



Artificial Intelligence, Machine Learning and Deep Learning



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- B** What is Machine Learning?
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A What Is Artificial Intelligence?



Artificial Intelligence is the technique of building intelligent machines or computer programs – systems that can ‘think’. It is the set of principles applied to make computers capable of doing tasks that need human intelligence for e.g. playing chess, driving a car, carrying out a conversation.

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A The AI Milestones



Turing Test

John McCarthy coined the term Artificial Intelligence in 1955.

In 1950, Alan Turing devised the Turing Test to assess machine intelligence. The test requires that a human being should be unable to distinguish the machine from another human being by using the replies to questions put to both.



Gaming AI

Arthur Samuel's checkers program, developed in the middle 50s and early 60s, challenged a respectable amateur. In 1997 IBM's Deep Blue beat Gary Kasparov at chess.



Autonomous Cars

In 2005, a Stanford robot drove autonomously for 131 miles along an unrehearsed desert trail. Autonomous cars denote a significant break-through in the history of AI as it requires an agent to process multi-sensory inputs and process those in real-time.



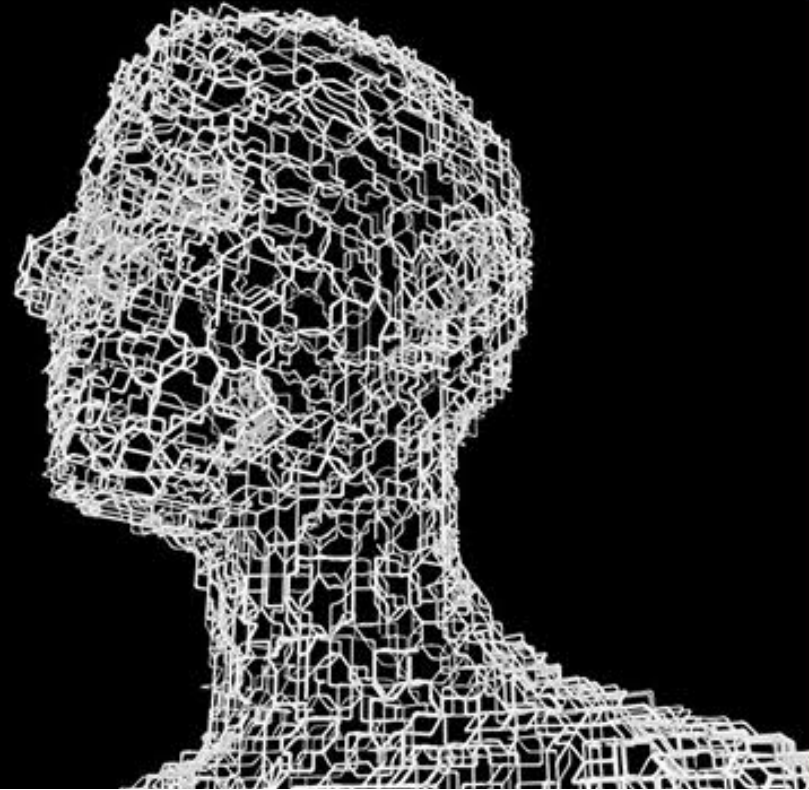
A Types of AI



Narrow AI or Weak AI – Defines most of the AI we have around us now – AI trained to perform a single task within a pre-defined range. E.g. Siri can tell you the weather but will be stumped if you ask it existential questions.

General AI or Strong AI (Also known as Full AI) - Strong artificial intelligence (strong AI) is an artificial intelligence construct that can 'think' for itself with full cognitive abilities like a human brain.

Super AI - Super-intelligence denotes hypothetical agent that possesses intelligence surpassing human intelligence. Think Matrix.



A AI World-view – The Optimist



“Machine learning and AI is a horizontal enabling layer. It will empower and improve every business, every government organization, every philanthropy — basically there’s no institution in the world that cannot be improved with machine learning.”
— Jeff Bezos



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A AI World-view – The Pessimist



“With Artificial Intelligence, we
are summoning the demon.”
– Elon Musk





A AI World-view – The Pragmatist

What we see around us, is still much of Applied Or Narrow AI, AI with ability to perform one task like playing chess or driving a car well. With more computing power, machines can beat us at these tasks too. But the construct of super-intelligent, omnipotent AI is at best a myth. Of course AI is subject to human bias and intentions – at best or worst and that is what we have to guard against.

Sorry, Elon but there are no demons coming!

