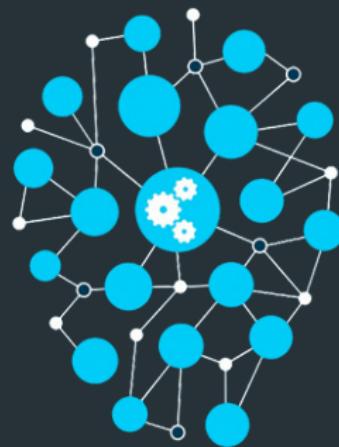


MACHINE LEARNING



The A Team

Machine Learning

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Deep Learning

Conclusion

Presented By:

Suvojit Manna

Pronab Mukherjee

Barun Gupta

Somnath Rakshit

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Let's Get Started

Machine Learning — What ?

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Field of study that gives computers the ability to learn without being explicitly programmed.

Instead of writing code, you feed data to the generic algorithm and it builds its own logic based on the data.



Figure: Classification Algorithms

Case Studies — Supervised Learning

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Bedroom	Sq.Ft	Neighbourhood	Price
3	2000	Uptown	\$350,000
2	800	Downtown	\$200,000
2	850	City Centre	\$150,000
1	550	Suburbs	\$75,000
4	2000	Suburbs	\$200,000

Bedroom	Sq.Ft	Neighbourhood	Price
3	2000	City Centre	???

Definition

Supervised learning is the machine learning task of inferring a function from labeled training data.

Case Studies — Supervised Learning

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Math's Exam - Answer Keys

- | | |
|--------------|---------------|
| 1) 2 4 5 = 3 | 5) 6 2 2 = 10 |
| 2) 5 2 8 = 2 | 6) 3 1 1 = 2 |
| 3) 2 2 1 = 3 | 7) 5 3 4 = 11 |
| 4) 2 2 4 = 6 | 8) 1 8 1 = 7 |

- The training data consist of a set of training examples.
- Training Data :
 - Input Object : Set of Features
 - Desired Output : Supervisory Signal
- A supervised learning algorithm produces an inferred function.
- An analogous task in human and animal psychology : Concept Learning.

Case Studies — Unsupervised Learning

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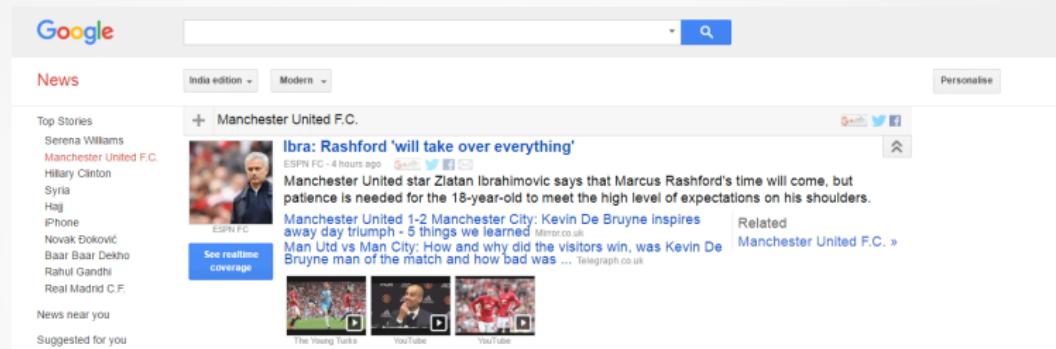


Figure: Google News grouping similar stories together.

Definition

Unsupervised learning is the machine learning task of inferring a function to describe hidden structure from unlabeled data.

Cocktail Party Problem — Unsupervised Learning

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Sound from :

- *Microphone 1*
- *Microphone 2*

Output from Learning Algorithm :

- *Output 1*
- *Output 2*

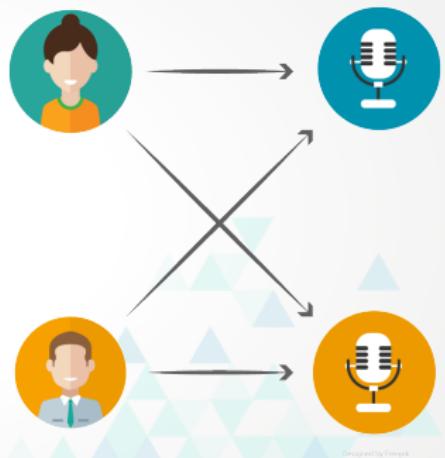


Figure: Overlapped Recordings

Case Studies — Unsupervised Learning

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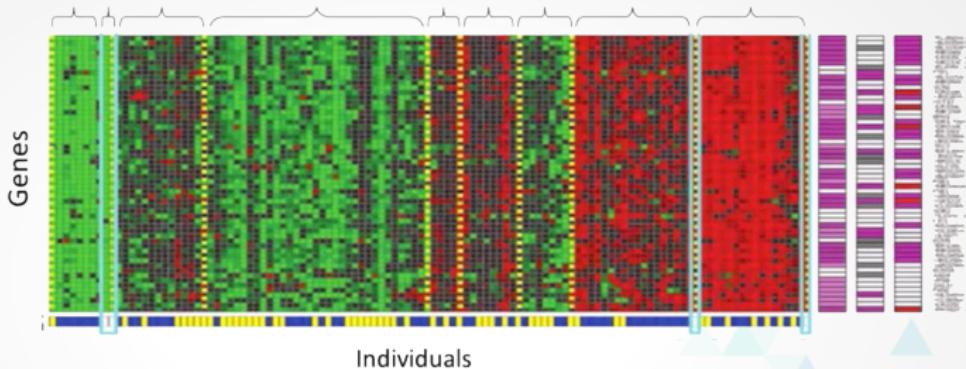


Figure: Gene Clustering

- Training Data given to the learner is unlabeled.
- No error or reward signal to evaluate a potential solution.
- Closely related to density estimation in statistics.

