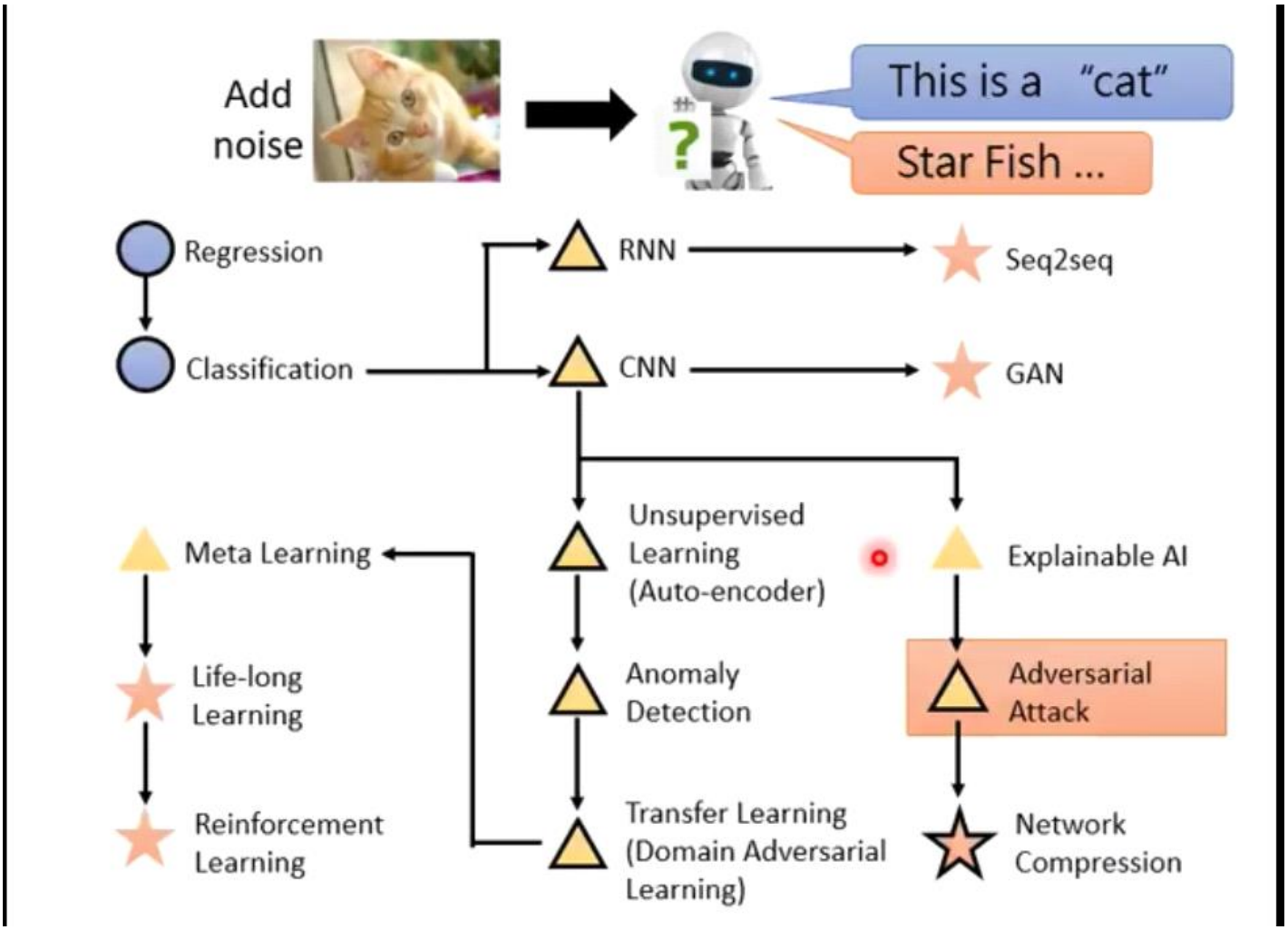
网络

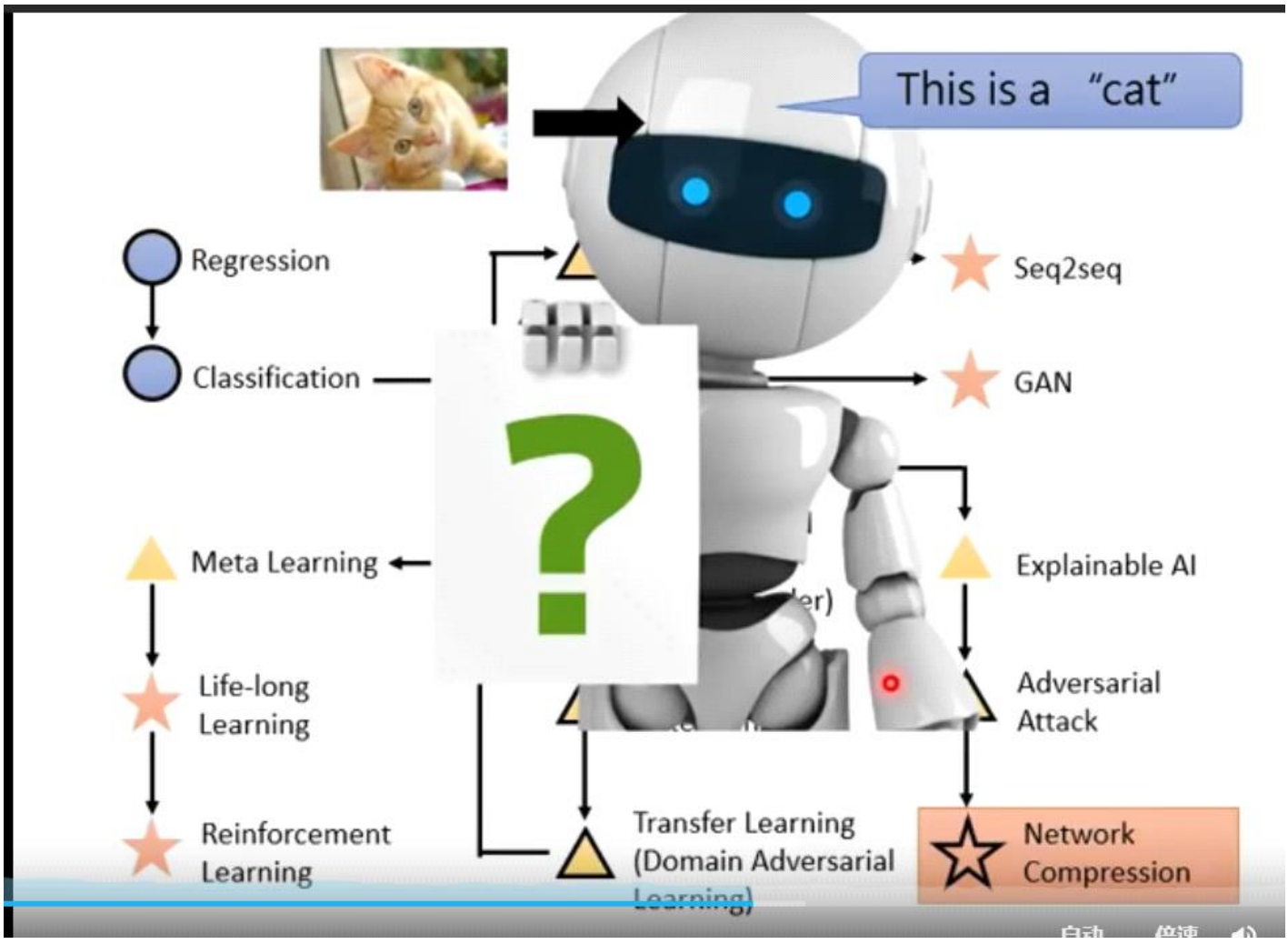

給定函式尋找範圍
Network Architecture
Use RNN
Use CNN
Regression
Classification
Linear
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression