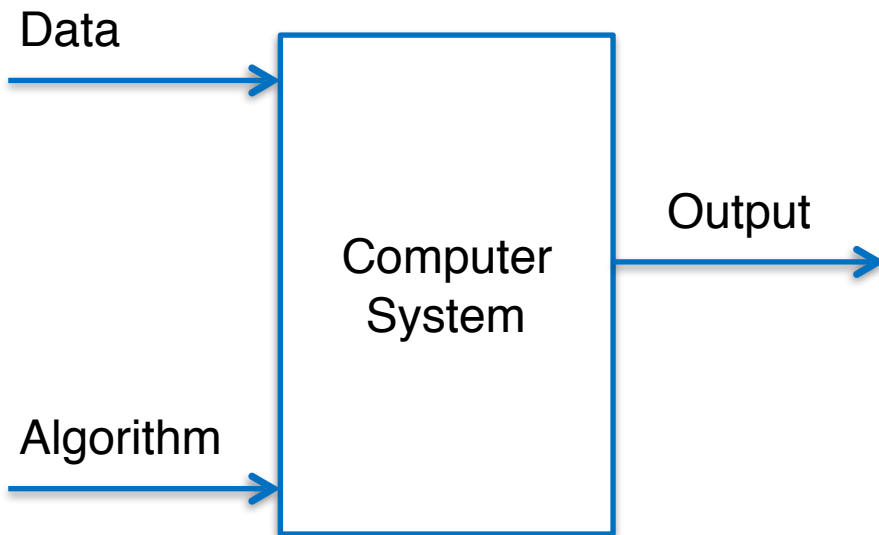




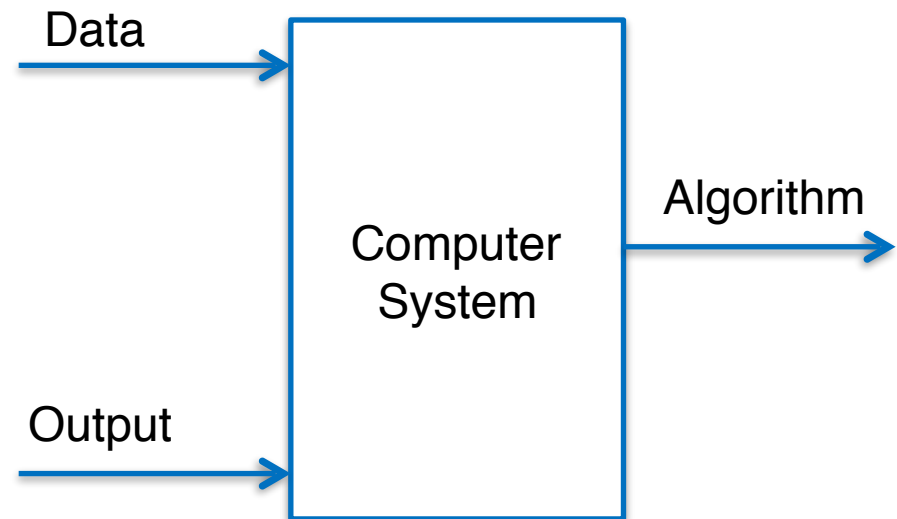
B What Is Machine Learning?

Machine Learning is a discipline of AI, specifying the ability of systems to automatically learn from experience without the need of being explicitly programmed. A key, building block of Artificial Intelligence, Machine Learning mimics human learning to allow systems automatically process data, infer results and adapt its behaviour.