Machine Learning — Formal Definition

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The field of machine learning is concerned with the question of how to construct computer programs that automatically improve with experience.

A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E.

Evolved from :

- Pattern Recognition
- Computational Learning Theory
- Artificial Intelligence

Industry Trends

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A large U.S. bank used IBM machine learning technologies to analyze credit card transactions. It resulted in the following:



Google Chauffer : Self Driving Car by Google

IBM Research : Credit Card Fraud Detection

Mail Services : Spam Filtering

Industry Trends

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Figure: Kaggle Challenge : Psychopathy Prediction

The aim of the competition is to determine to what degree it's possible to predict people with a sufficiently high degree of Psychopathy based on Twitter usage and Linguistic Inquiry.

Entertainment — Machine Learning

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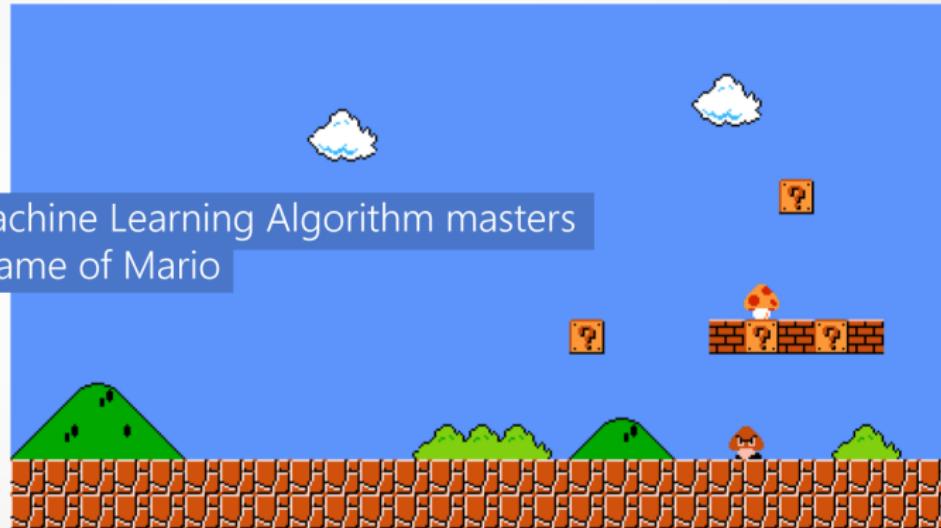
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► Machine Learning Algorithm masters
the game of Mario



Applications — Machine Learning

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- Adaptive websites
- Classifying DNA sequences
- Computer vision
- Internet fraud detection
- Natural language processing
- Online advertising
- Recommender systems
- Search engines
- Sentiment analysis
- Speech and handwriting recognition

Regression — What?

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Regression is an analysis process to predict the value of an attribute derived from multiple known attributes.

Regression — The Commander of Examples

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Suppose a Commander needs to be chosen out of a bunch of soldiers. Now no such attribute is known which determines the potential to become the Commander.

But other independent attributes are known such as Attendance, IQ Scores, Physical Fitness, Supervisor Rating.



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Suppose a Commander needs to be chosen out of a bunch of soldiers. Now no such attribute is known which determines the potential to become the Commander.

But other independent attributes are known such as Attendance, IQ Scores, Physical Fitness, Supervisor Rating.

This is where Regression Analysis comes handy.

Regression — How to?

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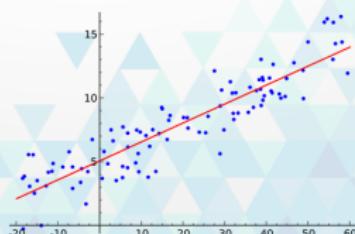
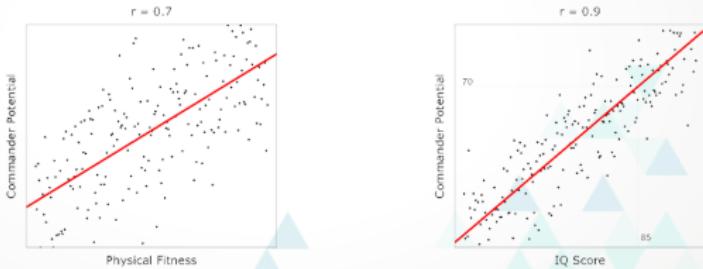
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First the known attributes are plotted separately. Then a composite plot is acquired from all the separate plots. Then we must acquire the Regression Line that is a line that fits the best with all the plots



Regression — Formal Definition

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In statistics, Regression Analysis is a statistical process for estimating the relationships among variables. It includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables.

