MACHINE LEARNING

The A Team

Machine Learning

Group 9

Introduction

Regression

Classifications

Deep Learning

Conclusion

Presented By:

Suvojit Manna
Pronab Mukherjee
Barun Gupta
Somnath Rakshit

Contents in Brief

1 Introduction

2 Regression

3 Classifications

4 Deep Learning

5 Conclusion

Let’s Get Started

Machine Learning — What ?

Machine Learning

Group 9

Introduction

Case Studies

Formal Defintion

Applications

Benefits

Regression

Classifications

Deep Learning

Conclusion

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.

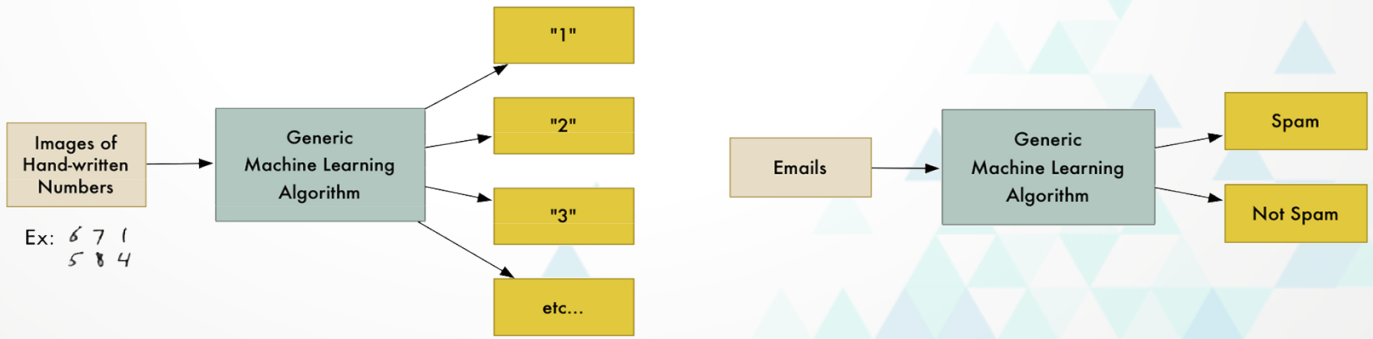


Figure: Classification Algorithms

Case Studies — Supervised Learning

Machine Learning

Group 9

Introduction
Case Studies
Formal Defintion
Applications
Benefits

Regression

Classifications

Deep Learning

Conclusion

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	???

Definiton

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

Case Studies — Supervised Learning

Machine Learning

Group 9

Introduction
Case Studies
Formal Defintion
Applications
Benefits
Regression
Classifications
Deep Learning
Conclusion

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 analogus task in human and animal phsycology : Concept Learning.

Case Studies — Unsupervised Learning

Machine Learning

Group 9

Introduction

Case Studies

Formal Defintion

Applications

Benefits

Regression

Classifications

Deep Learning

Conclusion

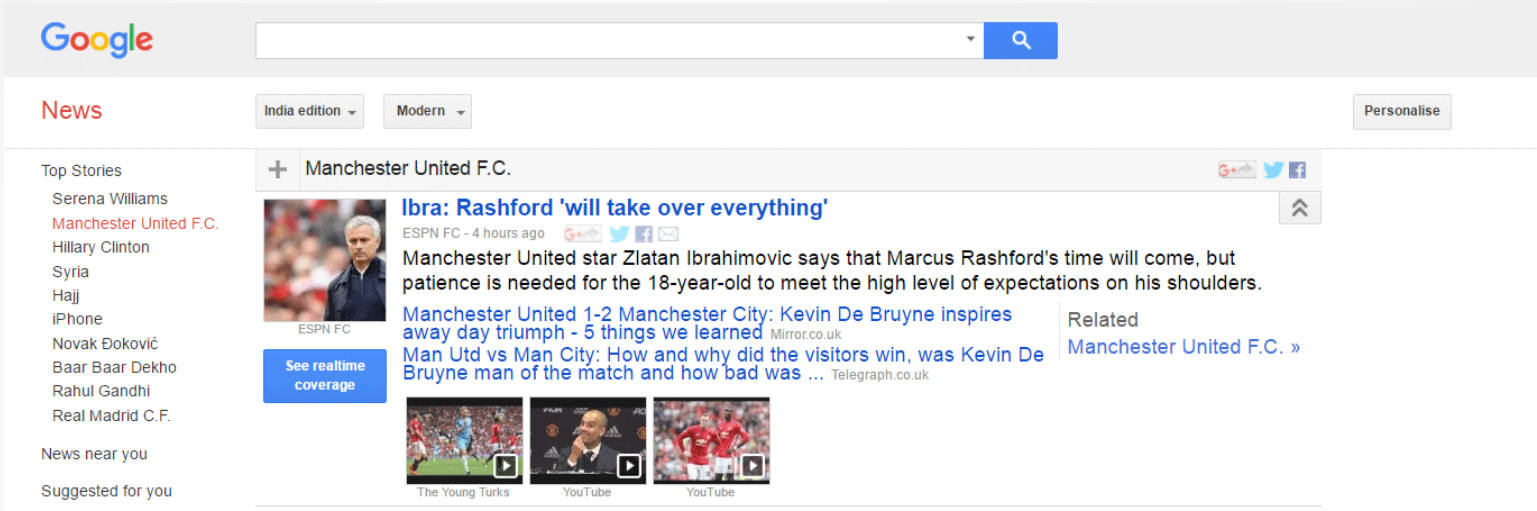


Figure: Google News grouping similar stories together.