Traditional Programming



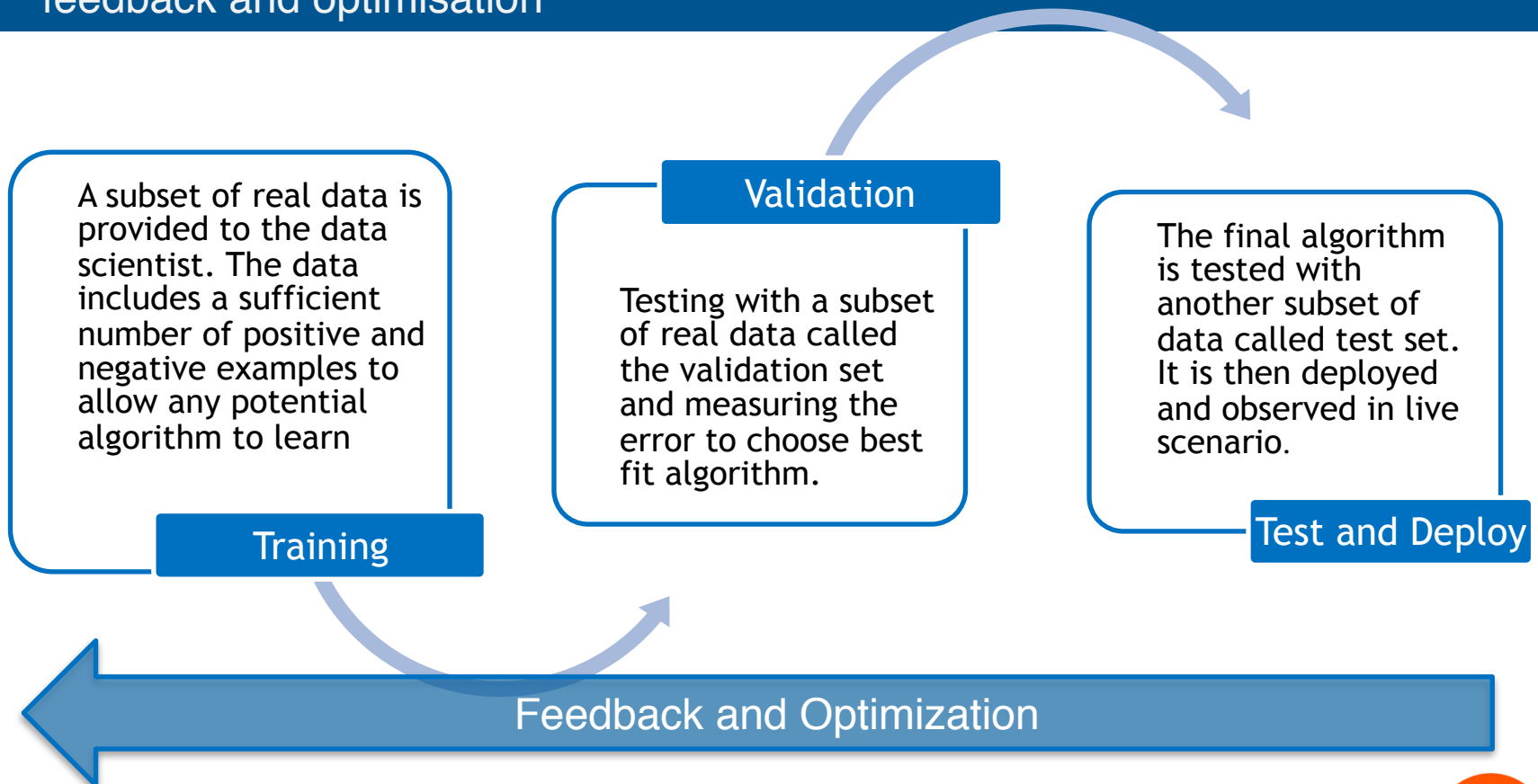
Machine Learning





C How does Machine Learning work?

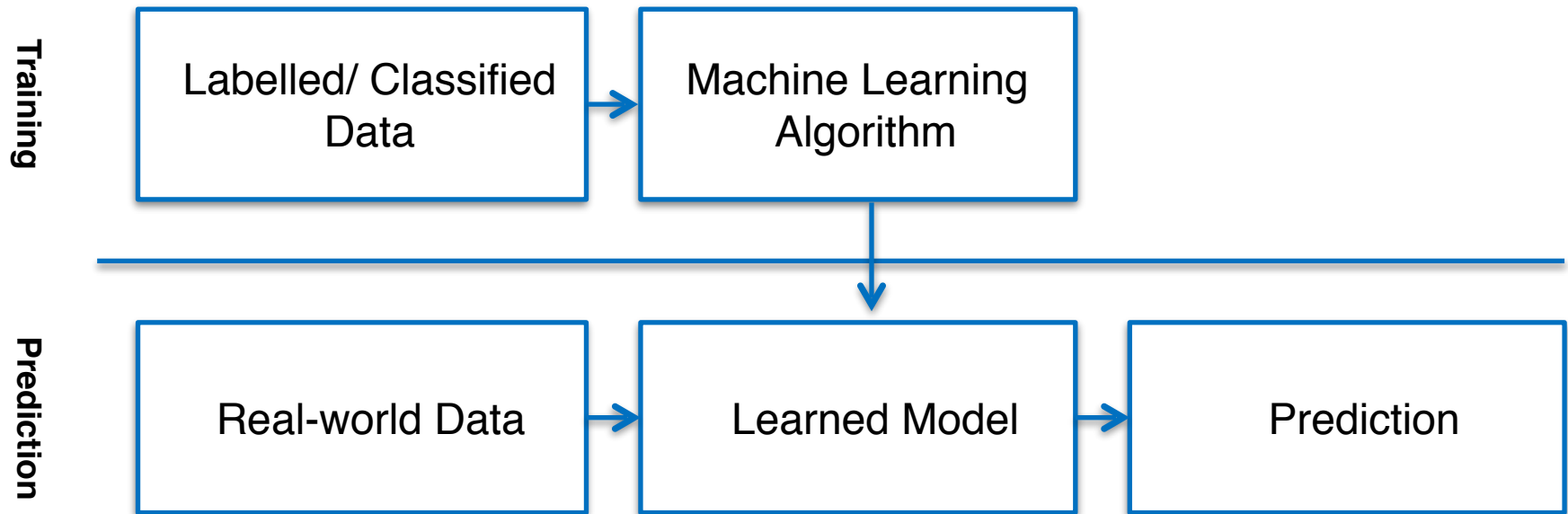
Machine Learning works through a cyclic process of training, validation, testing, feedback and optimisation