Regression — Types of Regression

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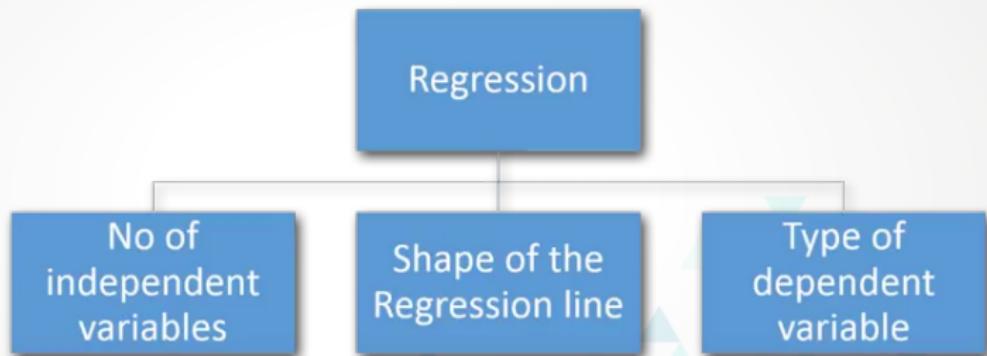


Figure: Types of Regression

Regression — Importance of Regression Line

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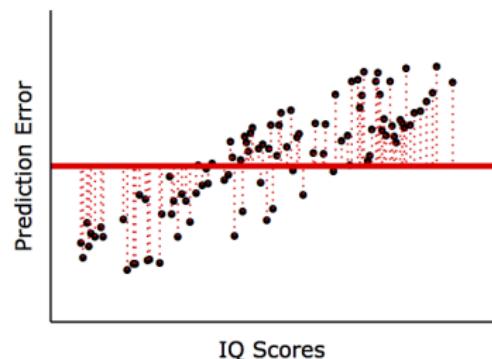
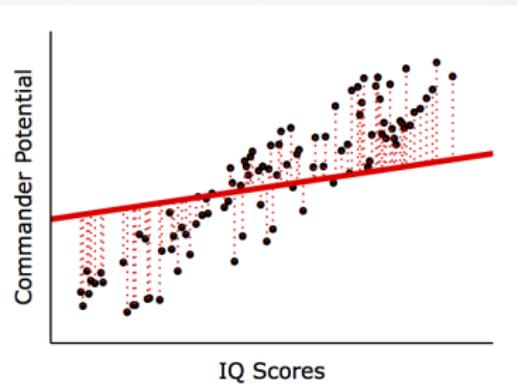
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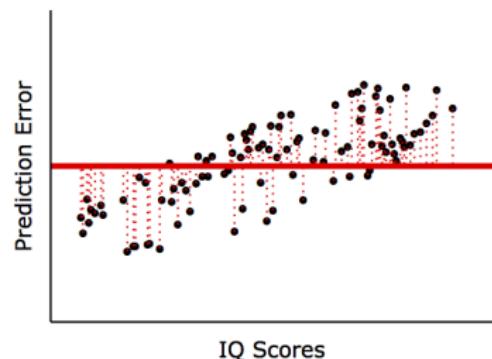
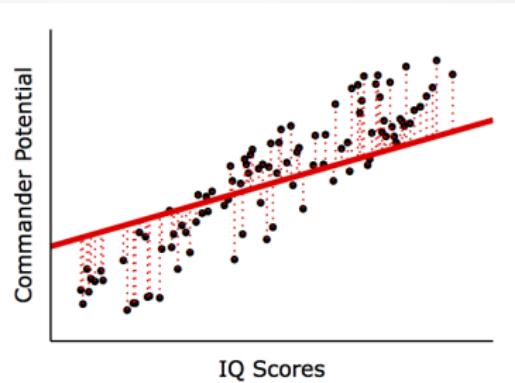
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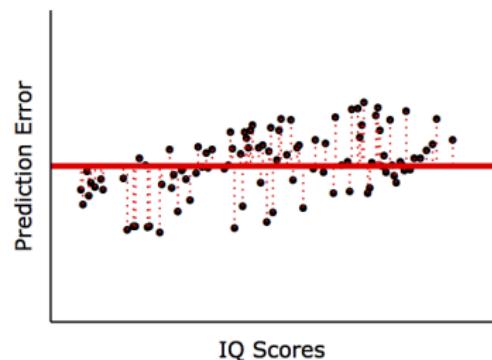
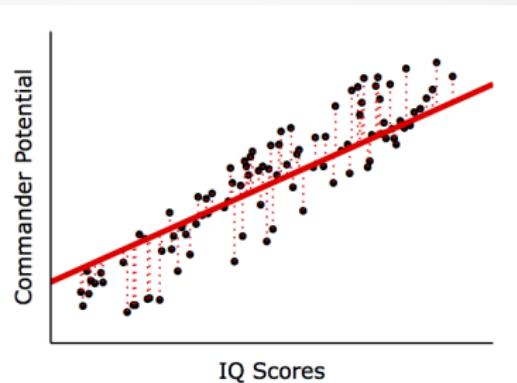
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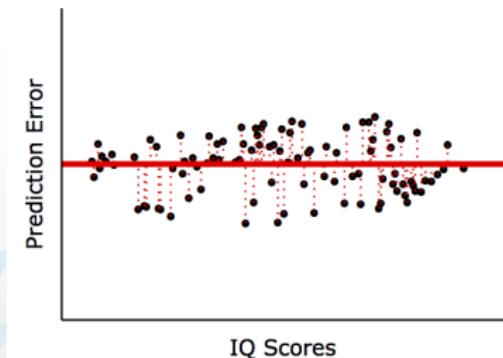
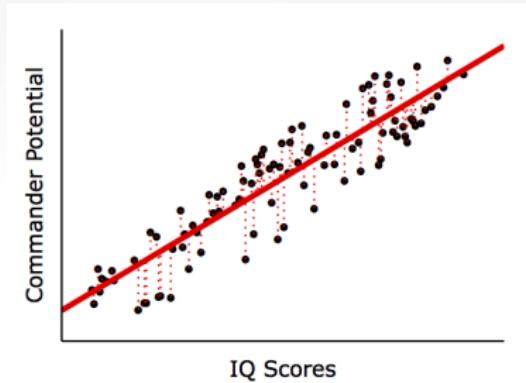
