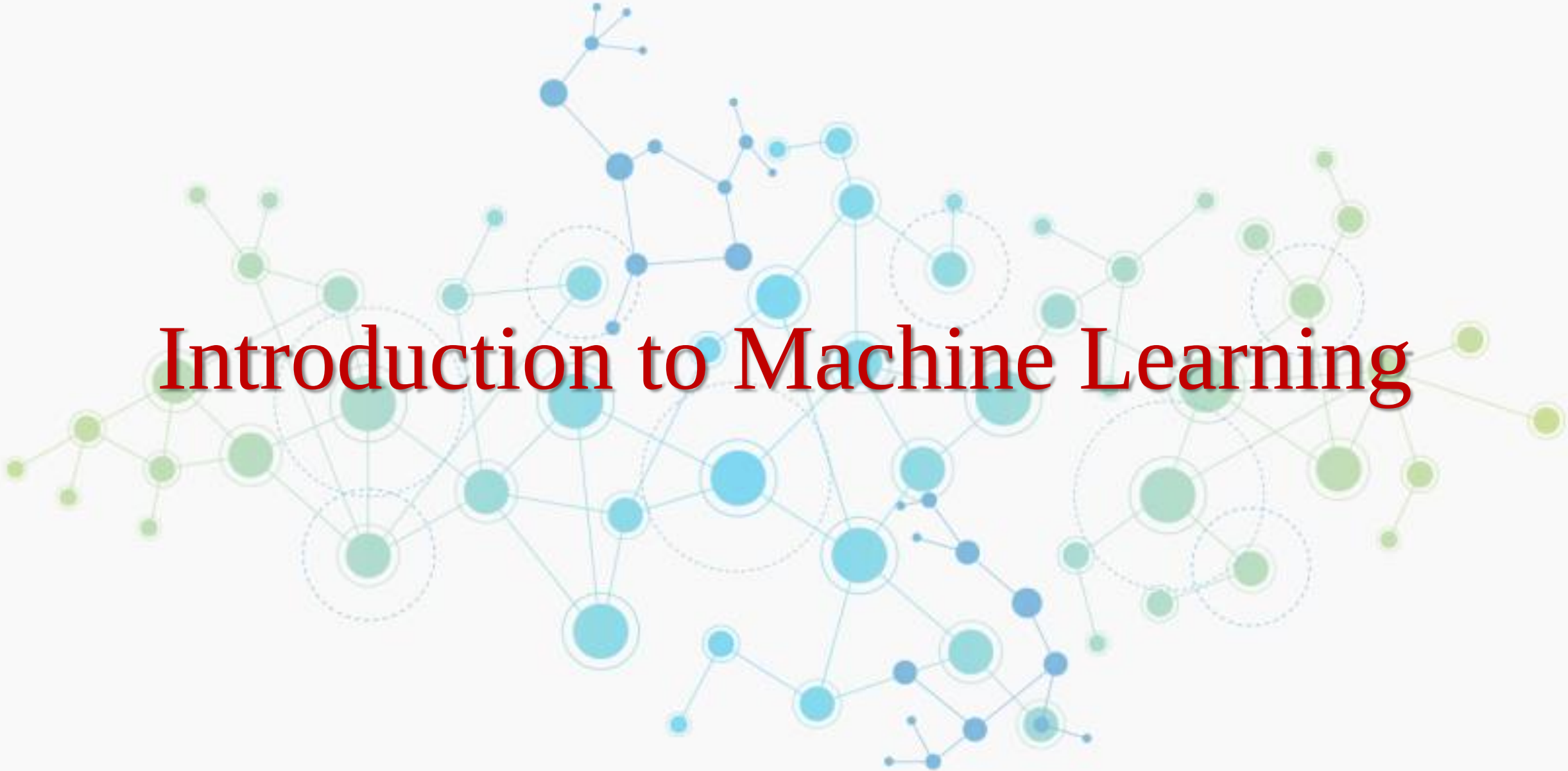


Introduction to Machine Learning

Course Coverage

- Foundational Concepts and Machine Learning Basics
- Deep Learning Fundamentals, Models and Intuition
- Convolutional Neural Networks
- Recurrent Neural Networks

References and Resources

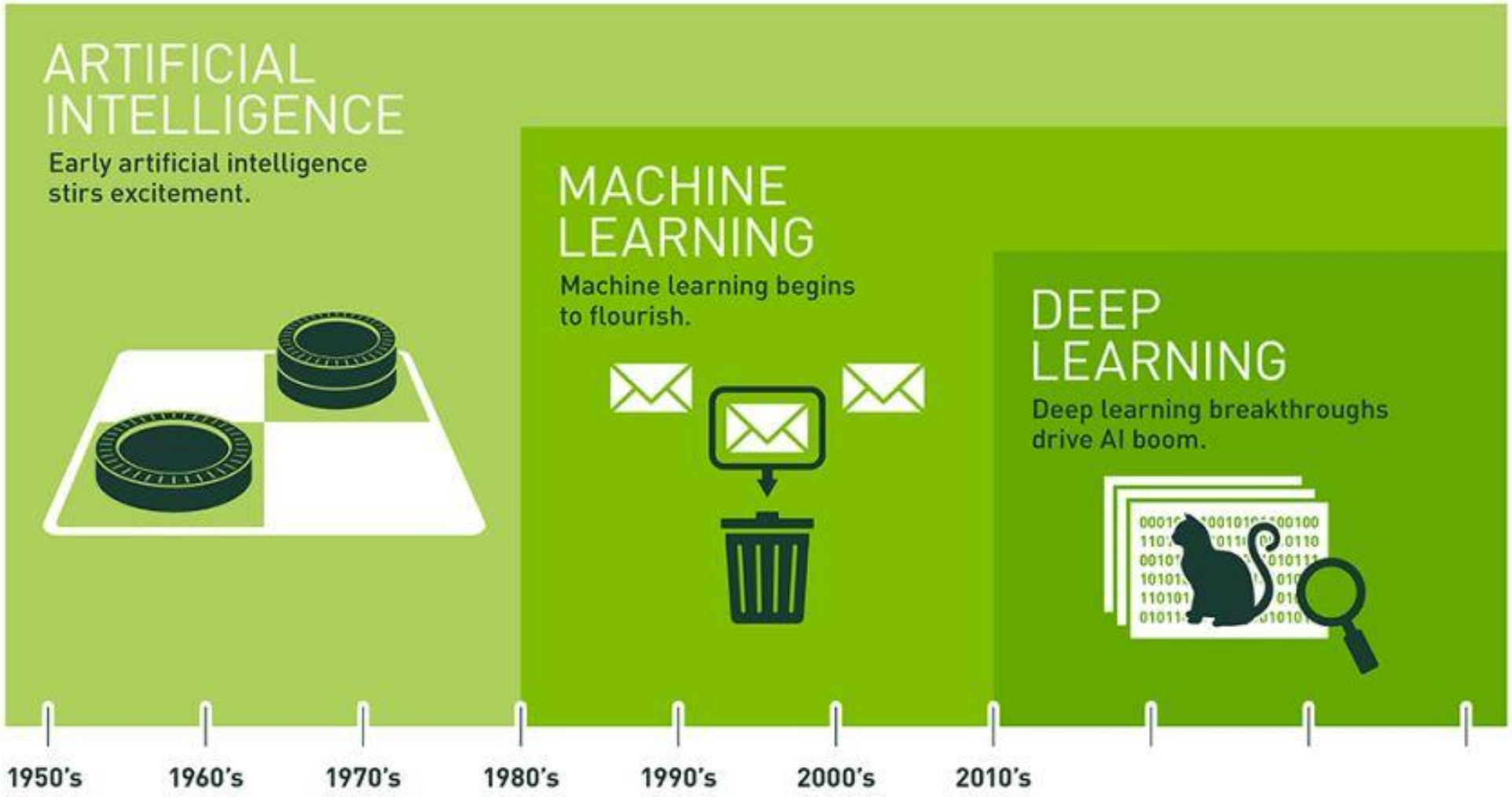
Online Courses of Machine Learning, Deep Learning and Data Science on edX, Udacity, Coursera