C How do you 'Train Machines'?

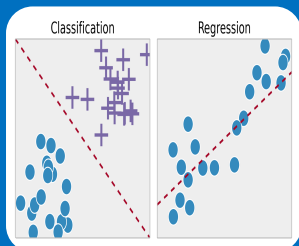
Machine Learning algorithms are trained on labelled data. For e.g., a chatbot is trained to recognise that words like 'Hey', 'Hello,' 'Hi', 'Hola' are greetings and have to be accordingly responded to.



D Types Of Learning

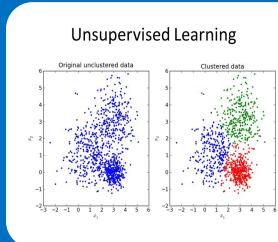


Machine Learning algorithms can be broadly divided into 3 types:



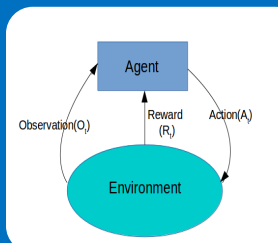
Supervised Learning

- Is a branch of machine learning that learns on the basis of labelled training data.
- E.g. a chatbot recognises greetings such as 'Hello', 'Hi', 'Hey' based on classified text.



Unsupervised Learning

- Unsupervised learning learns from test data that has not been labelled, classified or categorized. It works on the basis of clustering. E.g. grouping similar resumes based on text patterns.



Reinforcement Learning

- It is about taking suitable action to maximize reward in a particular situation. For e.g. learn how to play Chess or Jeopardy by winning/ losing or answering right/ wrong.

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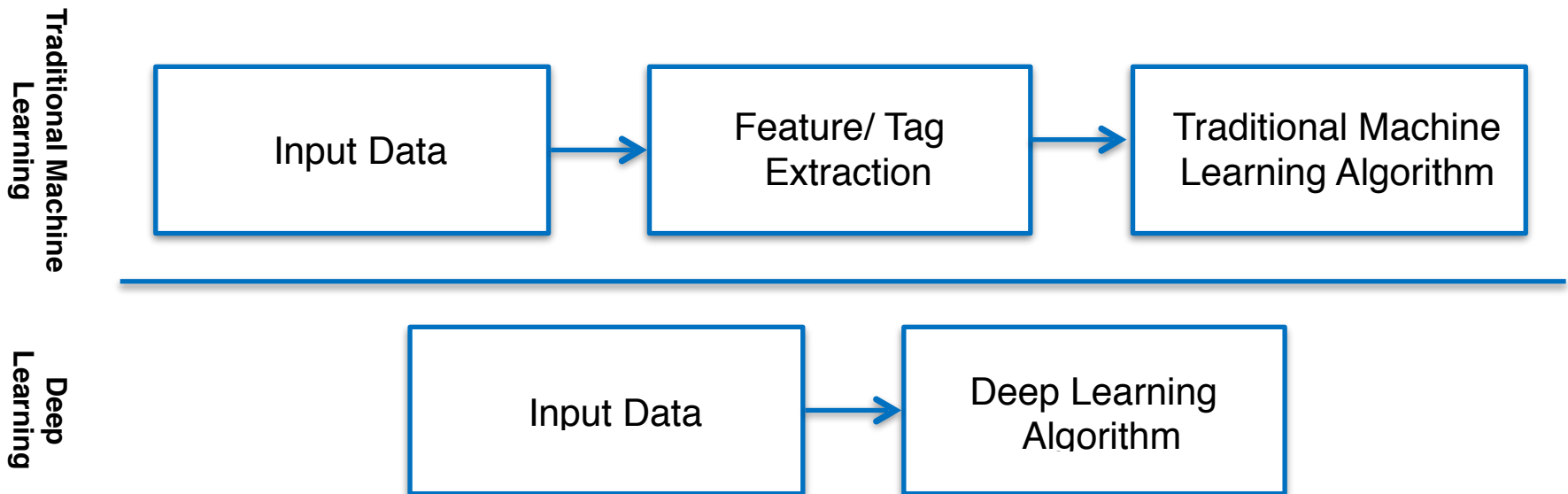