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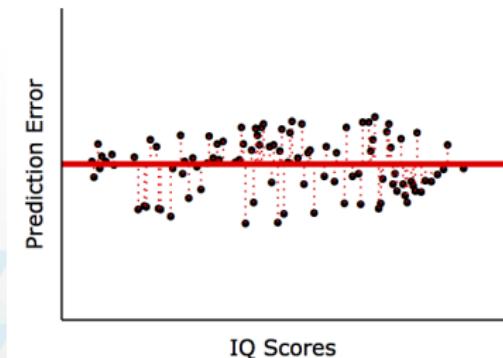
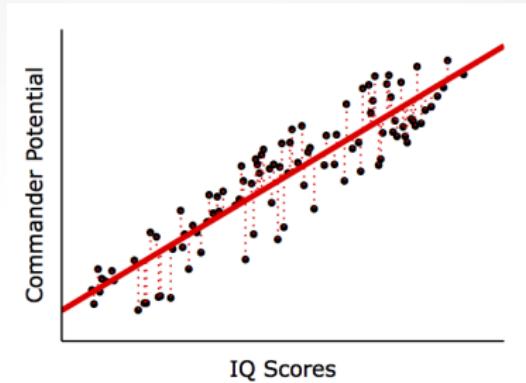
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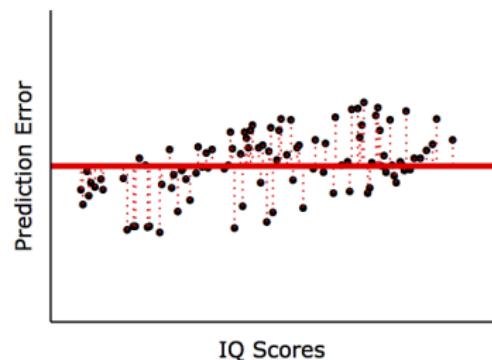
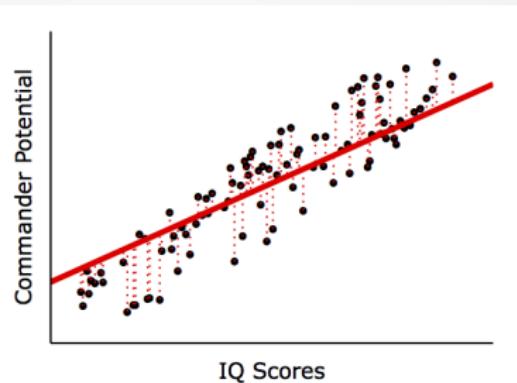
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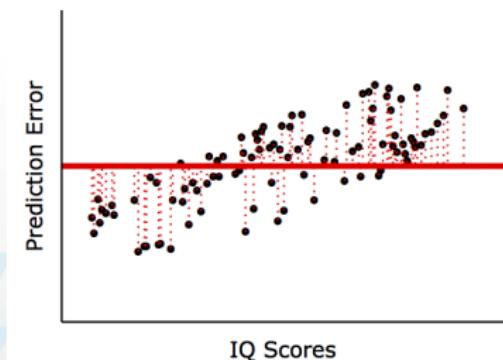
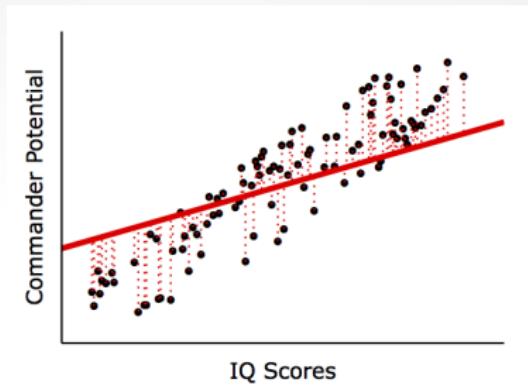
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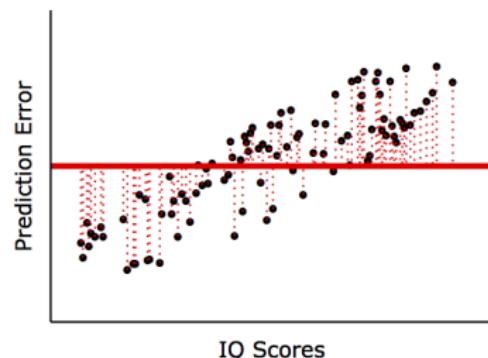
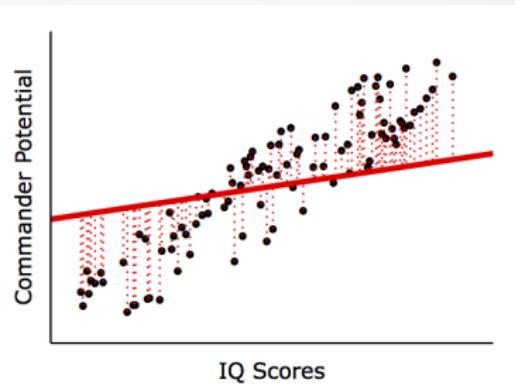
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- Estimates Future with minimal error
- Provides Aid in Decision Making
- Self Developing
- Increasing Accuracy
- Develops Big Data and Data Mining