Definiton

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

Cocktail Party Problem — Unsupervised Learning

Machine Learning

Group 9

Introduction

Case Studies

Formal Defintion

Applications

Benefits

Regression

Classifications

Deep Learning

Conclusion

Sound from :

- *Microphone 1*
- *Microphone 2*

Output from Learning Algorithm :

- *Output 1*
- *Output 2*

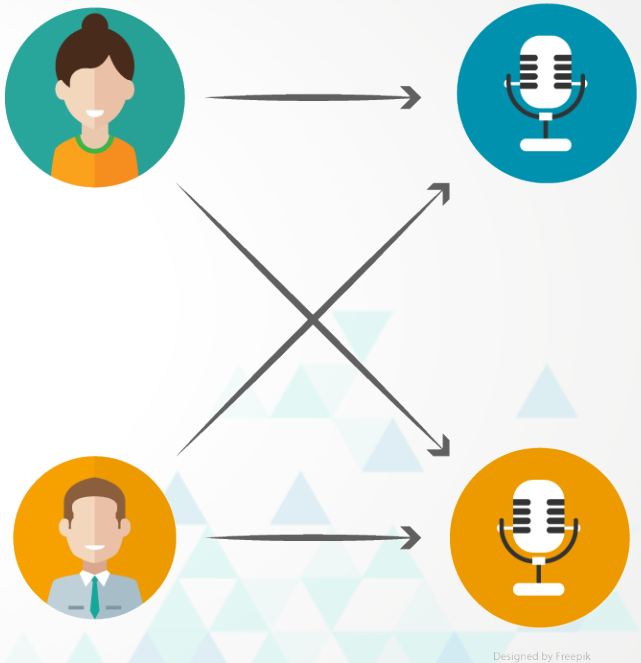


Figure: Overlapped Recordings

Case Studies — Unsupervised Learning

Machine Learning

Group 9

Introduction
Case Studies
Formal Defintion
Applications
Benefits
Regression
Classifications
Deep Learning
Conclusion

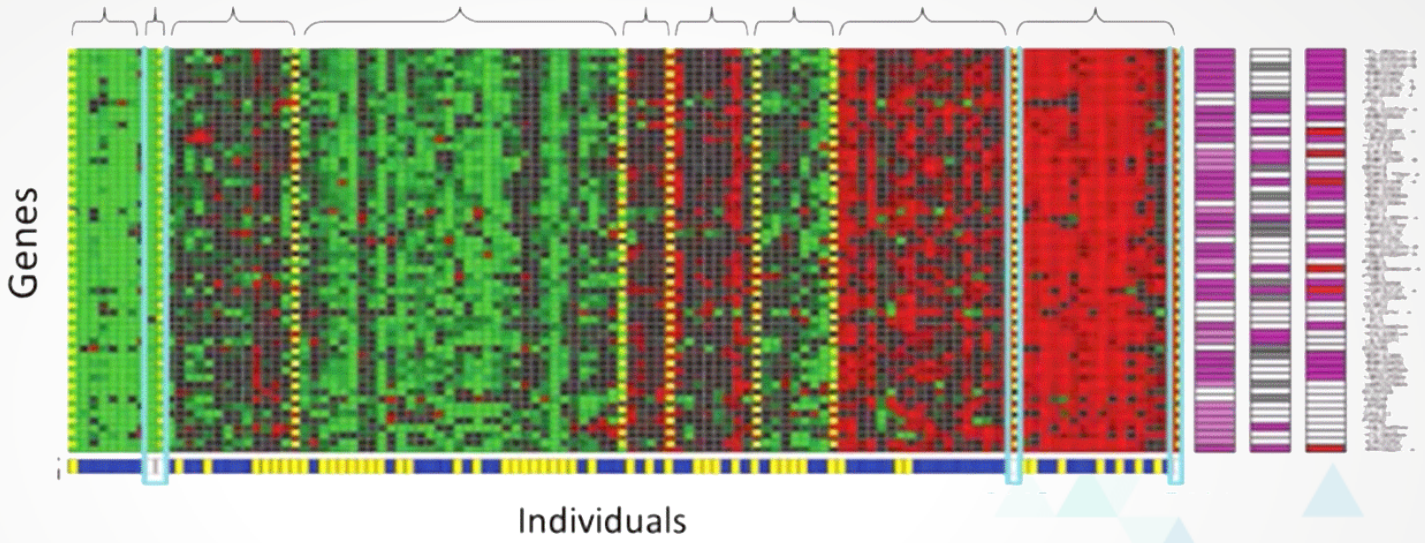


Figure: Gene Clustering

- 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 Definiton

Machine Learning

Group 9

Introduction
Case Studies
Formal Defintion
Applications
Benefits
Regression
Classifications
Deep Learning
Conclusion

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

Machine Learning

Group 9

Introduction

Case Studies

Formal Defintion

Applications

Benefits

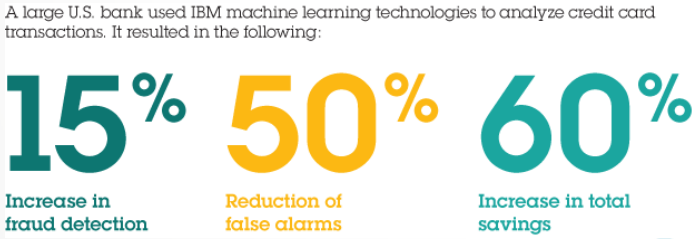
Regression

Classifications

Deep Learning

Conclusion

Google Chauffer : Self Driving Car by Google



IBM Research : Credit Card Fraud Detection

Mail Services : Spam Filtering

Industry Trends

Machine Learning

Group 9

Introduction

Case Studies

Formal Defintion

Applications

Benefits

Regression

Classifications

Deep Learning

Conclusion

Completed • $1,000

The Online Privacy Foundation

Psychopathy Prediction Based on Twitter Usage

Mon 14 May 2012 – Fri 29 Jun 2012 (4 years ago)

Dashboard

Private Leaderboard - Psychopathy Prediction Based on Twitter Usage

This competition has completed. This leaderboard reflects the final standings.

See someone using multiple accounts? Let us know.