E What Is Deep Learning?



Deep Learning is a specific type of Machine Learning that works on a hierarchy of concepts built on top of each other, eliminating the need for humans to explicitly specify all knowledge (tags, classifiers) for a machine to make a decision.

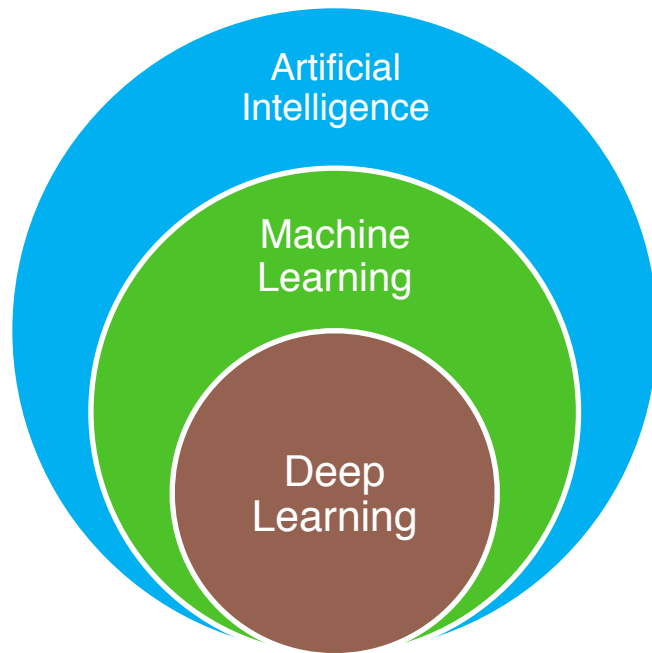
Deep Learning gives machines the power to solve more intuitive problems by automatically extracting features and classifiers from data sets.



E AI, ML and DL – How are they related?



Machine Learning is a discipline of Artificial Intelligence. Deep Learning is a specialised form of Deep Learning



Artificial Intelligence

- Ability of machines to think and act rationally

Machine Learning

- Ability of machines to take decisions without being explicitly programmed.
- Traditional Machine Learning trains machines based on labelled and classified data. Machines take decisions basis this data

Deep Learning

- Machines that mimic human brain through artificial neural networks capable of extracting features and classifiers from data
- Does not require pre-processing of data or feature engineering



E Difference Between ML and DL

	Machine Learning	Deep Learning
Feature Engineering	In traditional Machine Learning, features or discriminators have to be extracted and hand-coded by experts.	Deep Learning algorithms extract high-level features from data
Human Intervention	If an ML algorithm returns an inaccurate prediction, then an engineer needs to step in and make adjustments. E.g. a chatbot can be trained to start a conversation with Hello, Hi.	With a deep learning model, the algorithms can determine on their own if a prediction is accurate or not. A deep learning model analyses human conversation to know it can also start with Hey
Data Dependency	Traditional ML with handcrafted rules can be trained with less data.	Deep Learning algo need more extensive data sets for initial training.
Hardware Dependency	Traditional ML needs lower computing power as compared to Deep Learning	Needs higher computing power as it crunches large amounts of data.