Series of Courses by Andrew Ng

GitHub Code and sample projects provided by many programmers

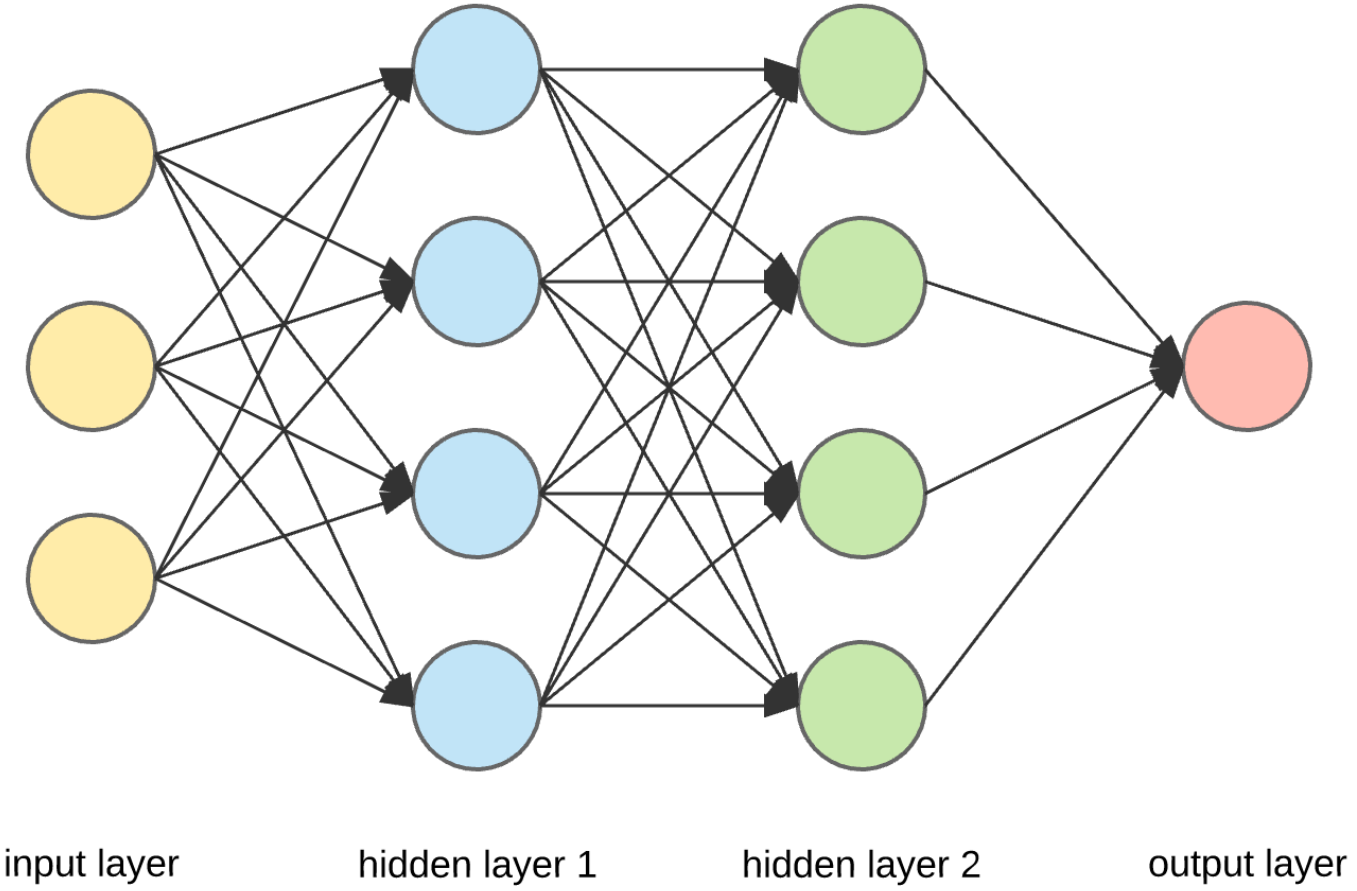
Blogs and Articles on the latest issues and trends in Deep Learning