#	Δrank	Team Name * in the money	Score	Entries	Last Submission UTC (Best – Last Submission)
1	↑5	y_tag *	0.86997	12	Tue, 26 Jun 2012 12:46:19
2	↑9	Bruce Cragin	0.86745	10	Fri, 29 Jun 2012 22:28:17 (-47.6h)
3	↑21	Indy Actuaries	0.86700	6	Fri, 29 Jun 2012 03:40:38 (-3.4d)

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

Machine Learning

Group 9

Introduction

Case Studies

Formal Defintion

Applications

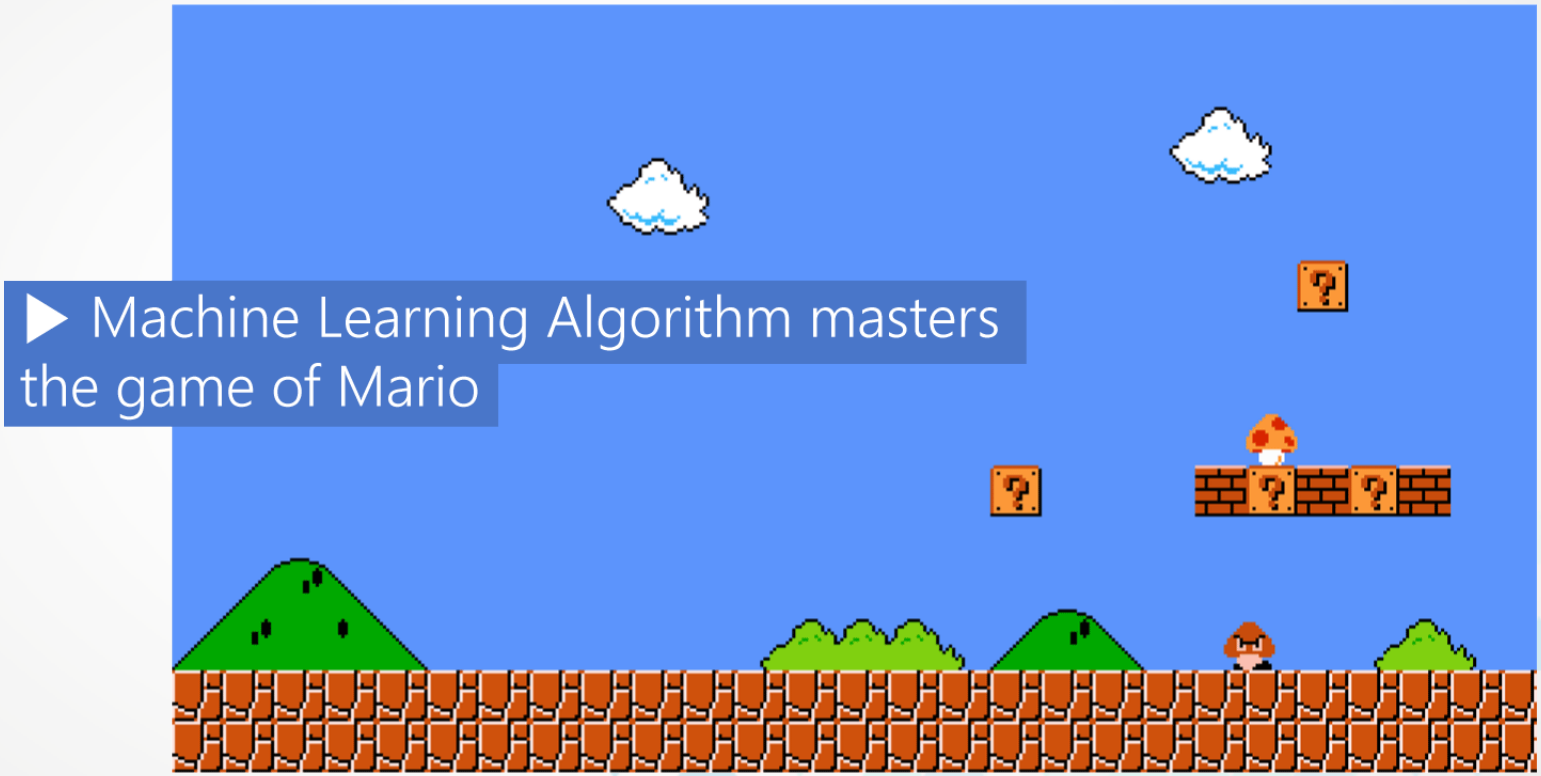
Benefits

Regression

Classifications

Deep Learning

Conclusion



Applications — Machine Learning

Machine Learning

Group 9

Introduction

Case Studies

Formal Defintion

Applications

Benefits

Regression

Classifications

Deep Learning

Conclusion

- 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

Machine Learning — Why ?

Machine Learning

Group 9

Introduction

Case Studies

Formal Defintion

Applications

Benefits

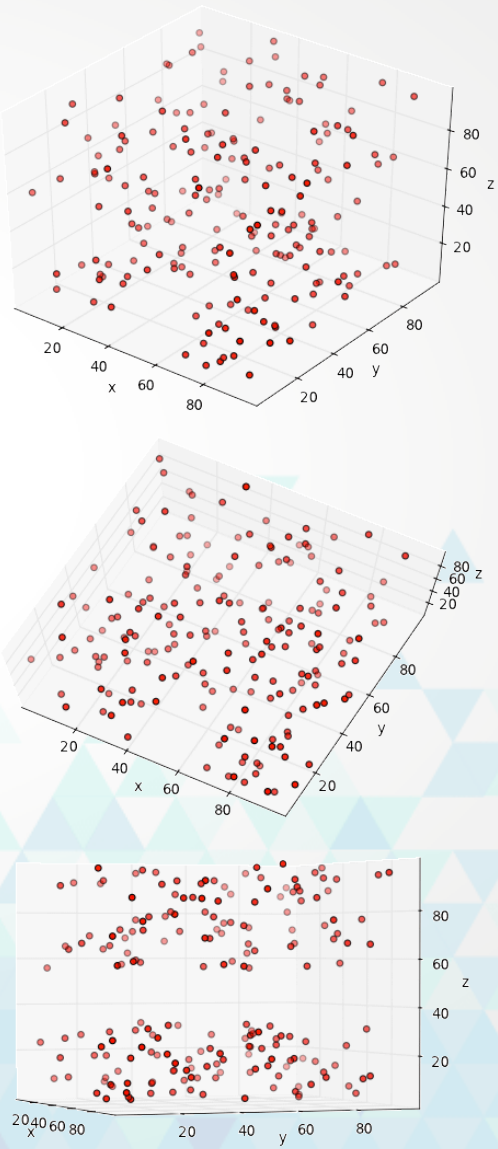
Regression

Classifications

Deep Learning

Conclusion

- Can work with huge amount of data.
- Can make intelligent decisions by taking into account multiple features.
- Can find patterns in large amount of data which is almost impossible for human beings.
- These algorithms are self-modifying in nature, they get better over time as the usage increases.



