Sentiment Analysis

with

Machine Learning

text, machines automatically learn how to detect sentiment without human input.

To put it simply, machine learning allows computers to learn new tasks without being expressly programmed to perform them. Sentiment analysis models can be trained to read beyond mere definitions, to understand things like, context, sarcasm, and misapplied words. For example:

“Super user-friendly interface. Yeah right. An engineering degree would be helpful.”

Out of context, the words ‘super user-friendly’ and ‘helpful’ could be read as positive, but this is clearly a negative comment. Using sentiment analysis, computers can automatically process text data and understand it just as a human would, saving hundreds of employee hours.

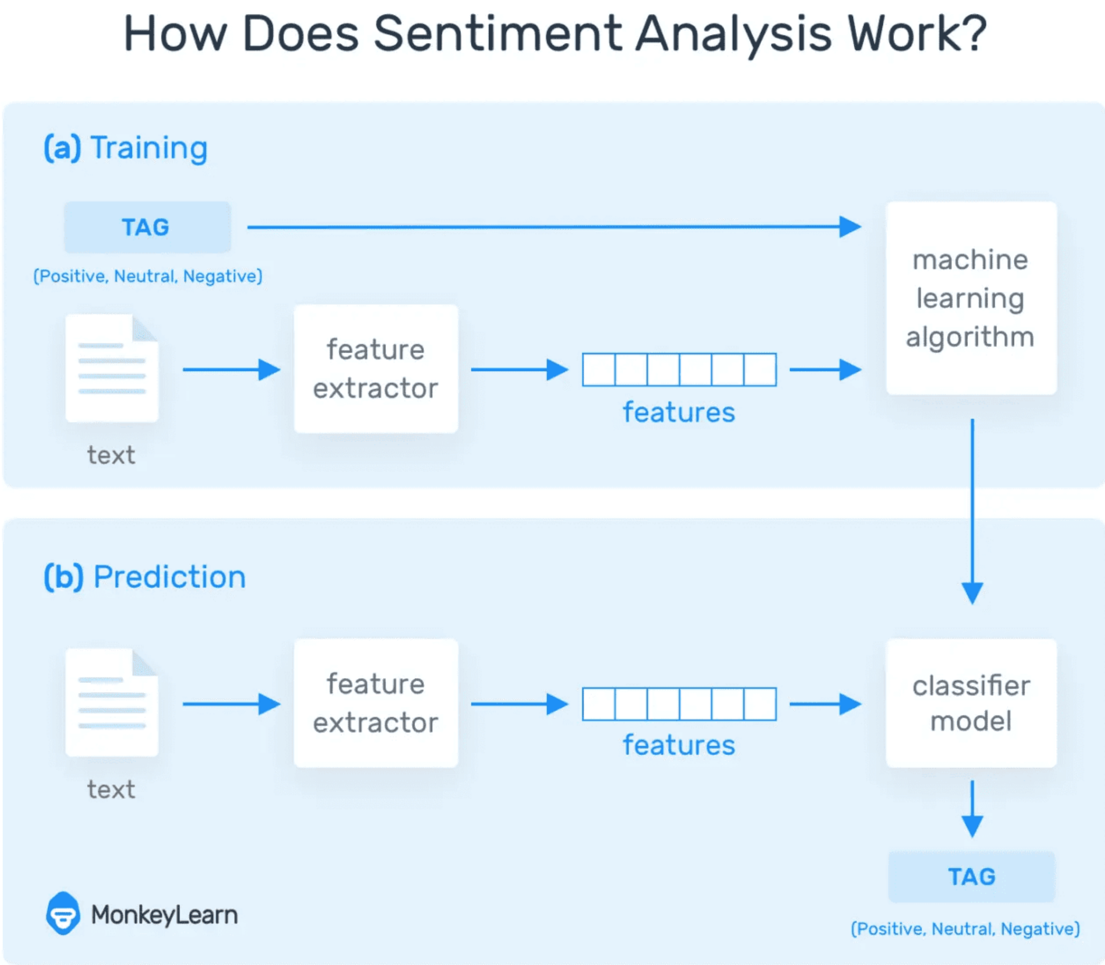
Imagine using machine learning to process customer service tickets, categorize them

How Does Sentiment Analysis with Machine Learning Work?

There are a number of techniques and complex algorithms used to command and train machines to

perform sentiment analysis. There are pros and cons to each. But, used together, they can provide

exceptional results. Below



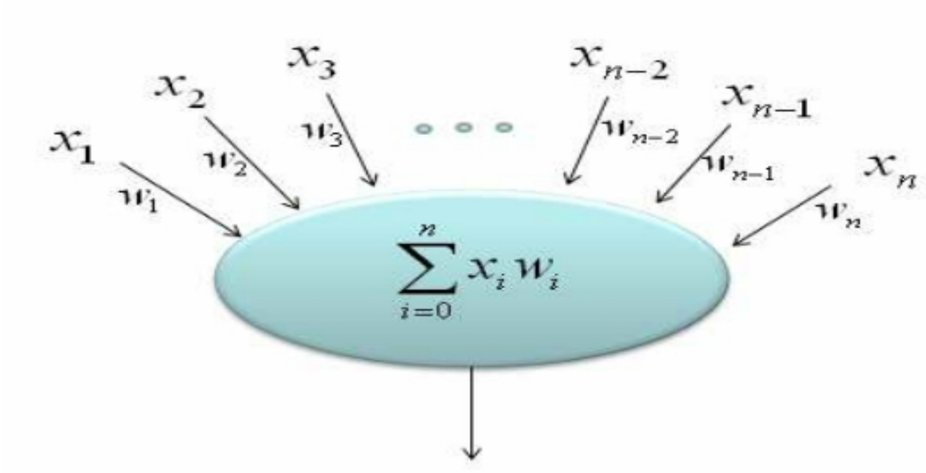
What is Machine Learning..?