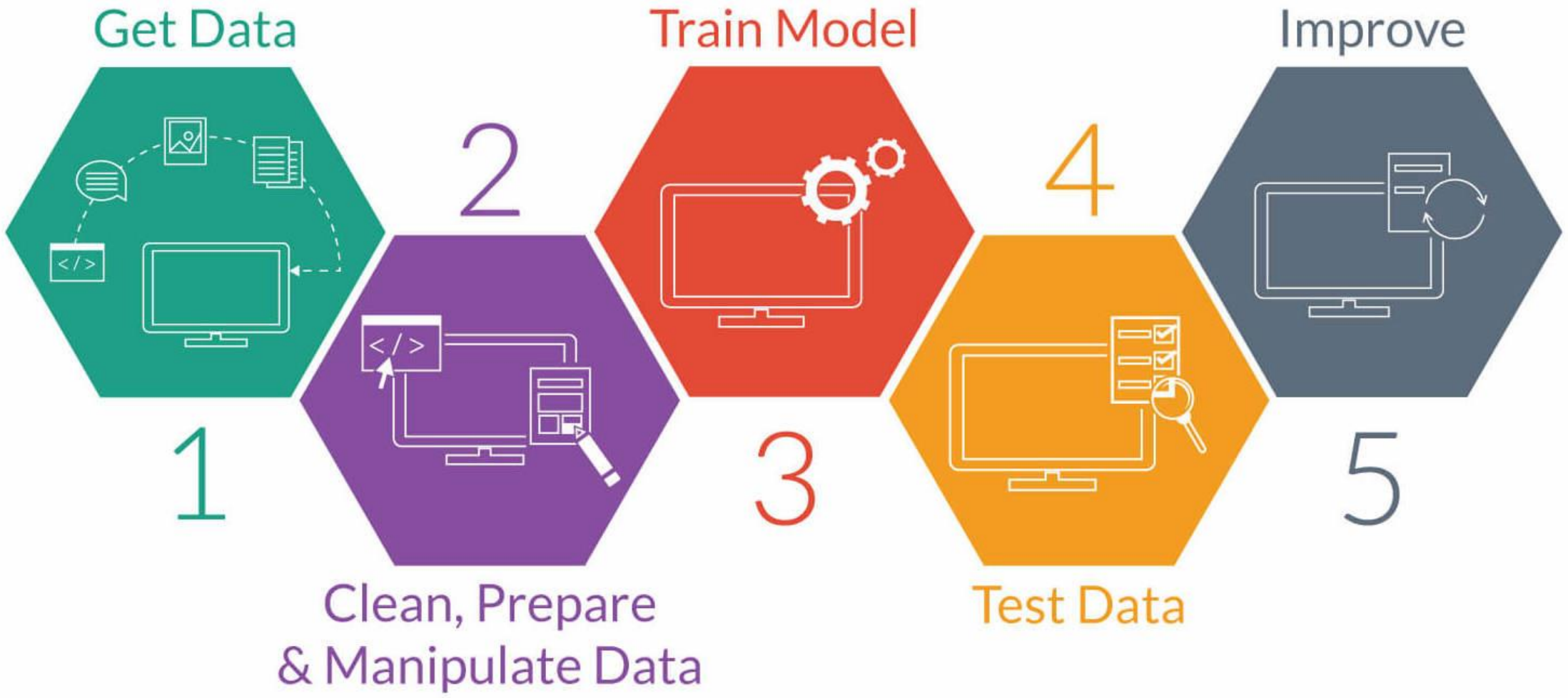
Resources page of leadingindia.ai



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

A Deep Neural Network




Get Data
1
Clean, Prepare
& Manipulate Data
2
Train Model
3
Test Data
4
Improve
5

Deep Learning/AI APPLICATIONS

Few Popular Applications: Precision Agriculture, Learner Profiling, Video Captioning, Exploring Patterns from Satellite images, Image detection in Healthcare, Identifying specific markers in Genomes, Creating Art and Music, Recommendations, behavior prediction,

Three main areas where Deep learning is being prominently applied

Detection

- Text & Speech
- Image interpretation
- Human behavior & identity
- Abuse & Fraud

Prediction

- Recommendations
- Individual behavior & condition
- Collective behavior

Generation

- Visual art
- Music
- Text
- Design

1. Problems where a) There is no deterministic algorithm (not even of evil complexity) e.g. Recognizing a 3D object from a given scene, Handwriting recognition, Speech recognition

2. Problems which don't have a fix solution and goal posts keep changing. System adapts and learns from experience e.g. SPAM emails, Financial fraud, IT Security Framework

3. Where Solutions are Individual specific or time dependent. e.g. recommendations and targeted advertisements

4. For prediction based on past and existing patterns (not defined or defined by huge number of weak rules) e.g. prediction of share prices etc.

For What kind of Applications we use Machine/Deep Learning

Types of Learning Algorithms

- Supervised
  - Learns from examples which provide desired outputs for given inputs
- Unsupervised
  - Learns patterns in input data when no specific output values are given
- Reinforcement
  - Learns by an indication of correctness at end of some reasoning

Features

The features are the elements of your input vectors. The number of features is equal to the number of nodes in the input layer of the network

Category	Features
Housing Prices	No. of Rooms, House Area, Air Pollution, Distance from facilities, Economic Index city, Security Ranking etc.
Spam Detection	presence or absence of certain email headers, the email structure, the language, the frequency of specific terms, the grammatical correctness of the text etc.
Speech Recognition	noise ratios, length of sounds, relative power of sounds, filter matches
Cancer Detection	Clump thickness, Uniformity of cell size, Uniformity of cell shape, Marginal adhesion, Single epithelial cell size, Number of bare nuclei, Bland chromatin, Number of normal nuclei, Mitosis etc.
Cyber Attacks	IP address, Timings, Location, Type of communication, traffic details etc.
Video Recommendations	Text matches, Ranking of the video, Interest overlap, history of seen videos, browsing patterns etc.
Image Classification	Pixel values, Curves, Edges etc.

Weights

Weights correspond to each feature.

Weights denote how much the feature matters in the model.

Higher weight of a particular feature means that it is more important in deciding the outcome of the model.

Weights of a feature represent that how much evidence it gives in favor or against the current hypothesis in context of the existence or non-existence of the pattern you are trying to identify in the current input.

Generally weights are initialized randomly.