Introduction — Regression

Machine Learning

Group 9

Introduction

Regression

Usages

Benefits

Example Cases

Classifications

Deep Learning

Conclusion

Usages — Regression

Machine Learning

Group 9

Introduction

Regression

Usages

Benefits

Example Cases

Classifications

Deep Learning

Conclusion

Benefits — Regression

Machine Learning

Group 9

Introduction

Regression

Usages

Benefits

Example Cases

Classifications

Deep Learning

Conclusion

Example Cases — Regression

Machine Learning

Group 9

Introduction

Regression

Usages

Benefits

Example Cases

Classifications

Deep Learning

Conclusion

Introduction — Classifications

Machine Learning

Group 9

Introduction

Regression

Classifications

Usages

Example Cases

Deep Learning

Conclusion

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.

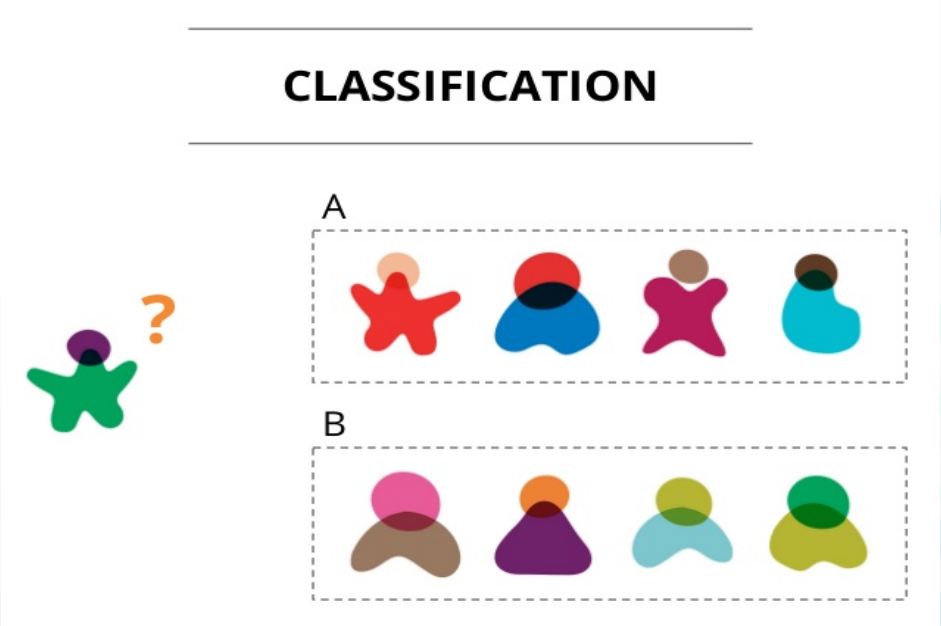


Figure: Classification

Usages — When it is used?

Machine Learning

Group 9

Introduction

Regression

Classifications

Usages

Example Cases

Deep Learning

Conclusion

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

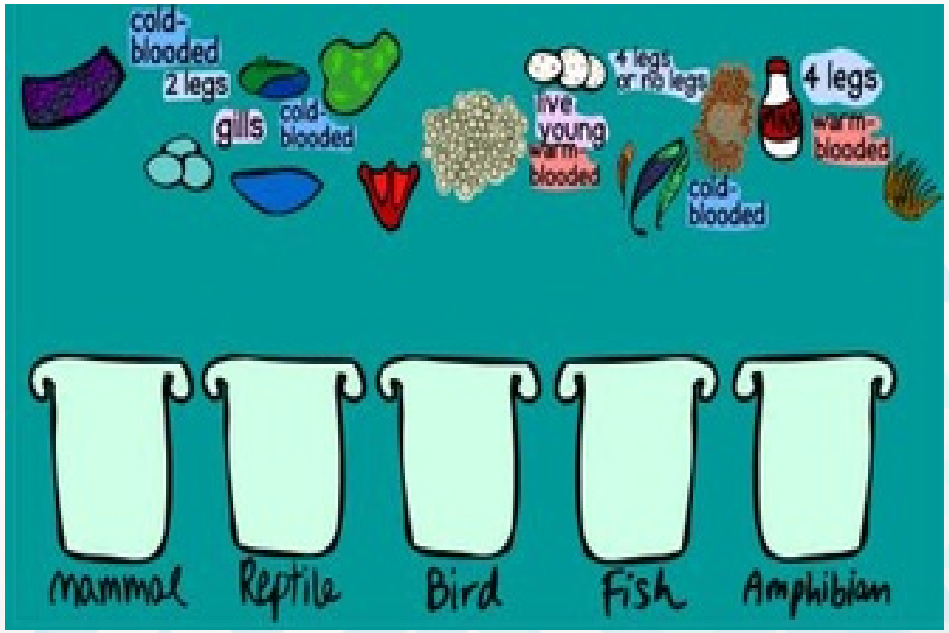


Figure: Training set is correctly Identified.

Usage — Types of Classifiers!!