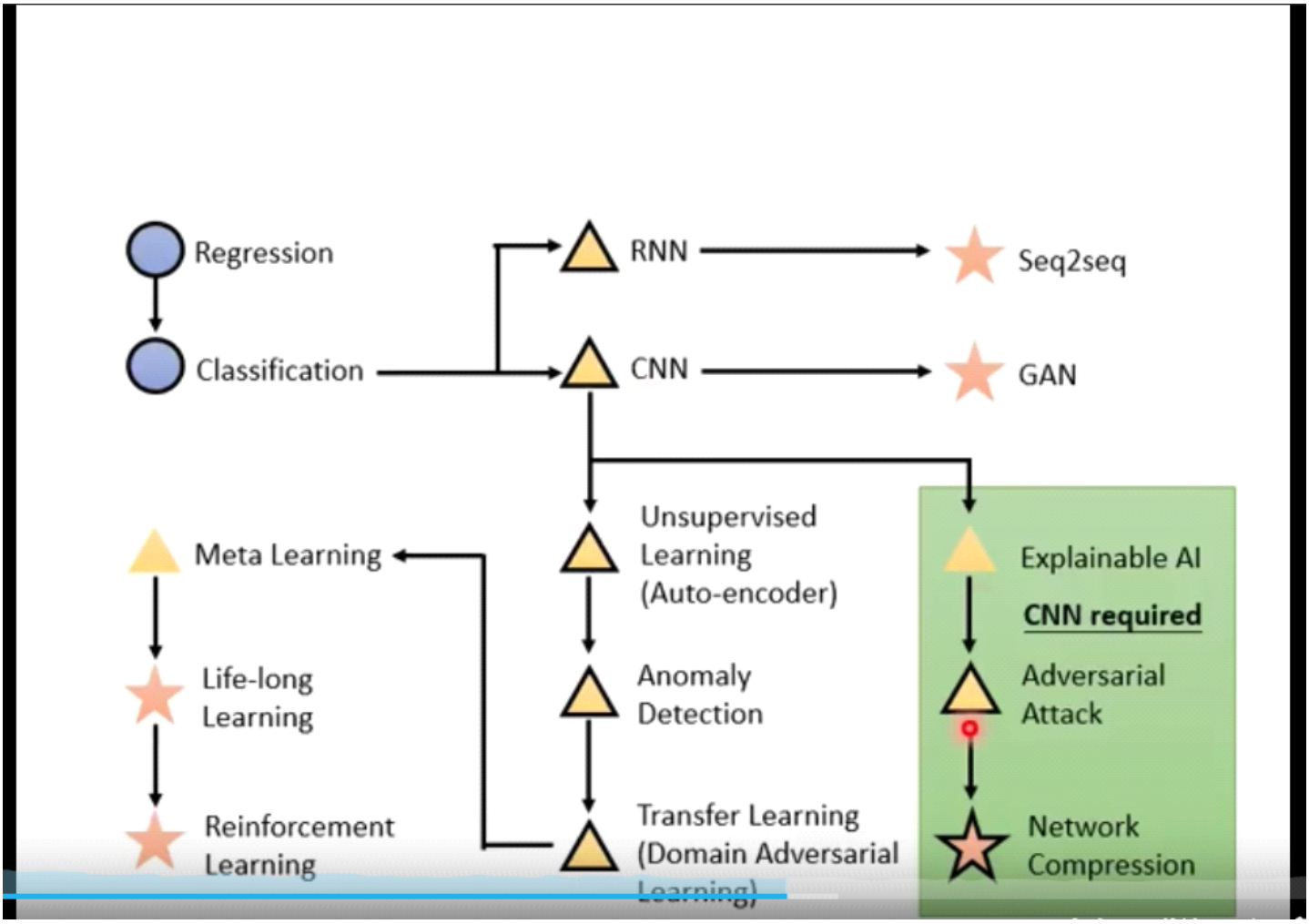

函式尋找方法 – Gradient Descent
Implement the algorithm by yourself
Deep Learning Framework
(3/26 PyTorch 教學、會錄影)
Regression
Classification
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression