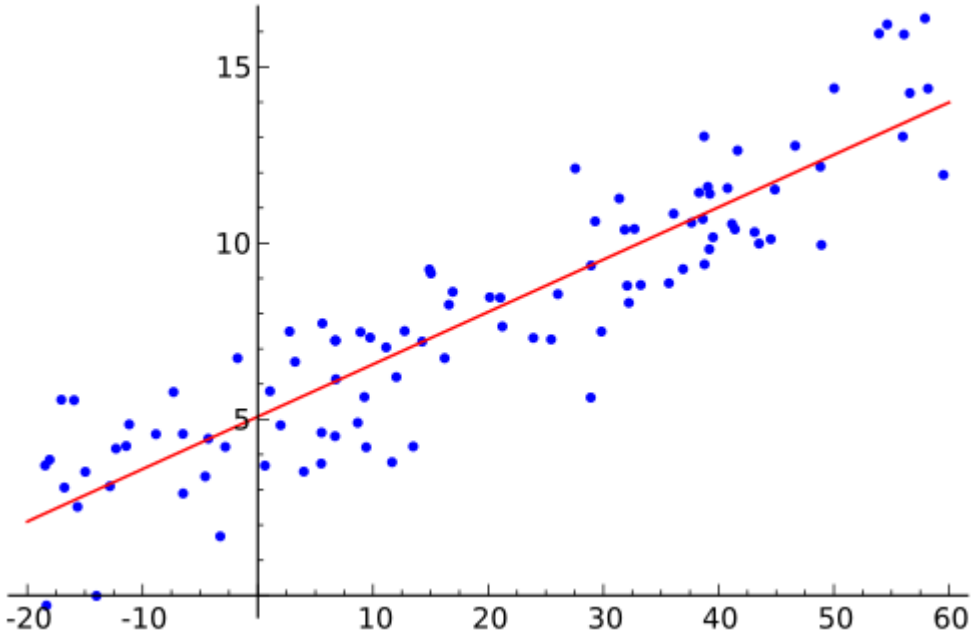
we try to bring them to near optimal values so that they are able to fit the model well and can help in prediction of unseen values

Linear Regression

Linear Regression: For applications where output will be a real value e.g. Predicting housing price, or predicting price of a share in stock market. In most cases we have multiple dependent variables, and we call it multiple linear regression

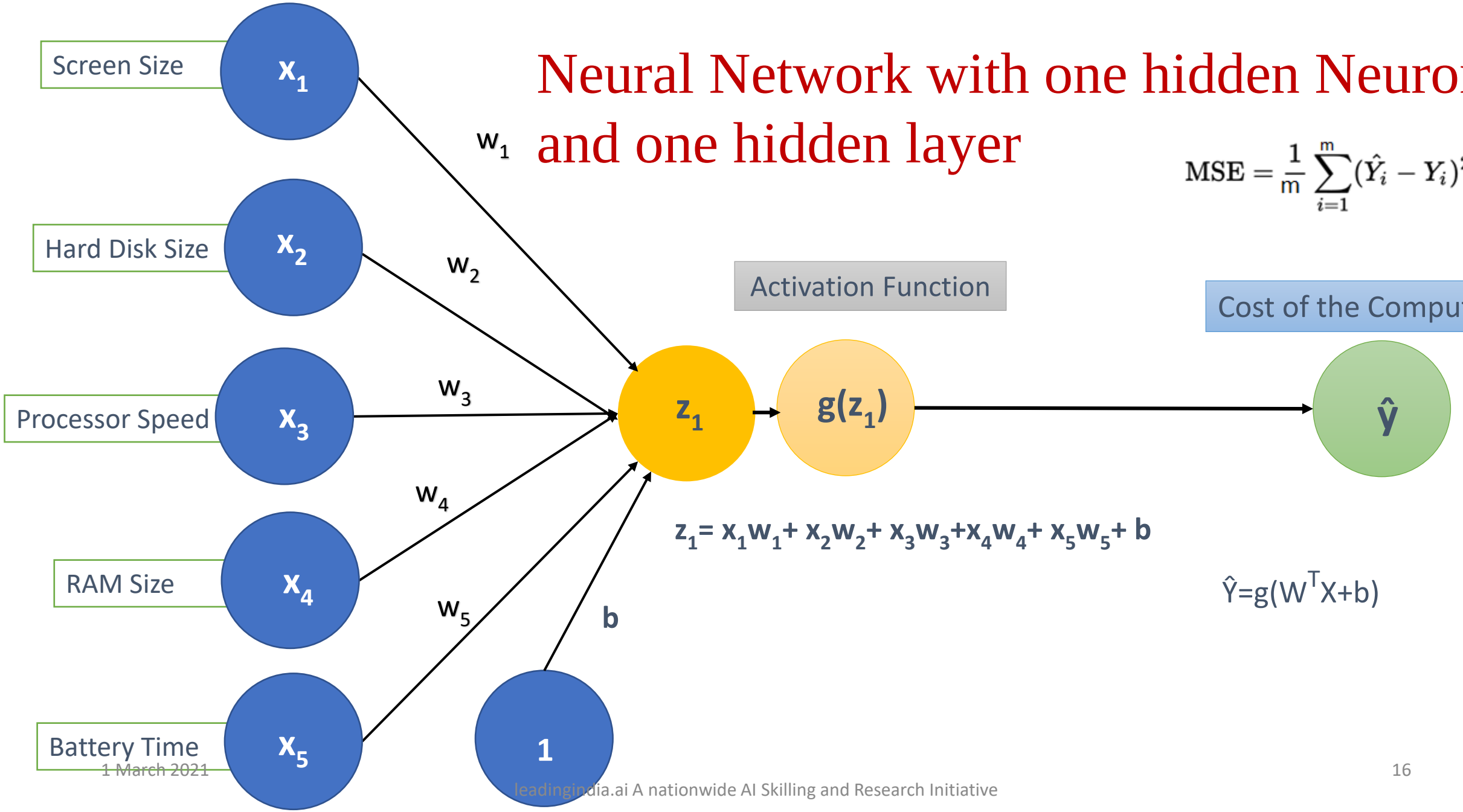
Logistic Regression: For applications where the output will be a binary value (0/1). E.g. whether this Medical Image depicts Tumor or not