Machine Learning

Group 9

Introduction

Regression

Classifications

Usages

Example Cases

Deep Learning

Conclusion

KNN algorithm :-

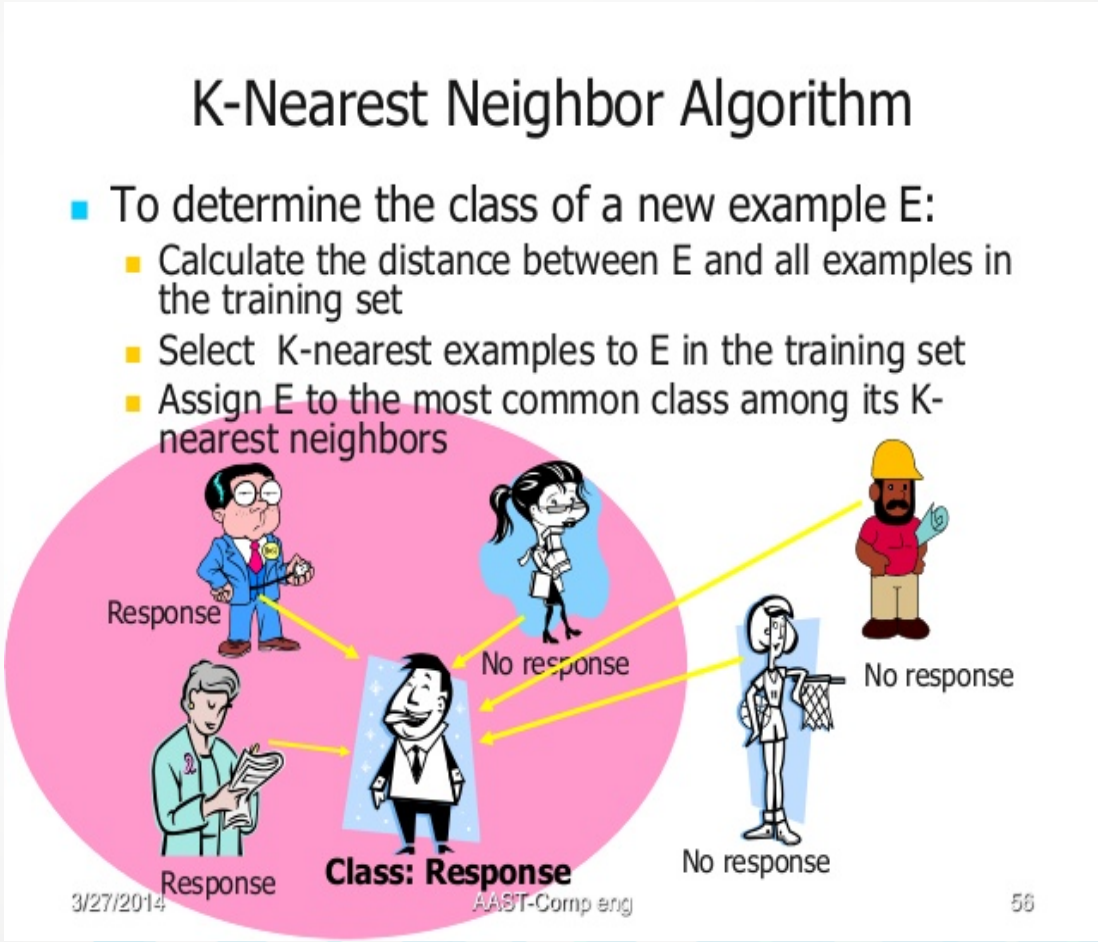


Figure: Example

Usage — Types of Classifiers!!