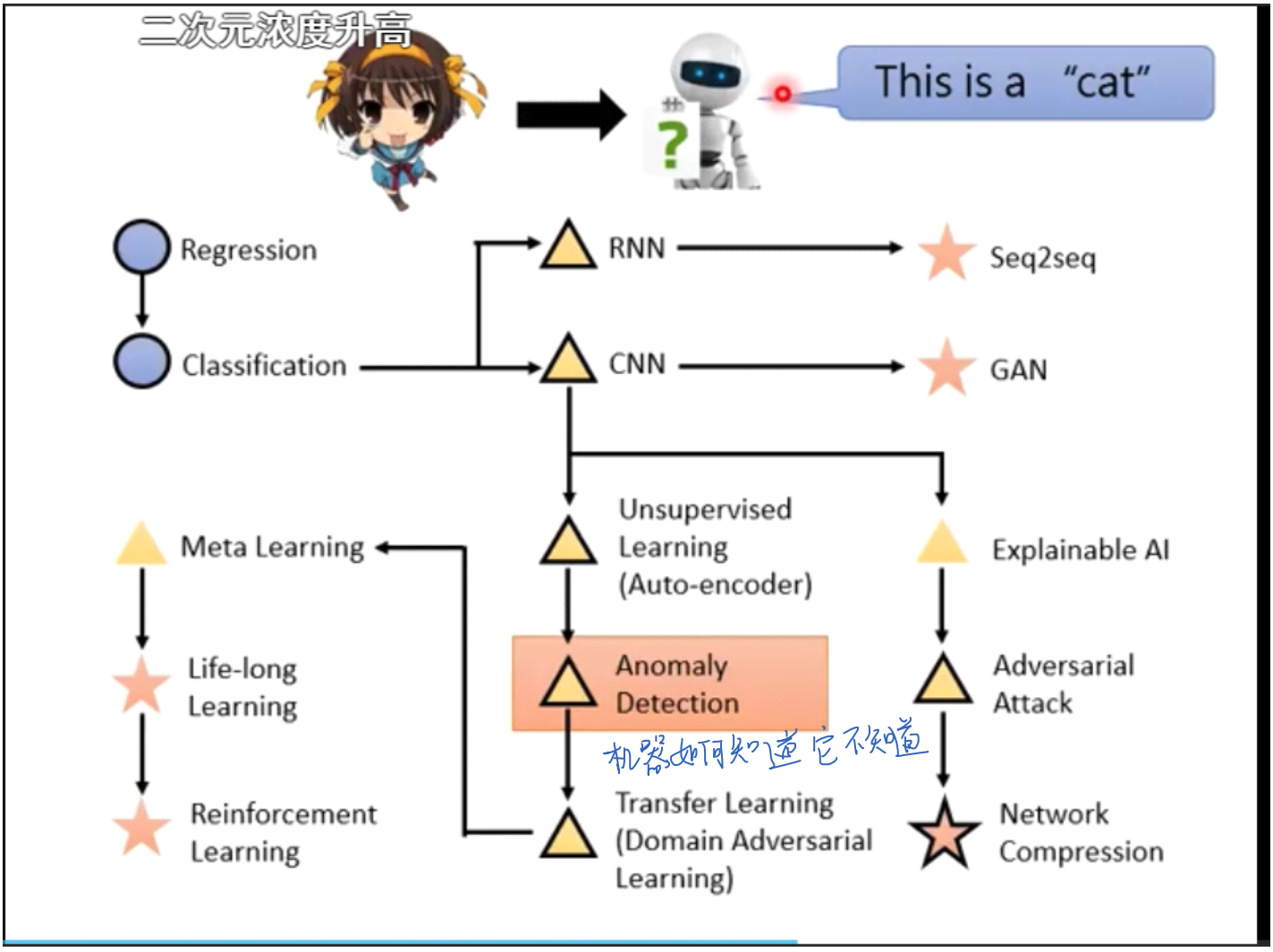
前沿研究

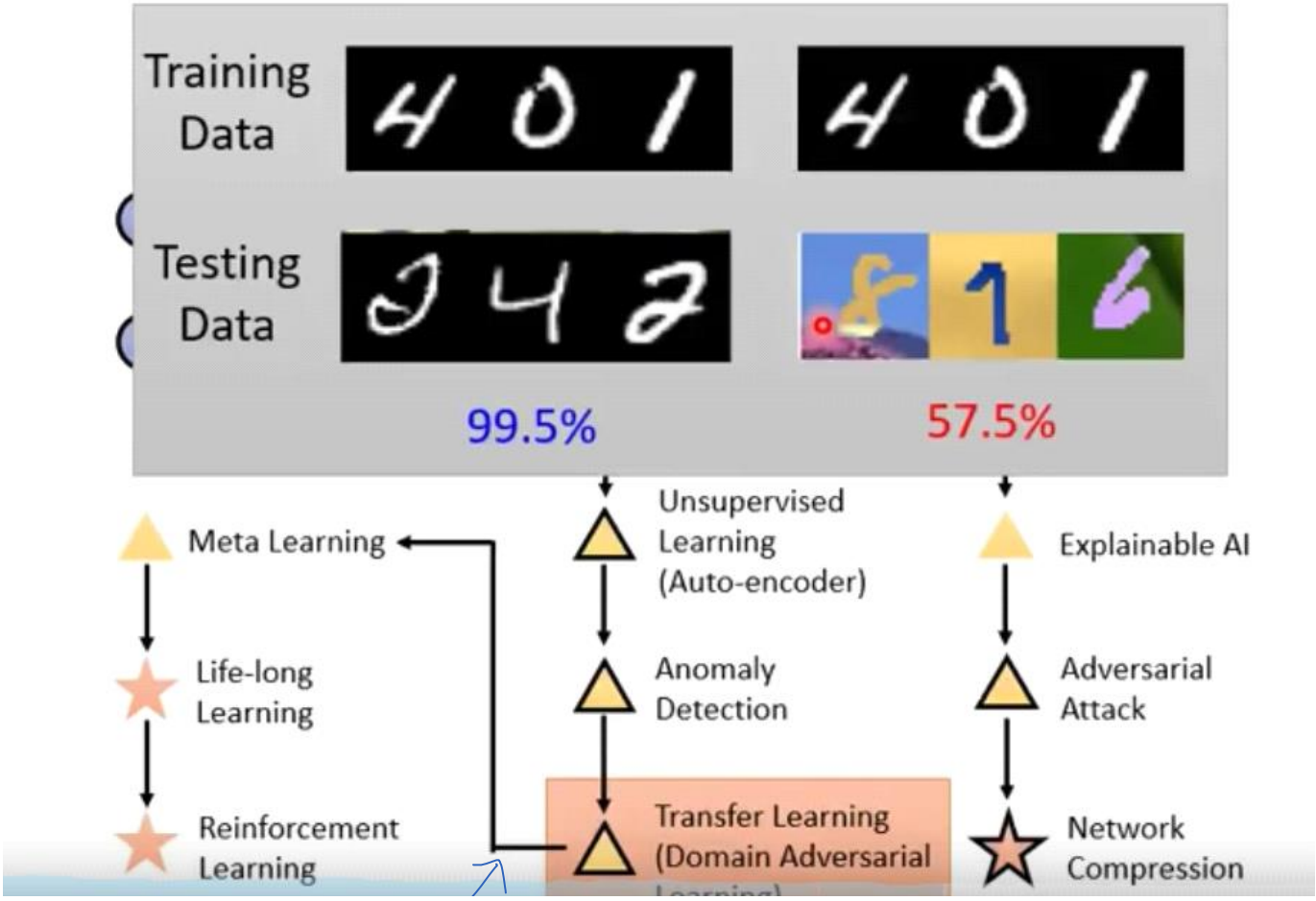

This is a "cat"
Because ...
Regression
Classification
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression

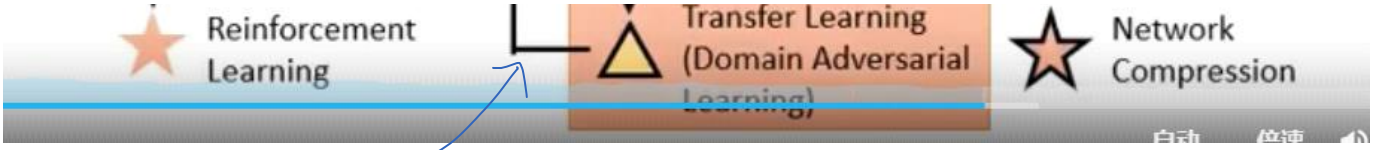

Add noise
This is a "cat"
Star Fish ...
Regression
Classification
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression


This is a "cat"
Regression
Classification
Meta Learning
Life-long Learning
Reinforcement Learning
Seq2seq
GAN
Explainable AI
Adversarial Attack
Network Compression
Transfer Learning (Domain Adversarial Learning)
?


Regression
Classification
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
CNN required
Adversarial Attack
Network Compression


二次元浓度升高
This is a "cat"
Regression
Classification
RNN
CNN
Seq2seq
GAN
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial Learning)
Explainable AI
Adversarial Attack
Network Compression
机器如何知道它不知道


Training Data
Testing Data
99.5%
57.5%
Meta Learning
Life-long Learning
Reinforcement Learning
Unsupervised Learning (Auto-encoder)
Anomaly Detection
Transfer Learning (Domain Adversarial
Explainable AI
Adversarial Attack
Network Compression