Linear Regression



$$\text{MSE} = \frac{1}{m}\sum_{i=1}^{m}(\hat{Y}_i - Y_i)^2$$

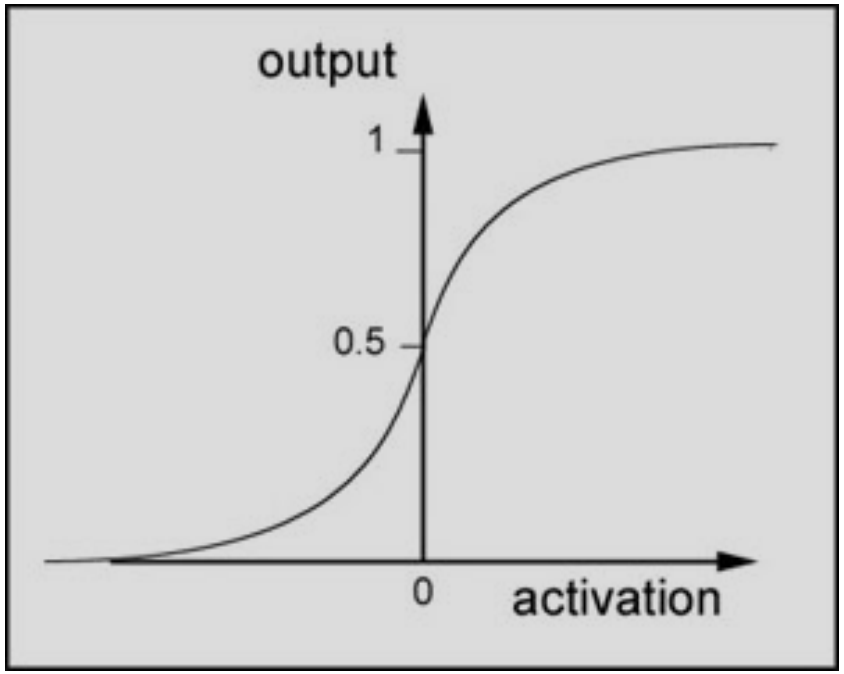
Neural Network with one hidden Neuron and one hidden layer



$$\text{MSE} = \frac{1}{m}\sum_{i=1}^{m}(\hat{Y}_i - Y_i)^2$$

Sigmoid Activation Function

- $\hat{y}=\sigma\ (w^T x + b)$ where $\sigma(z)= \frac{1}{1+e^{-z}}$
- If z is very large then e^{-z} is close to zero and $\sigma(z) = \frac{1}{1+0} \approx 1$
- If z is very small then e^{-z} is large and $\sigma(z) = \frac{1}{1+Large\ Number} \approx 0$



Logistic Regression

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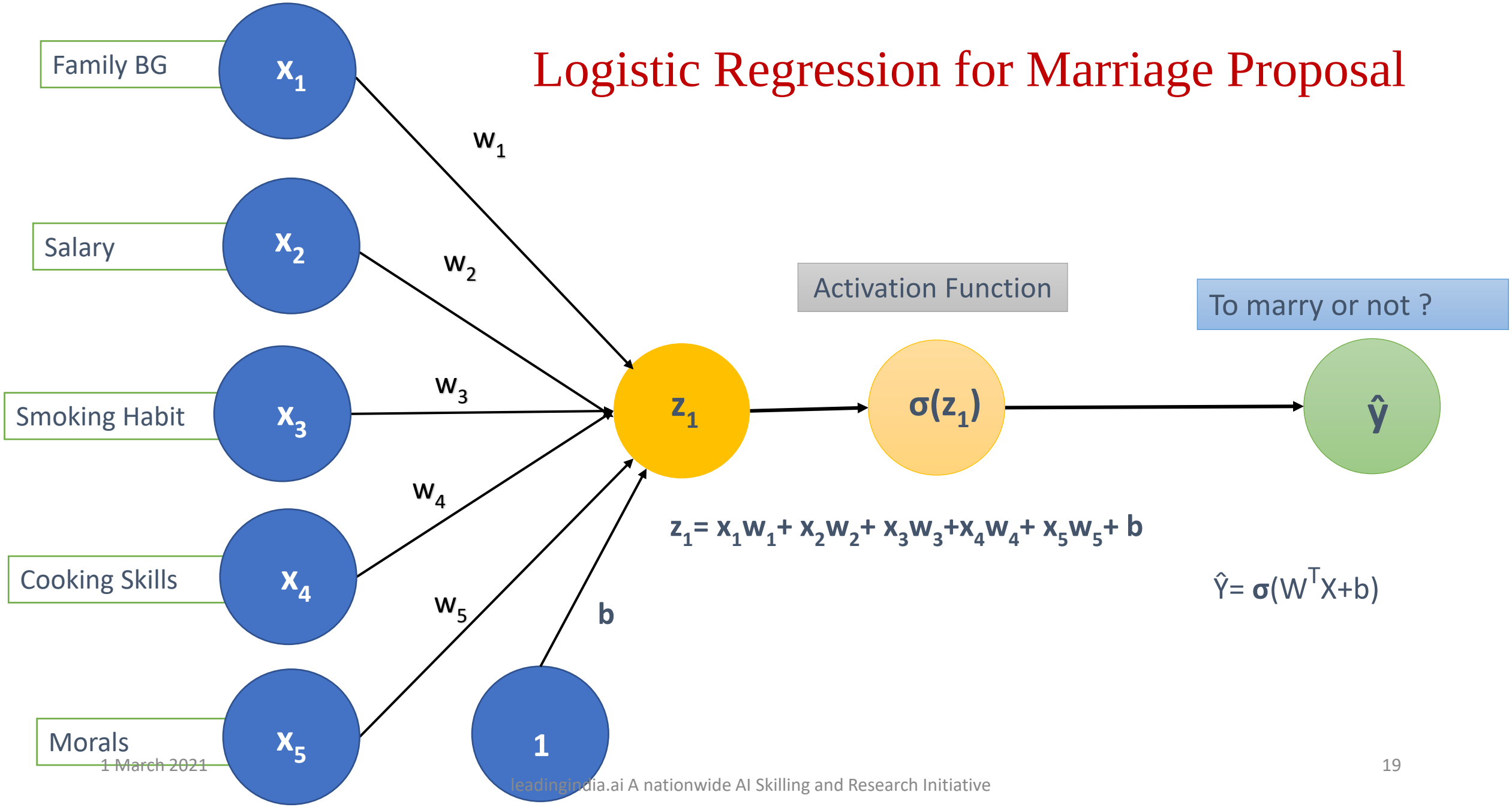
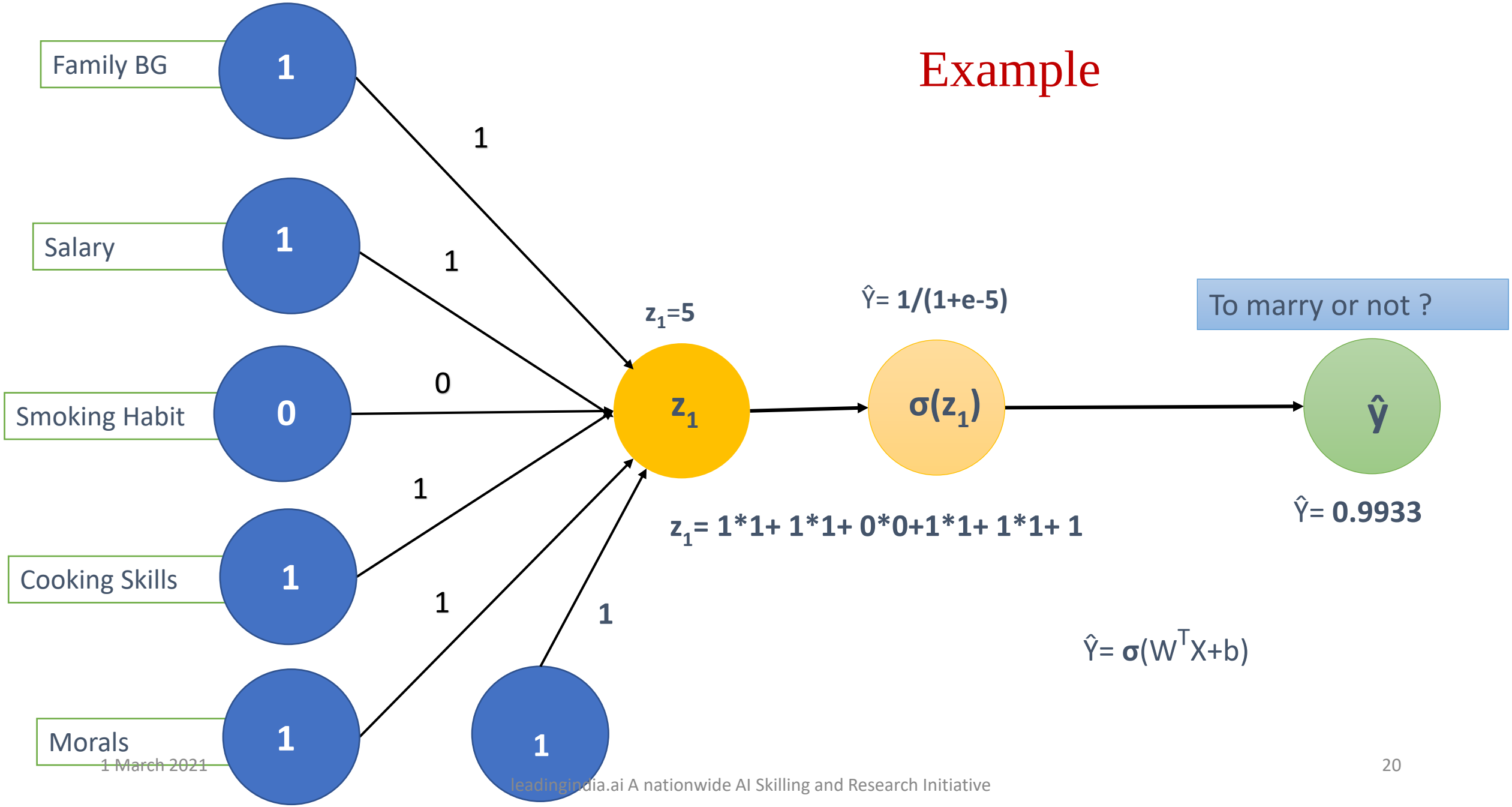
Logistic Regression: For applications where the output will be a binary value (0/1). E.g. whether this Medical Image depicts Tumor or not