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Regression analysis is most commonly used in forecasting or predicting how a set of conditions will impact an outcome.

- Weather Forecasting
- Stock Market Estimation
- Statistical Research
- Business Forecasting and Optimization
- Risk Forecasting in Medical Fields
- Decision Making of Regular Jobs



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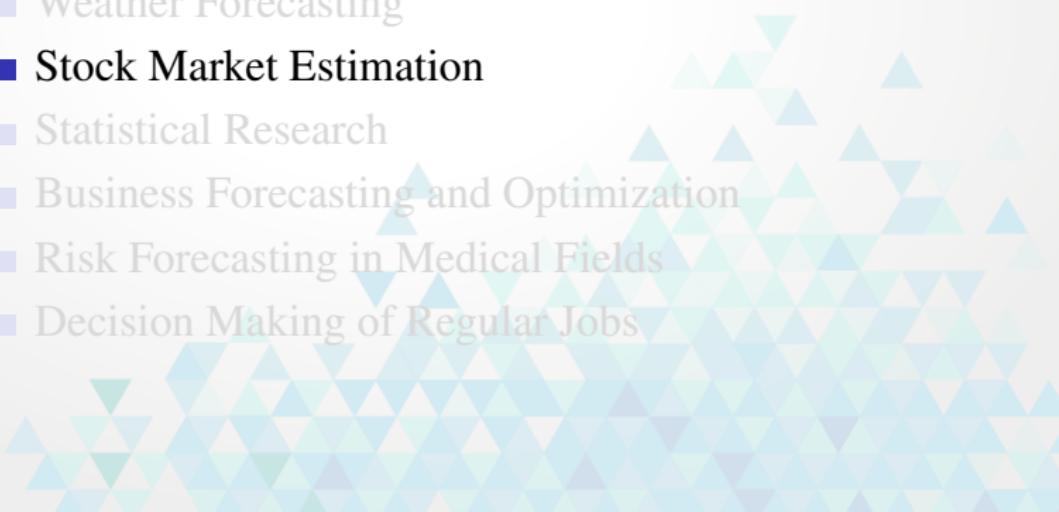
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Regression — Some Real Life Examples

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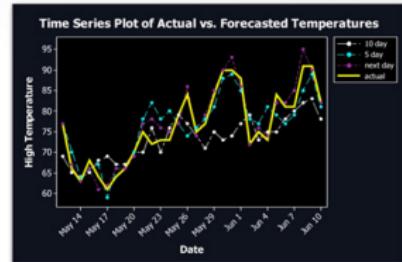
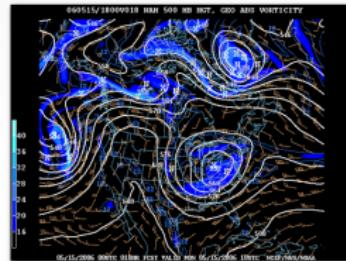
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Weather Forecasting



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STOCK MARKET Estimation

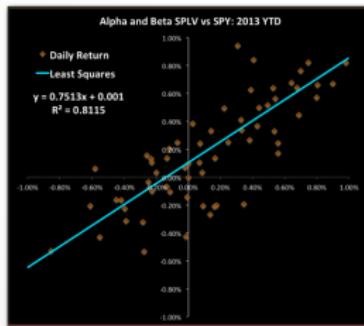


Figure: Stock Market Estimation

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Recommendation Engine

You may also be interested in

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Product	Rating	Reviews	Original Price	Discounted Price	Discount (%)
God Of War III [Essentials]	4.5★	(476)	₹899	₹699	21% off
Far Cry 3	4.6★	(883)	₹970	₹6269	25% off
Sony DUALSHOCK3 Wireless Controller	3.8★	(633)	₹1,289	₹8,860	96% off
Crysis 3 (Hunter Edition)	4.5★	(345)	₹1,299	₹6,669	33% off
The Winning Way: Learnings From Sport For Managers (English)	4.1★	(172)	₹164	₹999	34% off
Mass Effect 3	4.5★	(336)	₹799	₹4,999	38% off

Figure: Recommendation Engine

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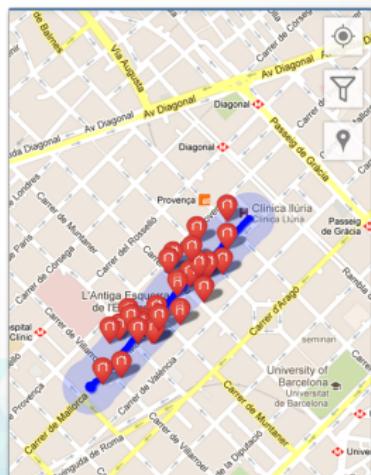
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Crowd Management



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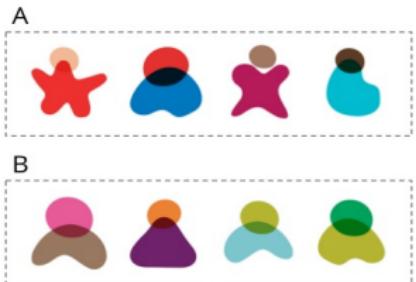
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In machine learning and statistics, classification is the problem of identifying to which of a set of categories (sub-populations) a new observation belongs.