Artificial Neural Networks – Definition and Types



Artificial Neural Network (ANN), forming the basis of Deep Learning, is an information processing construct modeled on the brain. An ANN is made up of layers of inter-connected processing elements (neurons). Each neuron takes an input, performs a task and passes the output to the following neuron. There are 6 broad types of ANNs listed below:

Feed-forward Network

Convolutional Neural Network

Self-organising Neural Network

Recurrent Neural Networks or LSTM (Long Short Term Memory)

Modular Neural Network

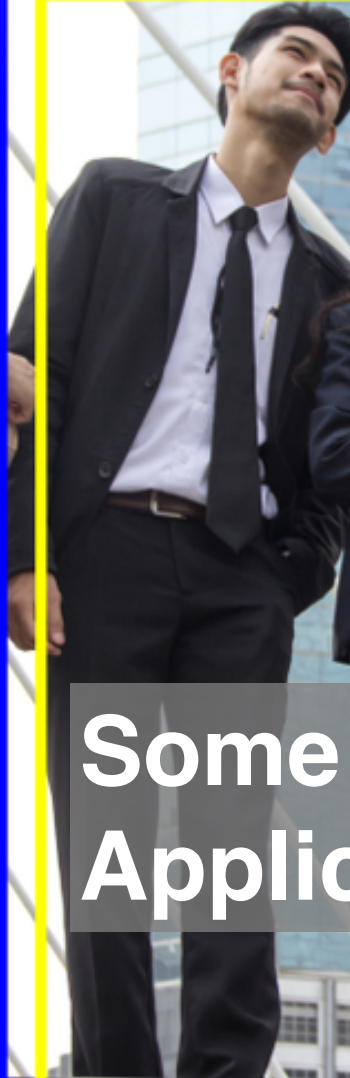
Radial Basis Function Neural Network



0.708



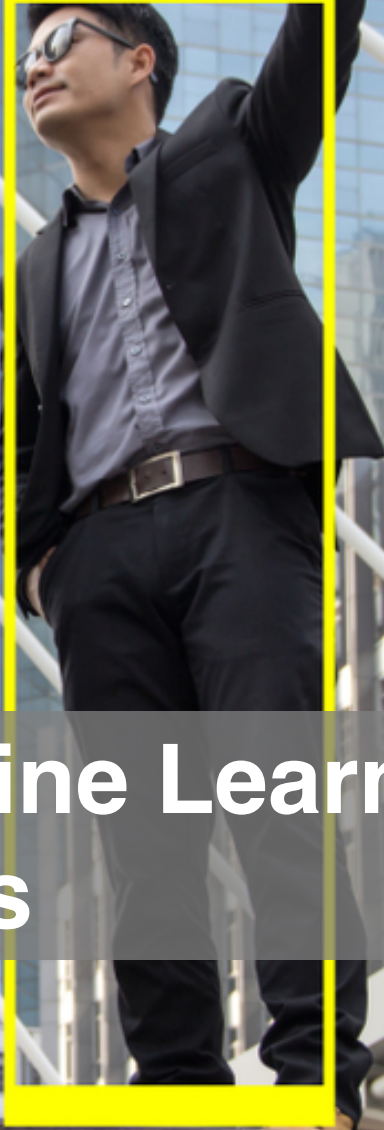
0.805



0.702



0.808



Some Machine Learning Applications



Recommender Systems – Netflix Knows Your Favourite Movies



NETFLIX Browse Kids Search

Because you watched GoodFellas

The Godfather **COCAINE COWBOYS RELOADED**

More like Suits

CRAZY STUPID LOVE **NEW YEAR'S EVE** **Naomi No Kiss List**

More like Beasts of No Nation

WINTER ON FIRE **VIRUNGA** **D A W G F I L M**

Netflix's recommendation system works on a 3 pronged model:

- ✓ Viewing data from over 100M user accounts
- ✓ Content tagging by Netflix's staff and freelancers to understand for e.g. if a content is cerebral or funny
- ✓ Machine Learning Algorithms that crunch the labelled or tagged data and real-time user data to generate viewing predictions



Image Recognition - Voila! It Is A Cat!



Can a computer recognise a cat? Yes ML algorithms can be trained on tagged cat images, to recognise a cat.





Speech Recognition – Google Duplex, Siri, Alexa



Digital assistants such as Alexa or Siri or the supposedly mind-blowing Google Duplex use a variety of technology including 1. Speech Processor System consisting of a DSP or Digital Signal Processing Module 2. Pattern Recognition consisting of NLU (Natural Language Understanding) and NLP (Natural Language Processing) to understand the speech and 3. A Speech synthesis module based on NLG or Natural Language Generation techniques.