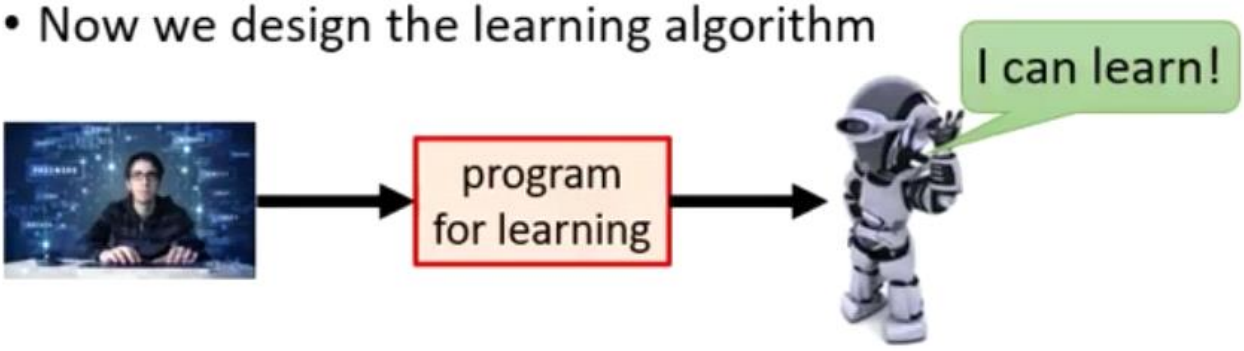


训练资料和测试资料不同时，如何处理

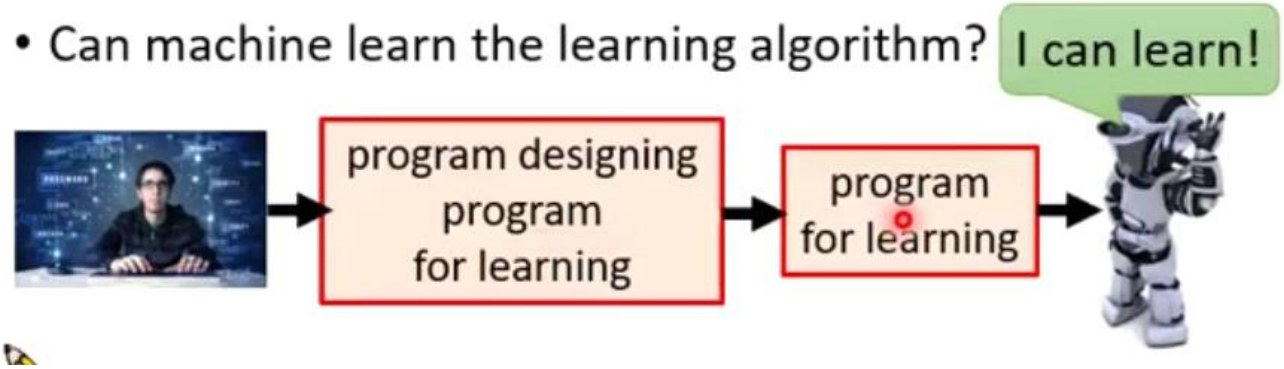
Meta Learning = Learn to learn

学习如何学习的能力 → 机器自己研发算法

- Now we design the learning algorithm

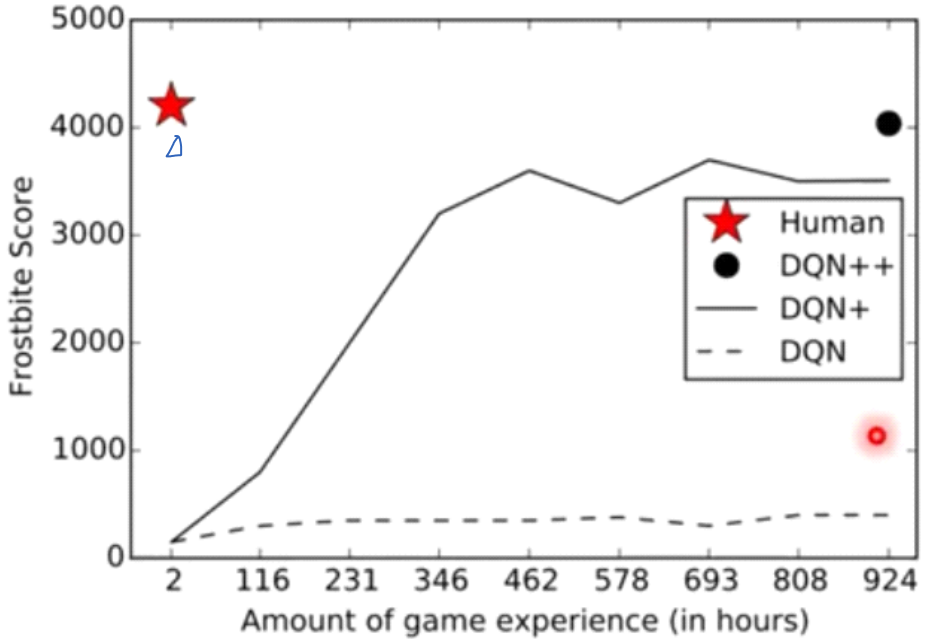


- Can machine learn the learning algorithm?