On the basis of a training set of data containing observations (or instances) whose category membership is known.

CLASSIFICATION



Usages — When it is used?

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Classification is considered an instance of supervised learning, i.e. learning where a training set of correctly identified observations is available..

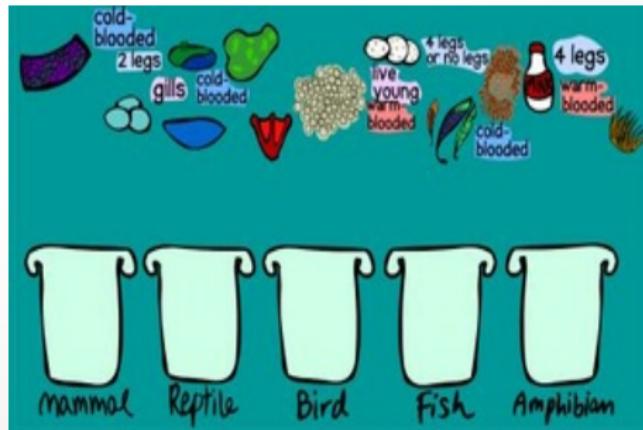


Figure: Training set is correctly Identified.

Usages — Types Of Classifiers

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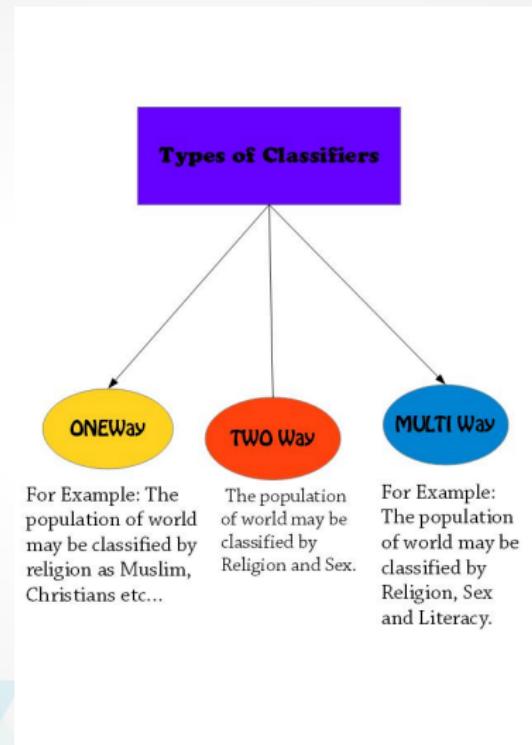


Figure: Types of Classifiers.

Usage — Brief Discussion

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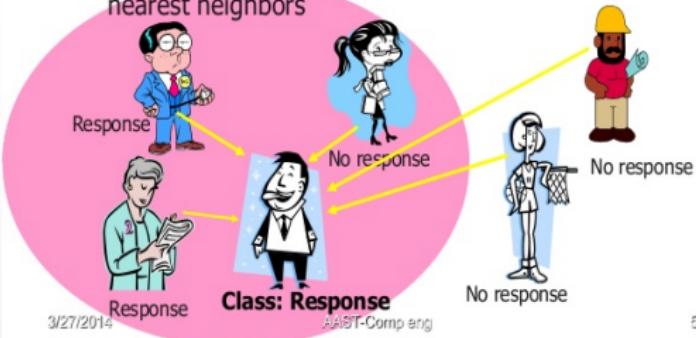
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KNN algorithm :-

K-Nearest Neighbor Algorithm

- To determine the class of a new example E:
 - Calculate the distance between E and all examples in the training set
 - Select K-nearest examples to E in the training set
 - Assign E to the most common class among its K-nearest neighbors



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Figure: Example

Usage — Brief Discussion!

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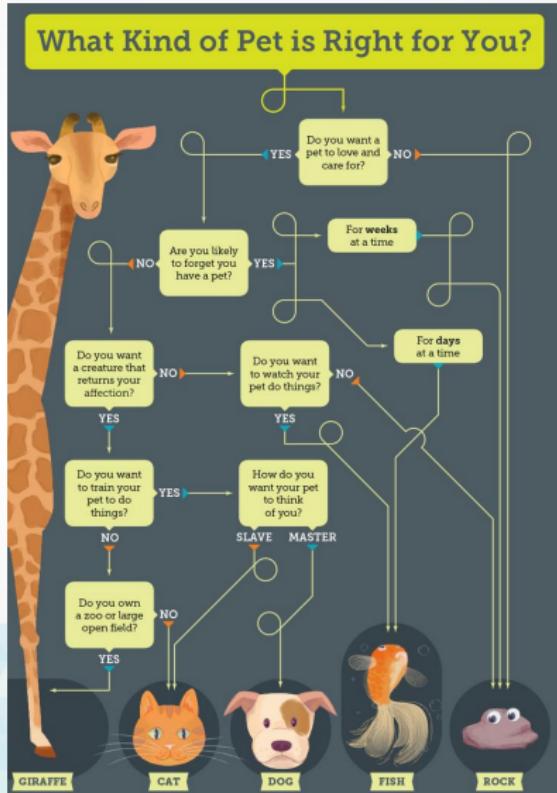
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Decision Tree :-