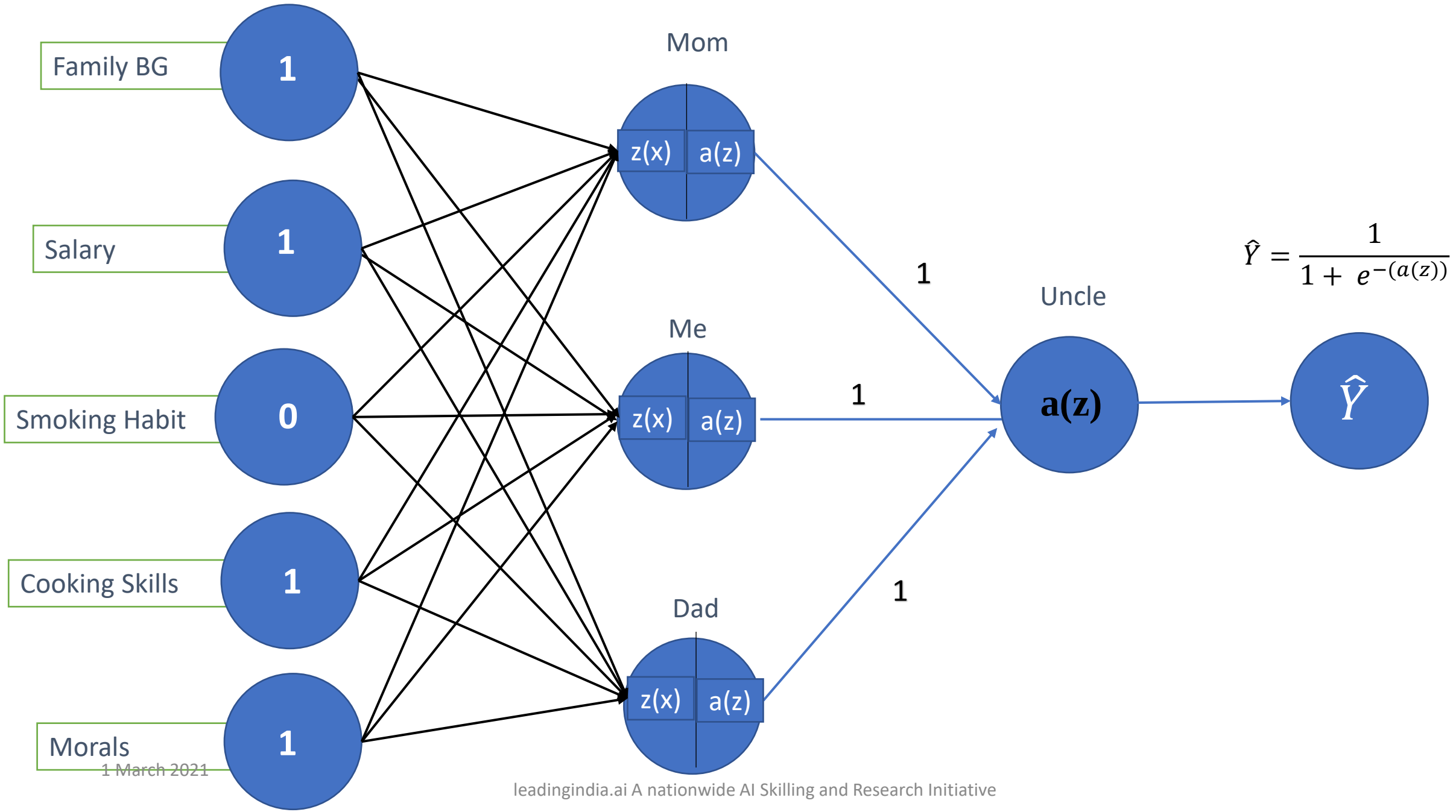
Logistic Regression for Marriage Proposal