能不能讓機器聰明一點？

勤奮不懈卻天資不佳？



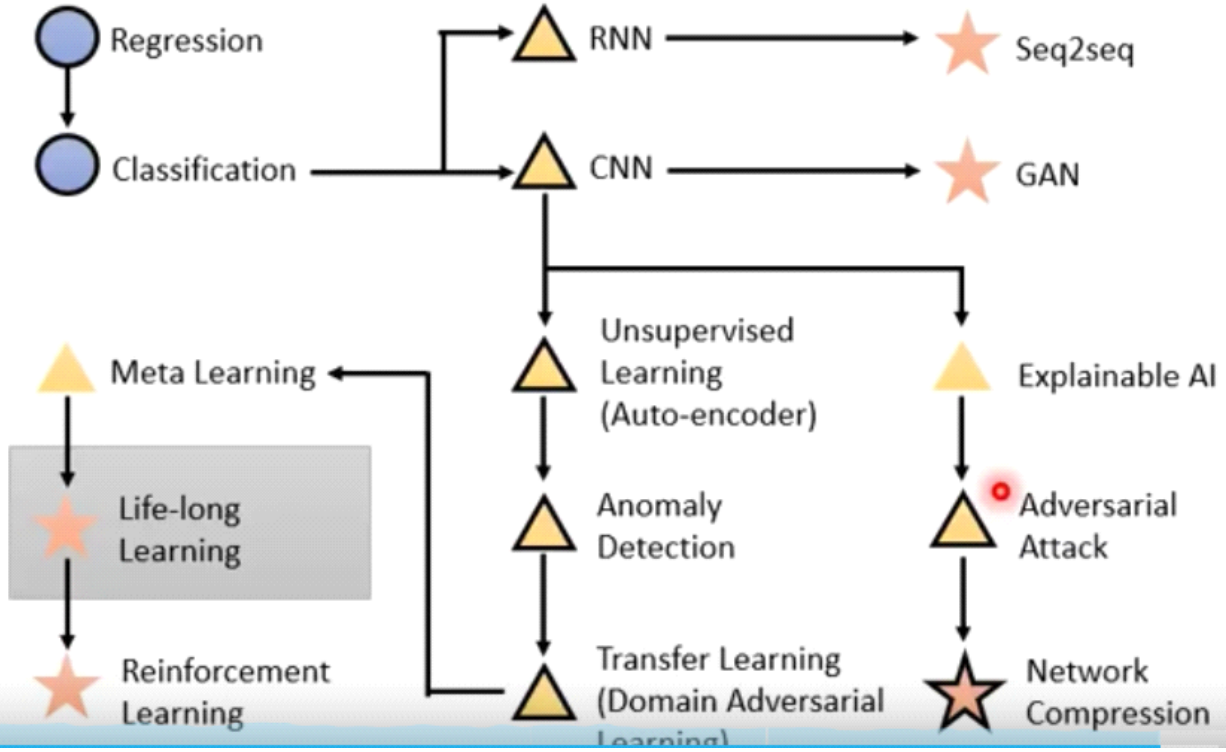
玩游戏

人类 40 min

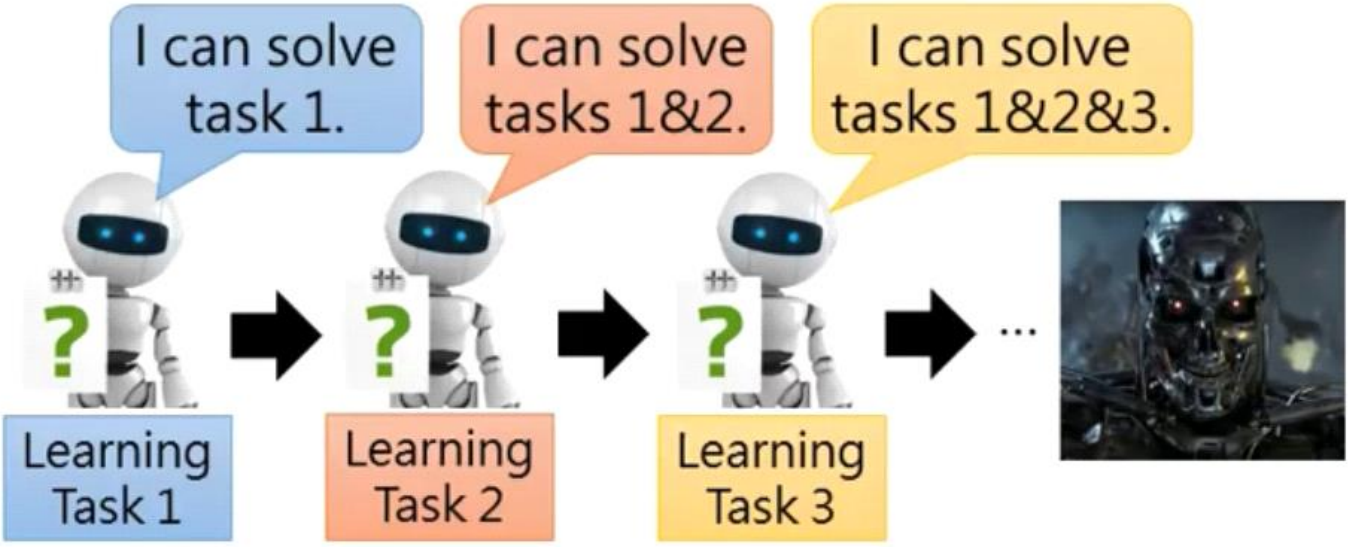