Example Cases — Real Life Examples

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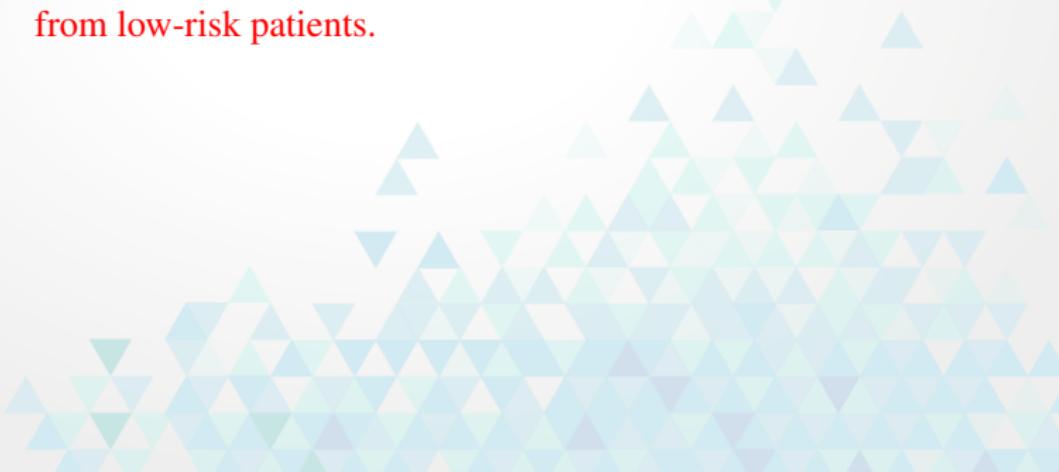
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- Example 1:- An emergency room in a hospital measures 17 variables (e.g., blood pressure, age, etc) of newly admitted patients. A decision is needed: whether to put a new patient in an intensive-care unit. Due to the high cost of ICU, those patients who may survive less than a month are given higher priority.
Problem: to predict high-risk patients and discriminate them from low-risk patients.



Example Cases — Real Life Examples

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- Example 1:- An emergency room in a hospital measures 17 variables (e.g., blood pressure, age, etc) of newly admitted patients. A decision is needed: whether to put a new patient in an intensive-care unit. Due to the high cost of ICU, those patients who may survive less than a month are given higher priority.
Problem: to predict high-risk patients and discriminate them from low-risk patients.

- Example 2:- A credit card company receives thousands of applications for new cards. Each application contains information about an applicant, age Marital status annual salary outstanding debts credit rating etc.
Problem: to decide whether an application should approved, or to classify applications into two categories, approved and not approved.

Deep Learning — What is Deep Learning

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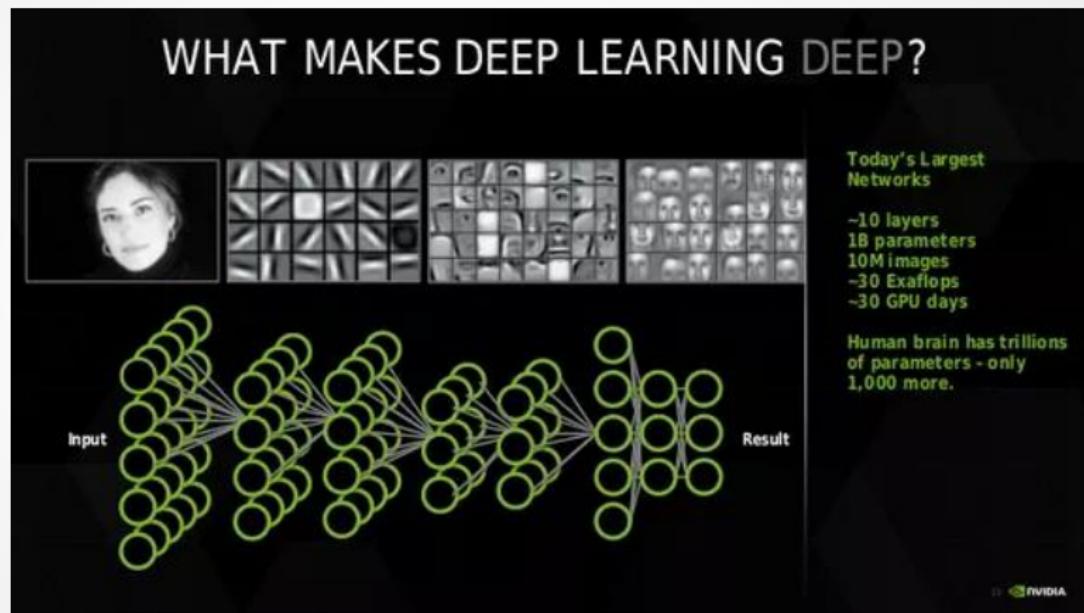
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Neural Networks — What is ANN?