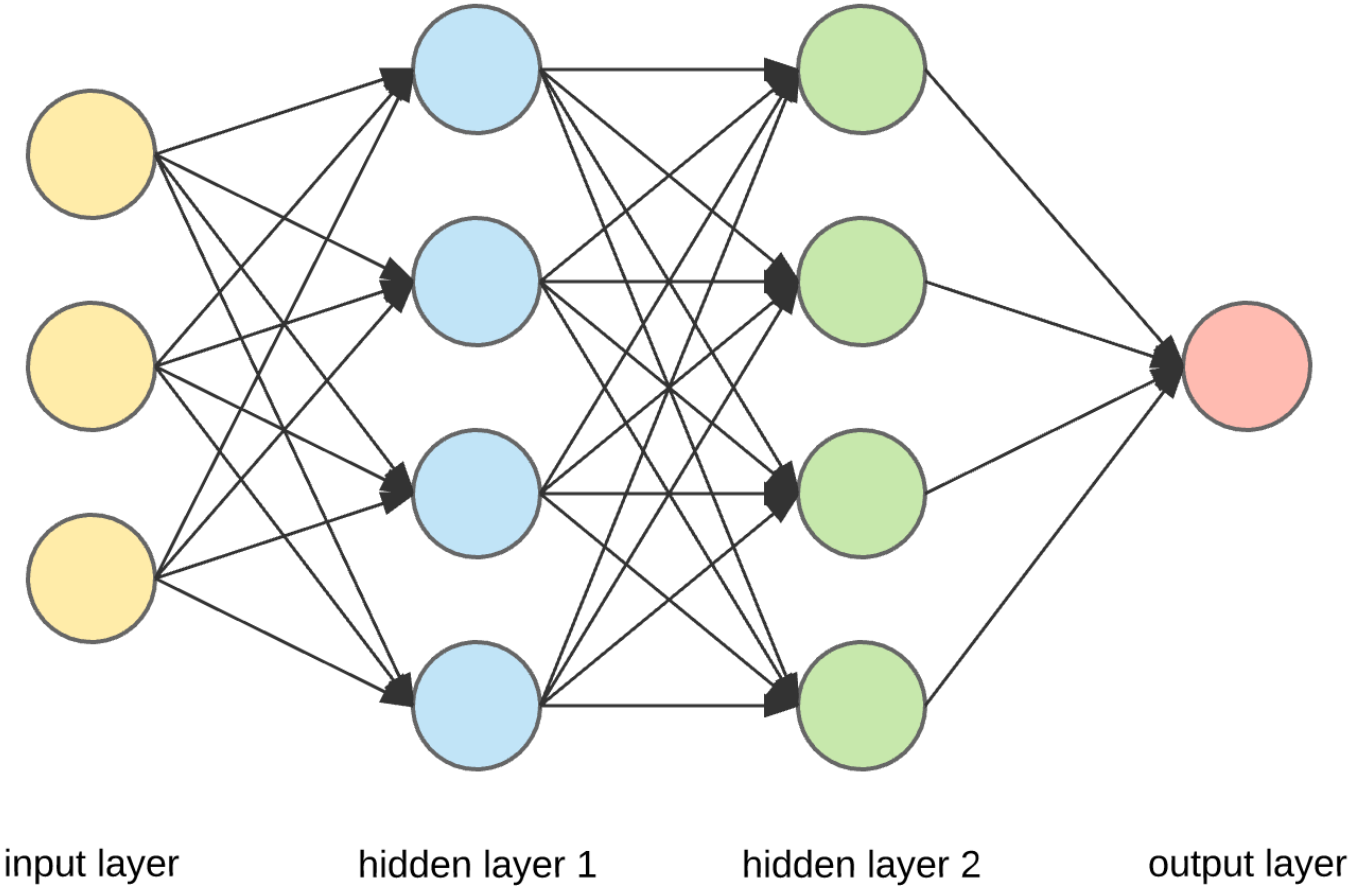
Example


Family BG
1
Salary
1
Smoking Habit
0
Cooking Skills
1
Morals
1
1
1
0
1
1
1
z_1=5
z_1
$\hat{Y}$= 1/(1+e-5)
$\sigma(z_1)$
To marry or not ?
$\hat{y}$
$\hat{Y}$= 0.9933
z_1= 1*1+ 1*1+ 0*0+1*1+ 1*1+ 1
$\hat{Y}$= $\sigma(W^T X+b)$