机器 924h

才到4000分

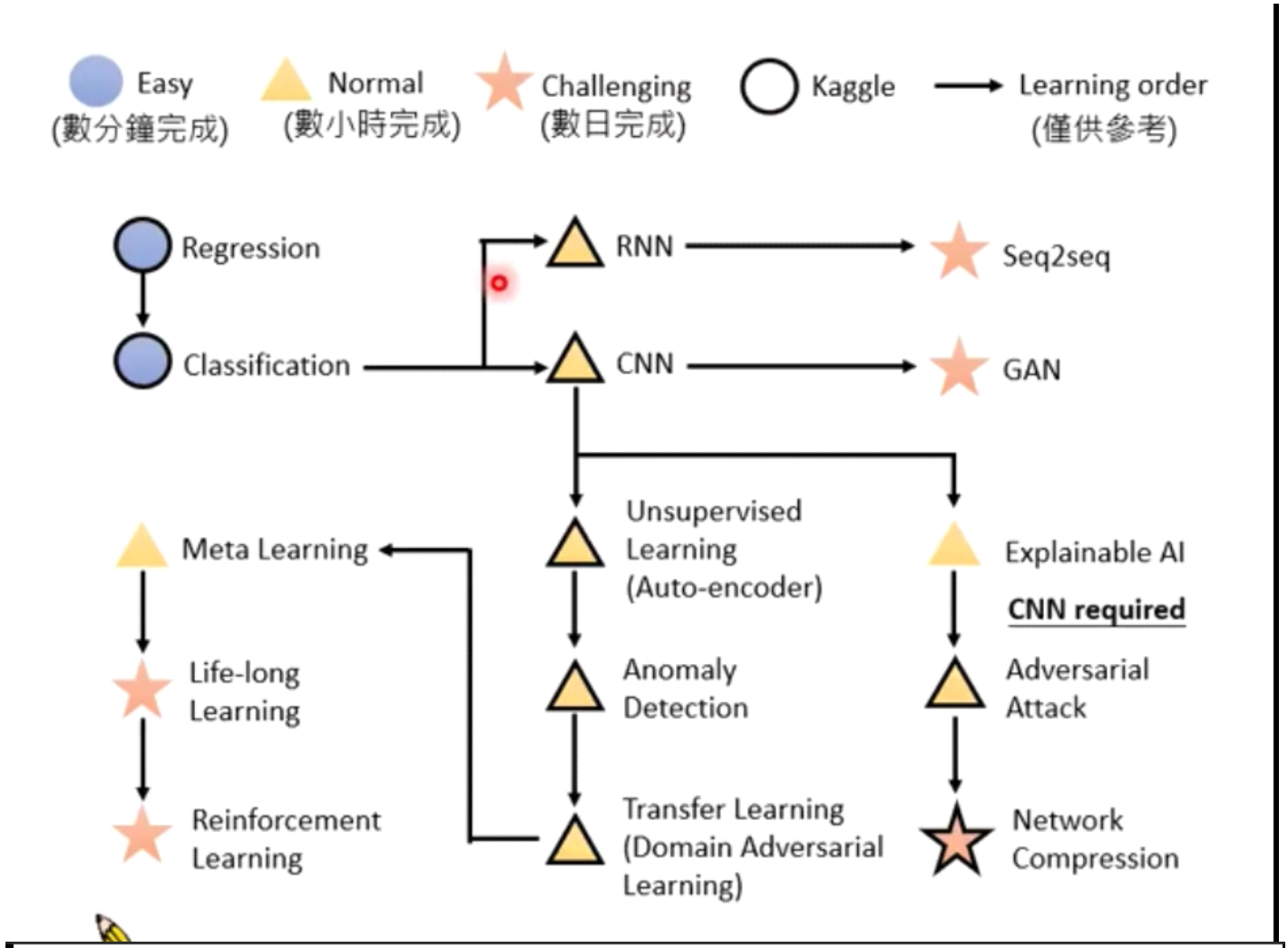
http://web.stanford.edu/class/psych209/Readings/LakeEtAlBBS.pdf