Machine Learning

Group 9

Introduction

Regression

Classifications

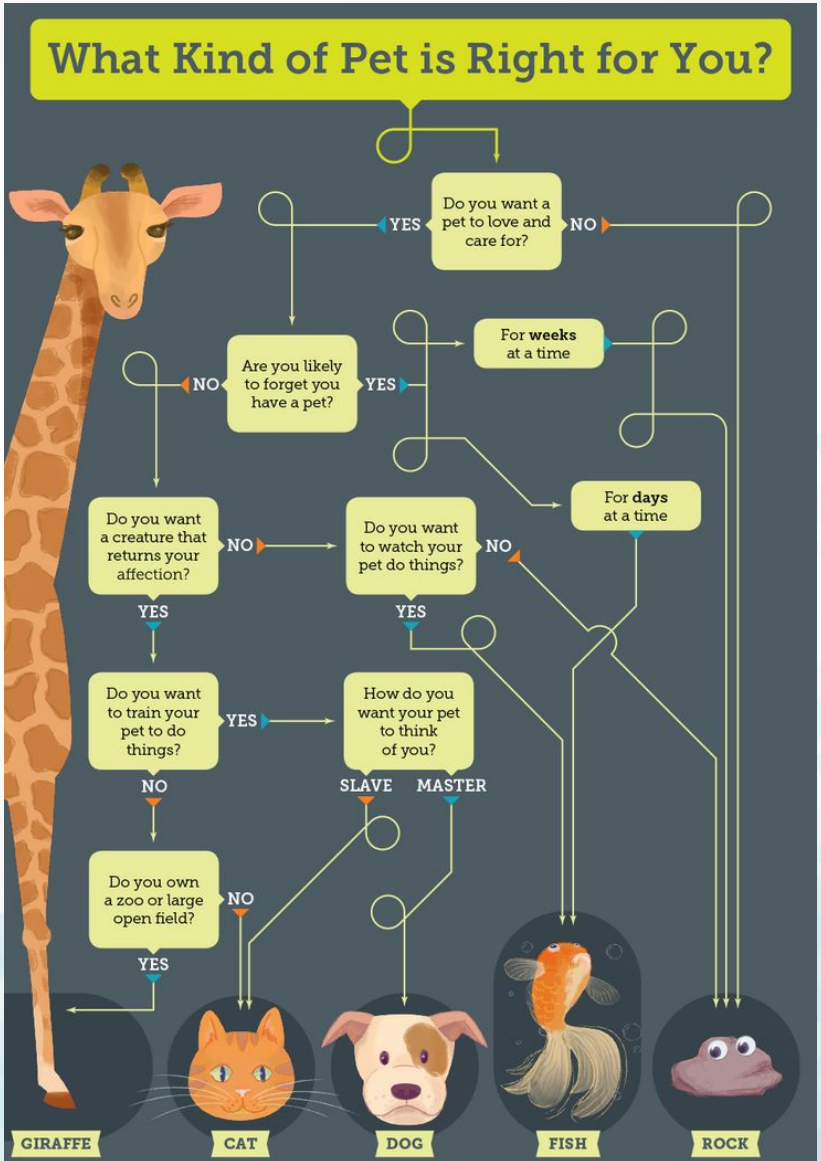
Usages

Example Cases

Deep Learning

Conclusion

Decision Tree :-



Example Cases — Real Life Examples

Machine Learning

Group 9

Introduction

Regression

Classifications

Usages

Example Cases

Deep Learning

Conclusion

Example Cases — Real Life Examples

- 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

- 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

Machine Learning

Group 9

Introduction

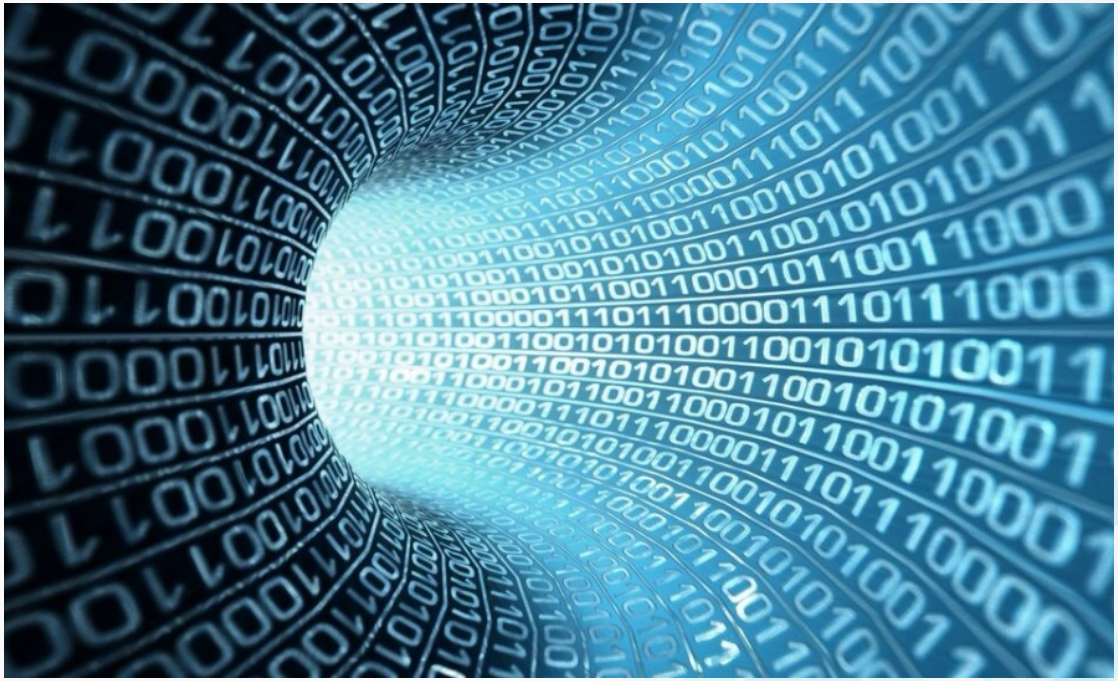
Regression

Classifications

Deep Learning

- Neural Networks
- Meaning
- Advantages
- Advantages
- Usages

Conclusion



Meaning — Deep Learning

Machine Learning

Group 9

Introduction

Regression

Classifications

Deep Learning

Neural Networks

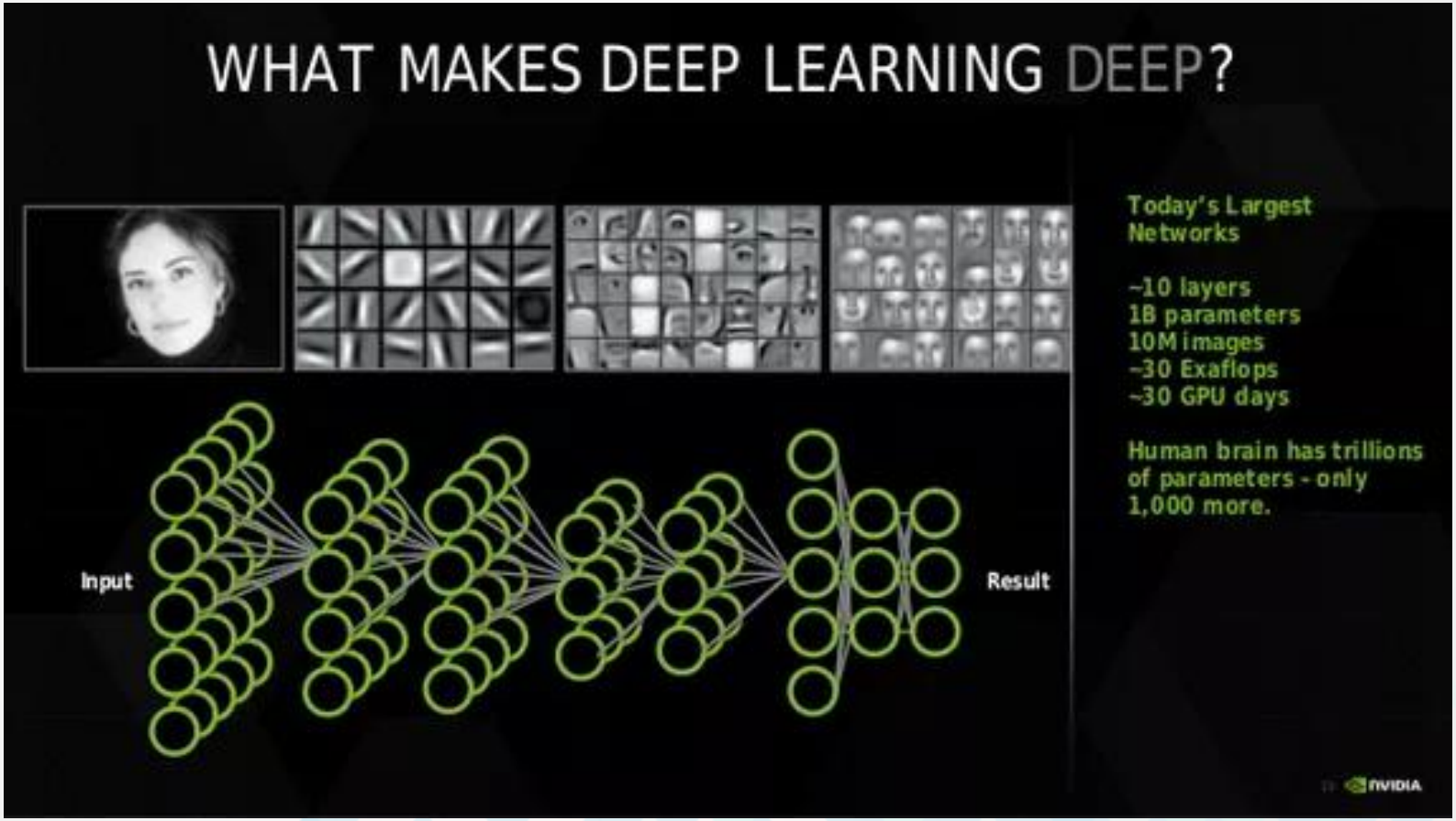
Meaning

Advantages

Advantages

Usages

Conclusion



Neural Networks — What is ANN?