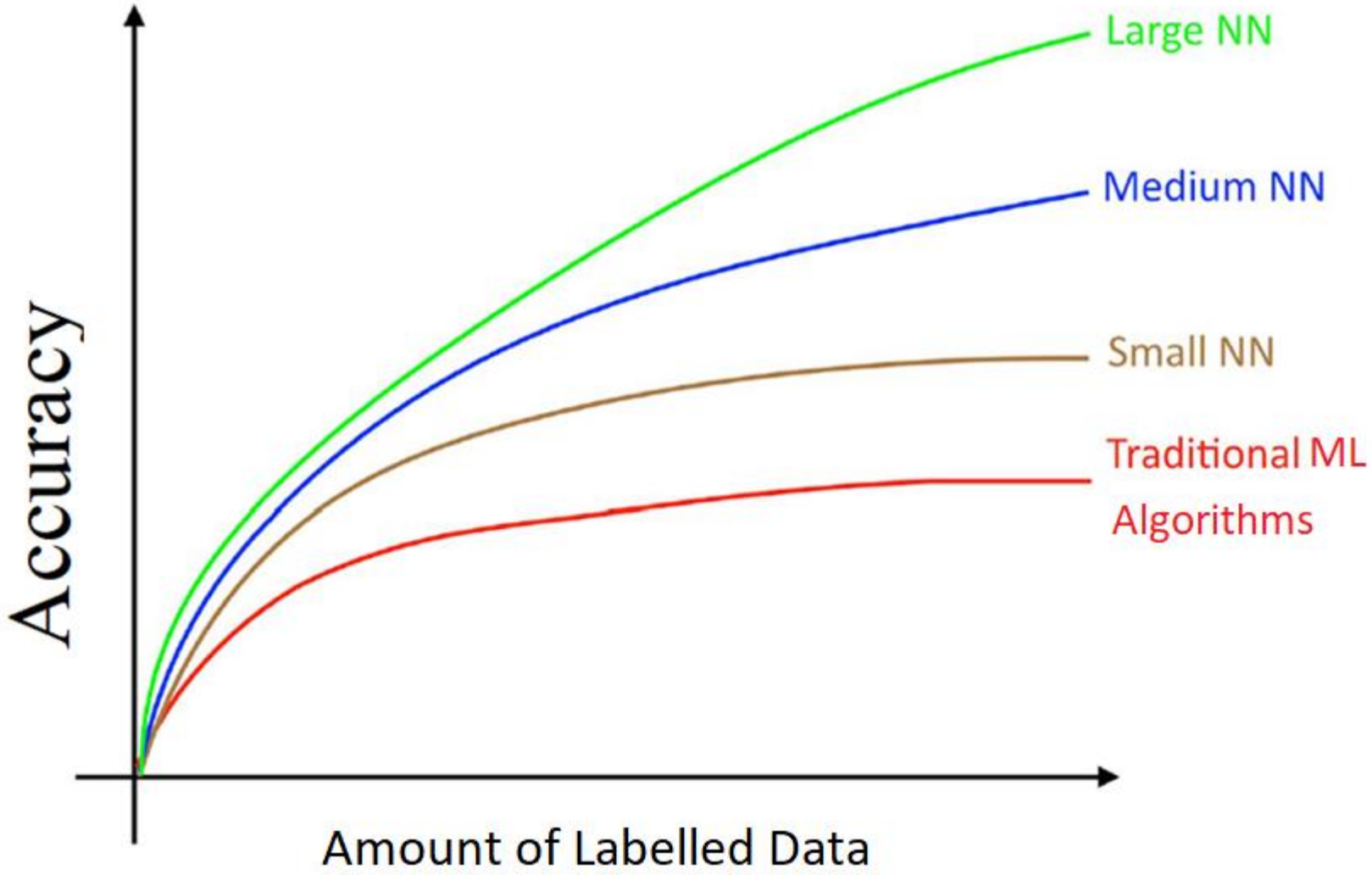
5 * 3 Connections and weights



A Deep Neural Network



Why it has taken off now

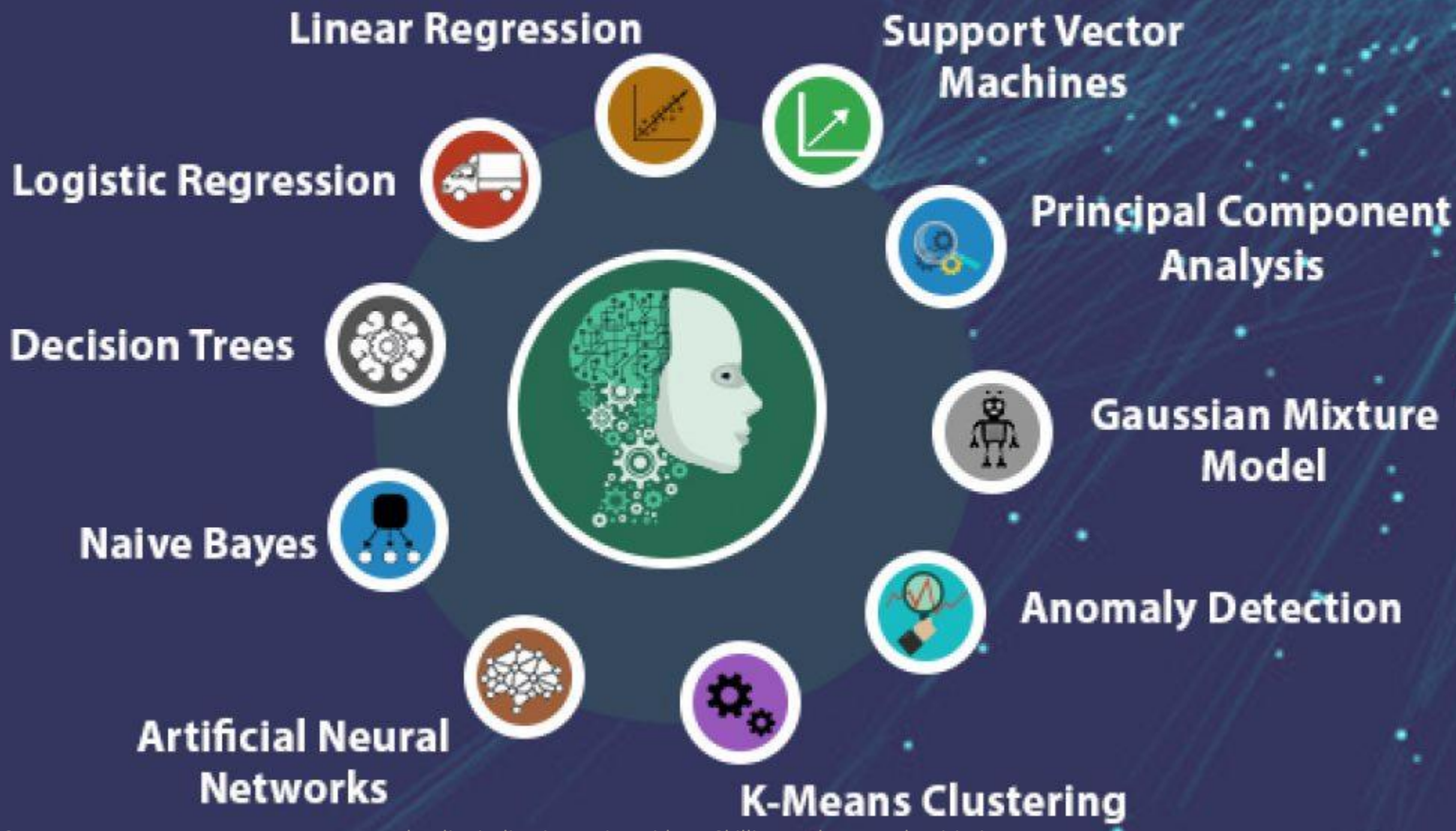


Availability of Data has increased due to explosion in Smart Mobiles and devices

More Computing Power is available due to coming of NVIDIA GPUs

Release/development of new algorithms, APIs and Platforms for Deep Learning Applications

Top Machine Learning Algorithms



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Thank
you!