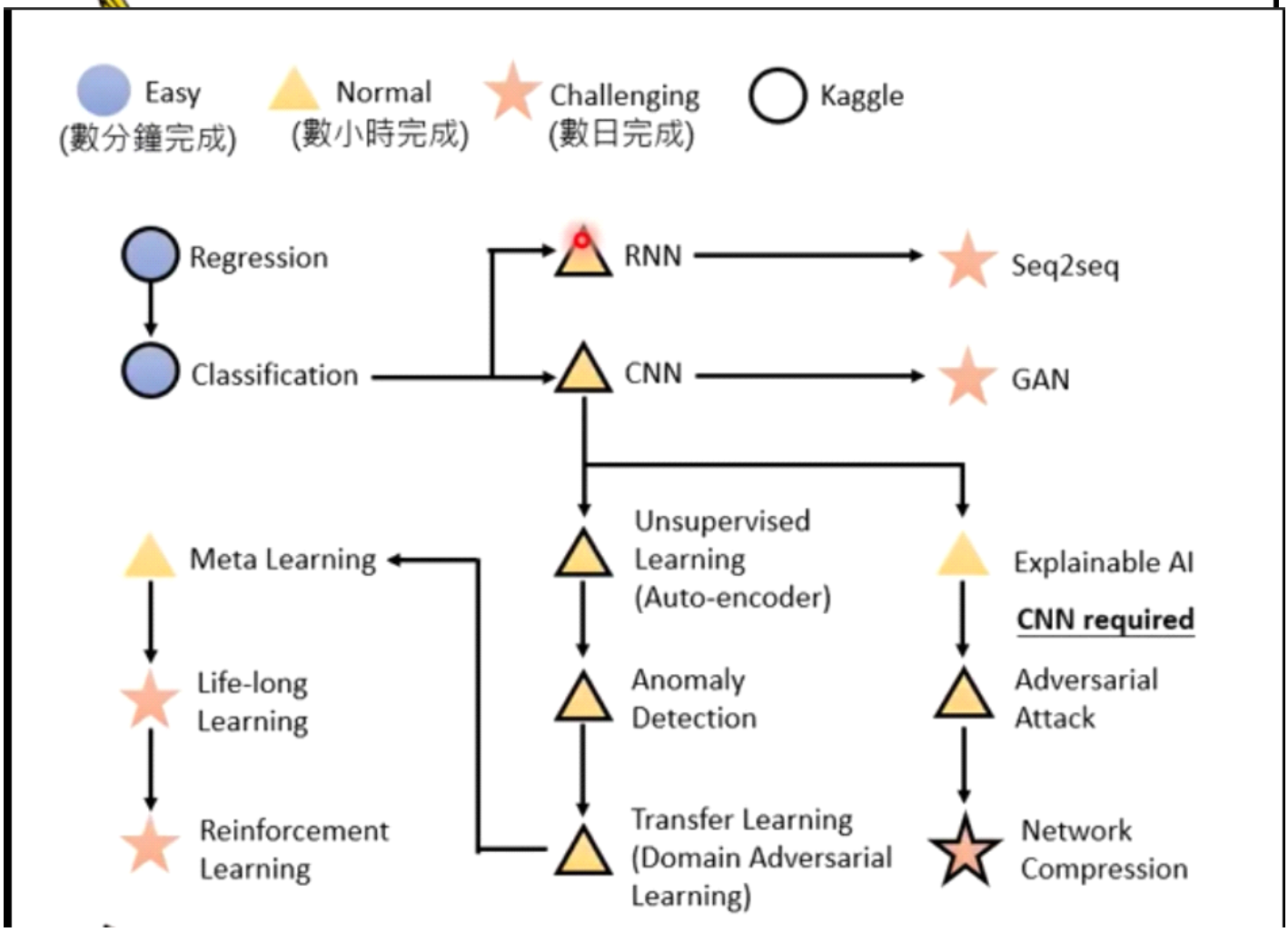


終身學習 (Life-long Learning)



Life-Long Learning (終身學習), Continuous Learning, Never Ending Learning, Incremental Learning


Easy
(數分鐘完成)
Normal
(數小時完成)
Challenging
(數日完成)
Kaggle
Learning order
(僅供參考)
Regression
Classification
RNN
CNN
Seq2seq
GAN
Unsupervised
Learning
(Auto-encoder)
Meta Learning
Life-long
Learning
Reinforcement
Learning
Anomaly
Detection
Transfer Learning
(Domain Adversarial
Learning)
Explainable AI
CNN required
Adversarial
Attack
Network
Compression


Easy
(數分鐘完成)
Normal
(數小時完成)
Challenging
(數日完成)
Kaggle
Regression
Classification
RNN
CNN
Seq2seq
GAN
Unsupervised
Learning
(Auto-encoder)
Meta Learning
Life-long
Learning
Reinforcement
Learning
Anomaly
Detection
Transfer Learning
(Domain Adversarial
Learning)
Explainable AI
CNN required
Adversarial
Attack
Network
Compression

有这种老师真好

課程網頁

- http://speech.ee.ntu.edu.tw/~tlkagk/courses_ML20.html

完全可以在家自學!

課程網頁

作業編號	線上學習	作業範例	作業說明	上課補充	繳交時間
課程簡介	Introduction (slide)				
作業一	Regression, Basic Concept	Regression	slide		3/26
Gradient Descent	Gradient Descent 1 2 3			4/09	
作業二	Classification 1 2	Classification	slide		3/26
DL預備	DL, Backprop, Tips, Why Deep	PyTorch 教學 (3/26 現場教學、會錄影)			
作業三	CNN	CNN	slide	3/26 (GNN)	4/30
作業四	RNN 1 2	RNN	slide		4/30
作業五	Explainable AI	Explainable AI	slide	4/16	4/30
作業六	Adversarial Attack	Adversarial Attack	slide	4/23	4/30
作業七	Network Compression	Network Compression 1 2 3 4	slide	4/30	5/21
作業八	Seq2seq	Seq2seq	slide	5/07 (New Architecture)	5/21
作業九	Dimension Reduction, Neighbor Embedding, Auto-encoder	Unsupervised Learning	slide	5/14 (Model Pretraining)	5/21
作業十	Anomaly Detection	Anomaly Detection	slide	5/21	6/11
作業十一	GAN (10 videos)	GAN	slide	5/28	6/11
作業十二	Semi-supervised, Transfer	Transfer Learning	slide	6/04	6/11
作業十三	Meta Learning	Meta 1 2	slide	6/11	7/02
作業十四	Life-long Learning	Life-long	slide	6/18	7/02
作業十五	RL 1, 2, 3, Advanced Version (8 videos)	RL	slide	6/25	7/02