Machine Learning

Group 9

Introduction

Regression

Classifications

Deep Learning

Neural Networks

Meaning

Advantages

Advantages

Usages

Conclusion

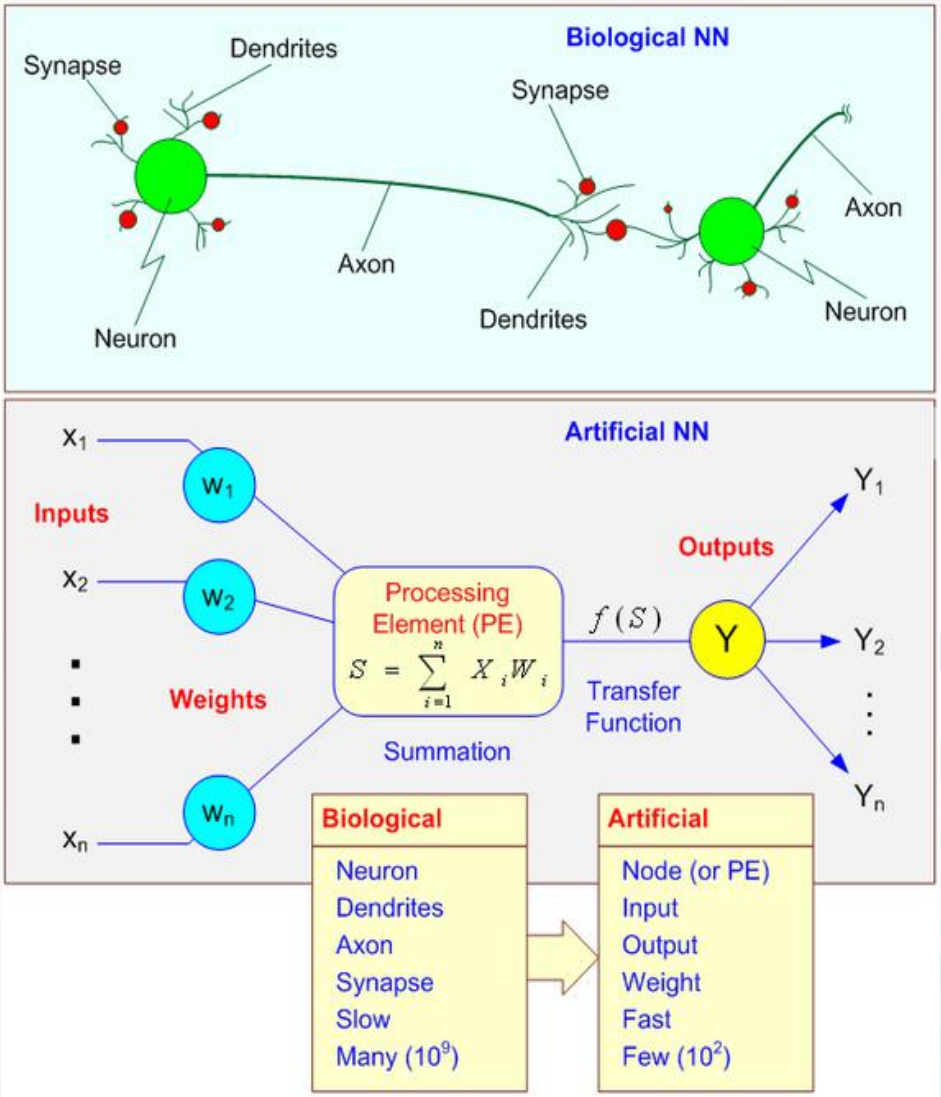


Figure: Artificial Neural Network

Traditional vs Deep learning — Deep Learning

Machine Learning

Group 9

Introduction

Regression

Classifications

Deep Learning

Neural Networks

Meaning

Advantages

Advantages

Usages

Conclusion

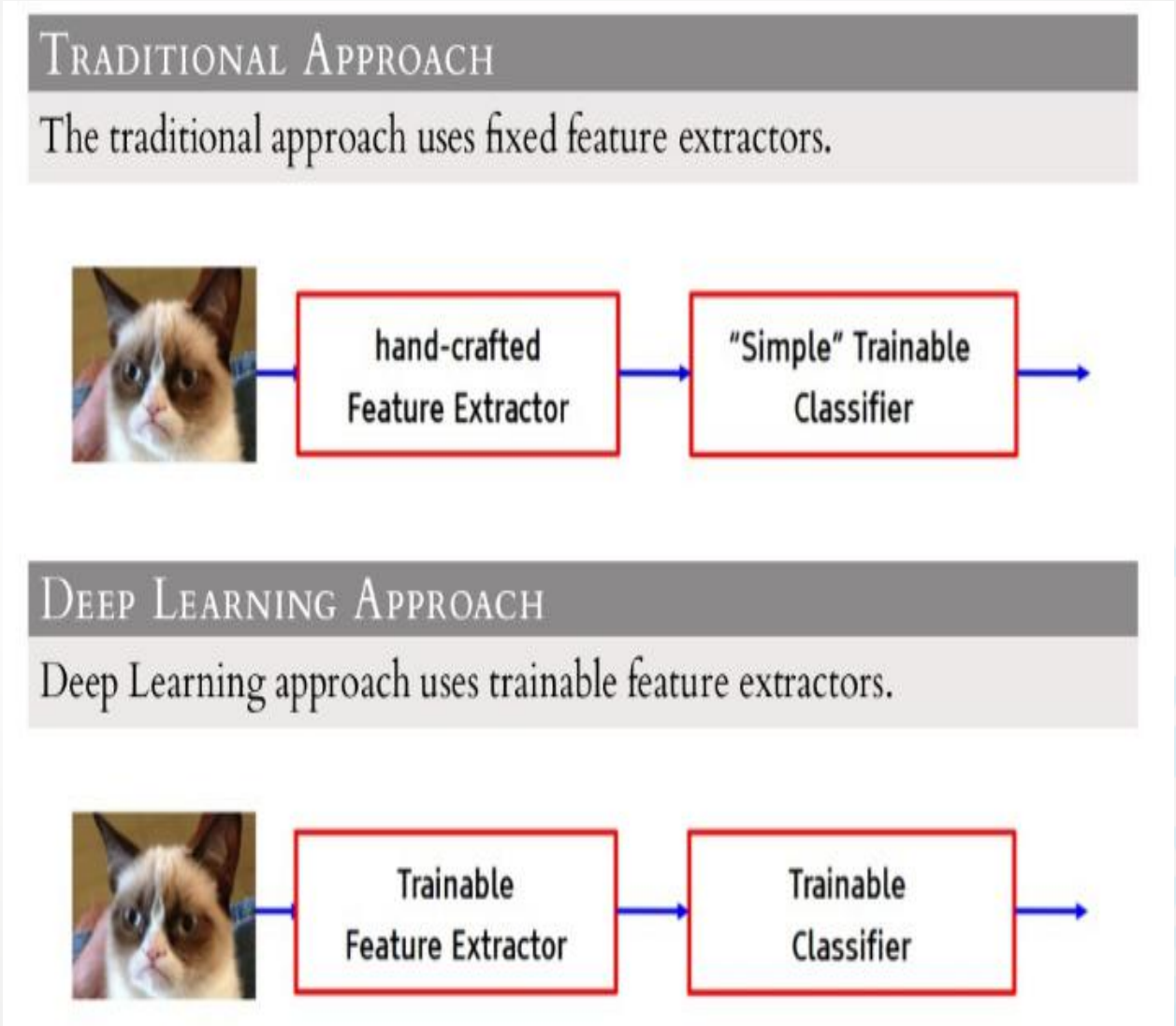


Figure: Tradition vs Deep Learning

Advantages — Deep Learning

Machine Learning

Group 9

Introduction

Regression

Classifications

Deep Learning

Neural Networks

Meaning

Advantages

Advantages

Usages

Conclusion

- 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 isnt 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

Machine Learning

Group 9

Introduction

Regression

Classifications

Deep Learning

Neural Networks

Meaning

Advantages

Advantages

Usages

Conclusion

- 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 whats going on. .

Usages — Deep Learning

Machine Learning

Group 9

Introduction

Regression

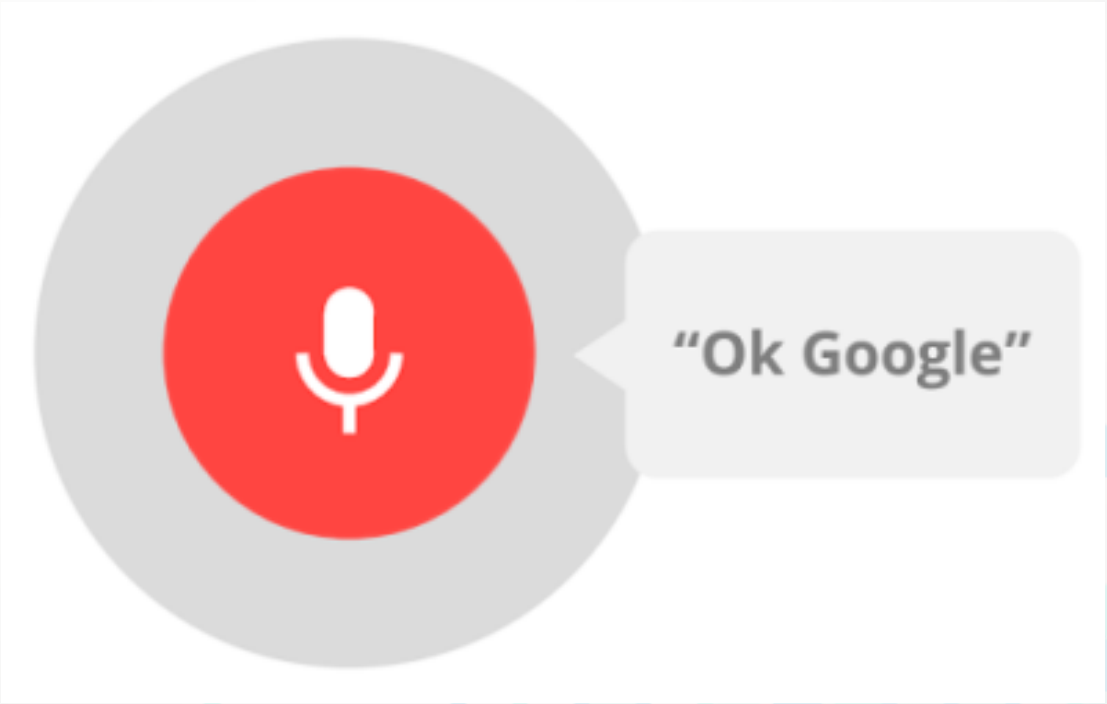
Classifications

Deep Learning

- Neural Networks
- Meaning
- Advantages
- Advantages
- Usages

Conclusion

Google Brain



Usages — Deep Learning

Machine Learning