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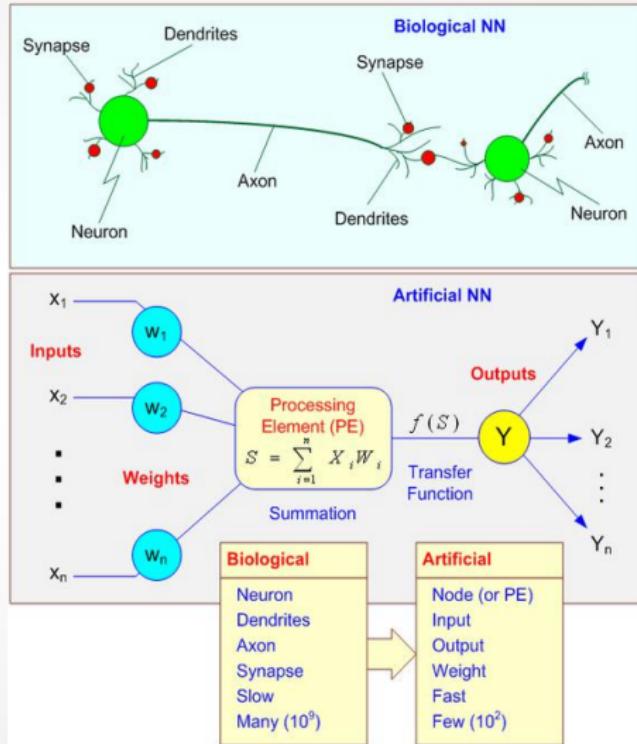


Figure: Artificial Neural Network

Traditional vs Deep learning — Deep Learning

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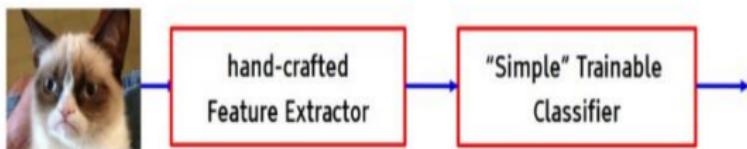
Advantages

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TRADITIONAL APPROACH

The traditional approach uses fixed feature extractors.



DEEP LEARNING APPROACH

Deep Learning approach uses trainable feature extractors.

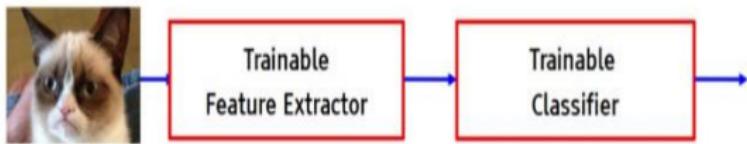


Figure: Tradition vs Deep Learning

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- Has best-in-class performance on problems that significantly outperforms other solutions in multiple domains. This includes speech, language, vision, playing games like Go etc. This isn't by a little bit, but by a significant amount. The current record is from 2013 where it classified 9979 out of 10,000 images accurately. This performance is human equivalent or even better. A Silicon Valleybased startup called Vicarious claims its created an artificial intelligence program so advanced it can solve CAPTCHAs with accuracy that, in many cases, approaches 100 percent.
- Reduces the need for feature engineering, one of the most time-consuming parts of machine learning practice.



Figure: Captcha

Disadvantages — Deep Learning

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- Requires a large amount of data if you only have thousands of example, deep learning is unlikely to outperform other approaches.
- Is extremely computationally expensive to train. The most complex models take weeks to train using hundreds of machines equipped with expensive GPUs.
- Do not have much in the way of strong theoretical foundation. This leads to the next disadvantage.
- Determining the topology/flavor/training method/hyperparameters for deep learning is a black art with no theory to guide you.
- What is learned is not easy to comprehend. Other classifiers (e.g. decision trees, logistic regression etc) make it much easier to understand what's going on. .

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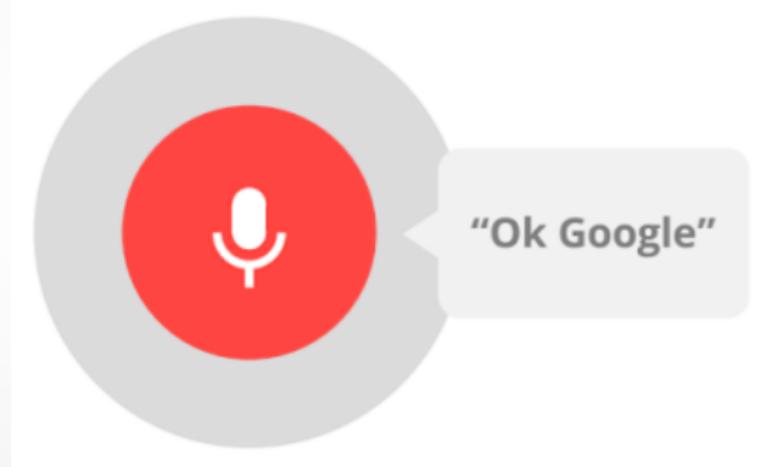
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Google Brain



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GoogleDeepMind



MATCH 1



AlphaGo vs Lee Sedol
Google DeepMind



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magenta



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Now that was very interesting!

The End