課程網頁

作業編號	線上學習	作業範例	作業說明	上課補充	繳交時間
課程簡介	Introduction (slide)				
作業一	Regression, Basic Concept	Regression	slide		3/26
Gradient Descent	Gradient Descent 1 2 3			4/09	
作業二	Classification 1 2	Classification	slide		3/26
DL預備	DL, Backprop, Tips, Why Deep	PyTorch 教學 (3/26 現場教學，會錄影)			
作業三	CNN	CNN	slide	3/26 (GNN)	4/30
作業四	RNN 1 2	RNN	slide		4/30
作業五	Explainable AI	Explainable AI	slide	4/16	4/30
作業六	Adversarial Attack	Adversarial Attack	slide	4/23	4/30
作業七	Network Compression	Network Compression 1 2 3 4	slide	4/30	5/21
作業八	Seq2seq	Seq2seq	slide	5/07 (New Architecture)	5/21
作業九	Dimension Reduction, Neighbor Embedding, Auto-encoder	Unsupervised Learning	slide	5/14 (Model Pretraining)	5/21
作業十	Anomaly Detection	Anomaly Detection	slide	5/21	6/11
作業十一	GAN (10 videos)	GAN	slide	5/28	6/11
作業十二	Semi-supervised, Transfer	Transfer Learning	slide	6/04	6/11
作業十三	Meta Learning	Meta 1 2	slide	6/11	7/02
作業十四	Life-long Learning	Life-long	slide	6/18	7/02
作業十五	RL 1, 2, 3, Advanced Version (8 videos)	RL	slide	6/25	7/02

- 在寫作業前先線上學習

課程網頁

所有作業都有 Colab 範例，
照著做就完成一半!

作業編號	線上學習	作業範例	作業說明	上課補充	繳交時間
課程簡介	Introduction (slide)				
作業一	Regression, Basic Concept	Regression	slide		3/26
Gradient Descent	Gradient Descent 1 2 3			4/09	
作業二	Classification 1 2	Classification	slide		3/26
DL預備	DL, Backprop, Tips, Why Deep	PyTorch 教學 (3/26 現場教學，會錄影)			
作業三	CNN	CNN	slide	3/26 (GNN)	4/30
作業四	RNN 1 2	RNN	slide		4/30
作業五	Explainable AI	Explainable AI	slide	4/16	4/30
作業六	Adversarial Attack	Adversarial Attack	slide	4/23	4/30
作業七	Network Compression	Network Compression 1 2 3 4	slide	4/30	5/21
作業八	Seq2seq	Seq2seq	slide	5/07 (New Architecture)	5/21
作業九	Dimension Reduction, Neighbor Embedding, Auto-encoder	Unsupervised Learning	slide	5/14 (Model Pretraining)	5/21
作業十	Anomaly Detection	Anomaly Detection	slide	5/21	6/11
作業十一	GAN (10 videos)	GAN	slide	5/28	6/11
作業十二	Semi-supervised, Transfer	Transfer Learning	slide	6/04	6/11
作業十三	Meta Learning	Meta 1 2	slide	6/11	7/02
作業十四	Life-long Learning	Life-long	slide	6/18	7/02
作業十五	RL 1, 2, 3, Advanced Version (8 videos)	RL	slide	6/25	7/02

課程網頁

作業的要求都在這裡
(錄影預計 3/12 全數完成)

作業編號	線上學習	作業範例	作業說明	上課補充	繳交時間
課程簡介	Introduction (slide)				
作業一	Regression, Basic Concept	Regression	slide		3/26
Gradient Descent	Gradient Descent 1 2 3			4/09	
作業二	Classification 1 2	Classification	slide		3/26
DL預備	DL, Backprop, Tips, Why Deep	PyTorch 教學 (3/26 現場教學、會錄影)			
作業三	CNN	CNN	slide	4/26 (GNN)	4/30
作業四	RNN 1 2	RNN	slide		4/30
作業五	Explainable AI	Explainable AI	slide	5/16	4/30
作業六	Adversarial Attack	Adversarial Attack	slide	5/23	4/30
作業七	Network Compression	Network Compression 1 2 3 4	slide	5/30	5/21
作業八	Seq2seq	Seq2seq	slide	6/07 (New Architecture)	5/21
作業九	Dimension Reduction, Neighbor Embedding, Auto-encoder	Unsupervised Learning	slide	6/14 (Model Pretraining)	5/21
作業十	Anomaly Detection	Anomaly Detection	slide	6/21	6/11
作業十一	GAN (10 videos)	GAN	slide	6/28	6/11
作業十二	Semi-supervised, Transfer	Transfer Learning	slide	7/04	6/11
作業十三	Meta Learning	Meta 1 2	slide	7/11	7/02
作業十四	Life-long Learning	Life-long	slide	7/18	7/02
作業十五	RL 1, 2, 3, Advanced Version (8 videos)	RL	slide	7/25	7/02

所有作業皆已經公告，現在就可以開始做了

課程網頁

上課補充的是相關主題最新的知識，
和作業沒有直接關連 (會錄影)

作業編號	線上學習	作業範例	作業說明	上課補充	繳交時間
課程簡介	Introduction (slide)				
作業一	Regression, Basic Concept	Regression	slide		3/26
Gradient Descent	Gradient Descent 1 2 3			4/09	
作業二	Classification 1 2	Classification	slide		3/26
DL預備	DL, Backprop, Tips, Why Deep	PyTorch 教學 (3/26 現場教學、會錄影)			
作業三	CNN	CNN	slide	4/26 (GNN)	4/30
作業四	RNN 1 2	RNN	slide		4/30
作業五	Explainable AI	Explainable AI	slide	5/16	4/30
作業六	Adversarial Attack	Adversarial Attack	slide	5/23	4/30
作業七	Network Compression	Network Compression 1 2 3 4	slide	5/30	5/21
作業八	Seq2seq	Seq2seq	slide	6/07 (New Architecture)	5/21
作業九	Dimension Reduction, Neighbor Embedding, Auto-encoder	Unsupervised Learning	slide	6/14 (Model Pretraining)	5/21
作業十	Anomaly Detection	Anomaly Detection	slide	6/21	6/11
作業十一	GAN (10 videos)	GAN	slide	6/28	6/11
作業十二	Semi-supervised, Transfer	Transfer Learning	slide	7/04	6/11
作業十三	Meta Learning	Meta 1 2	slide	7/11	7/02
作業十四	Life-long Learning	Life-long	slide	7/18	7/02
作業十五	RL 1, 2, 3, Advanced Version (8 videos)	RL	slide	7/25	7/02

10:20 開始，3/26 後每星期都有 (國定假日除外)

感謝助教群!!!

助教信箱：
ntu-ml-2020spring-ta@googlegroups.com