Group 9

Introduction

Regression

Classifications

Deep Learning

- Neural Networks
- Meaning
- Advantages
- Advantages
- Usages

Conclusion

GoogleDeepMind

Usages — Deep Learning

Machine Learning

Group 9

Introduction

Regression

Classifications

Deep Learning

- Neural Networks
- Meaning
- Advantages
- Advantages
- Usages

Conclusion

Prisma

Usages — Deep Learning

Machine Learning

Group 9

Introduction

Regression

Classifications

Deep Learning

Neural Networks

Meaning

Advantages

Advantages

Usages

Conclusion

Mageta

The pain is almost over

Bibliography

- Phil Simon (March 18, 2013). Too Big to Ignore: The Business Case for Big Data. Wiley. p. 89. ISBN 978-1-118 -63817-0.
- Mitchell, T. (1997). Machine Learning, McGraw Hill. ISBN 0-07-042807-7
- Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar (2012) Foundations of Machine Learning, The MIT Press ISBN 9780262018258.
- Jordan, Michael I.; Bishop, Christopher M. (2004). ”Neural Networks”. In Allen B. Tucker. Computer Science Handbook, Second Edition (Section VII: Intelligent Systems). Boca Raton, FL: Chapman & Hall/CRC Press LLC. ISBN 1-58488-360-X.
- https: //www.kaggle.com/c/twitter-psychopathy-prediction
- Mastering the game of Go with deep neural networks and tree search (2016), D. Silver et al.

Now that was very interesting!

The End