· **Machine learning** is a type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed .

· The Machine that Teaches Themselves.

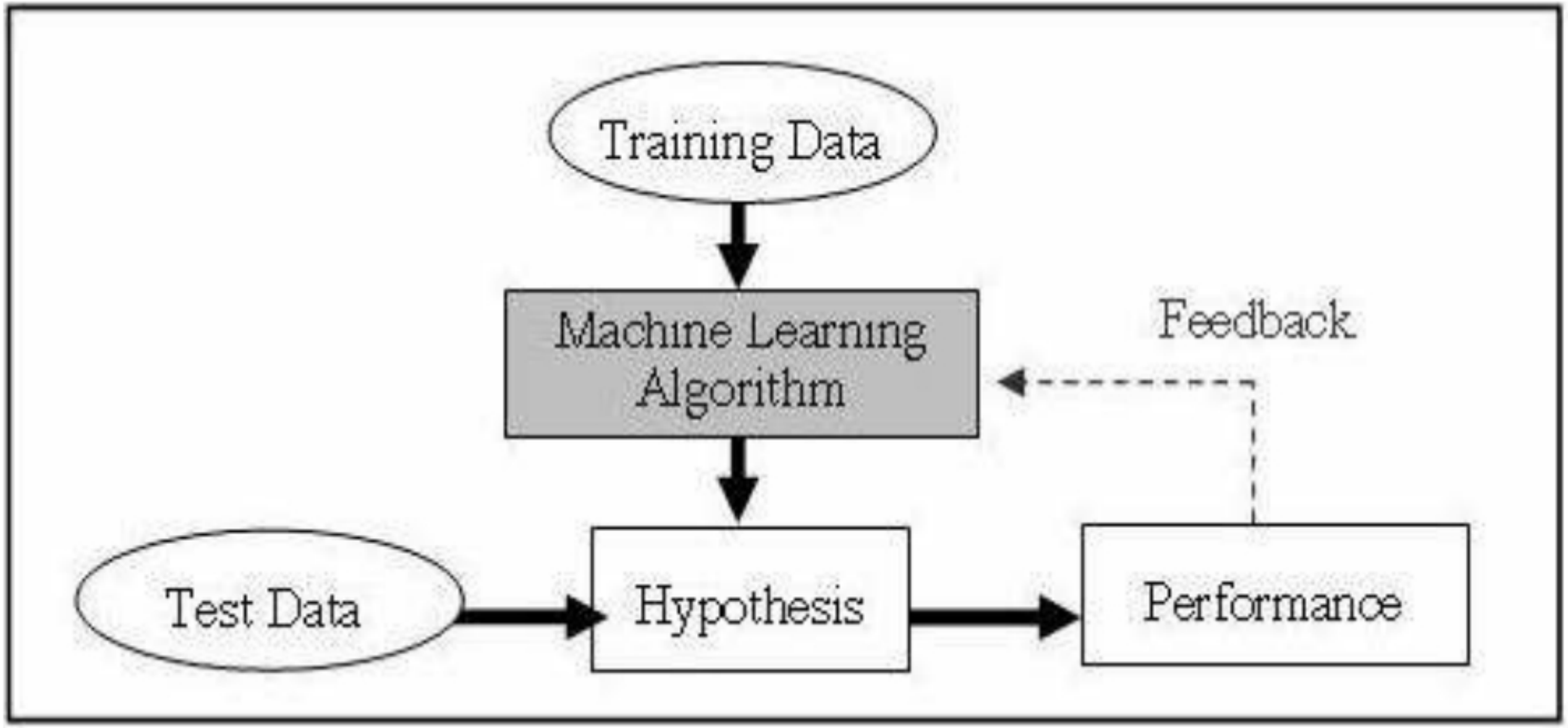
Things require for ML

- Data
- Pattern
- Mathematical Representation



DATA PATTERNS

Components Of ML



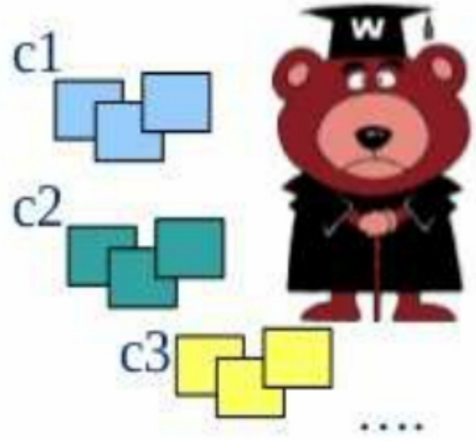
Types of learning

· **Supervised Learning:**
In this type we provide essential information to The machine. Input and Output Data sets are provided

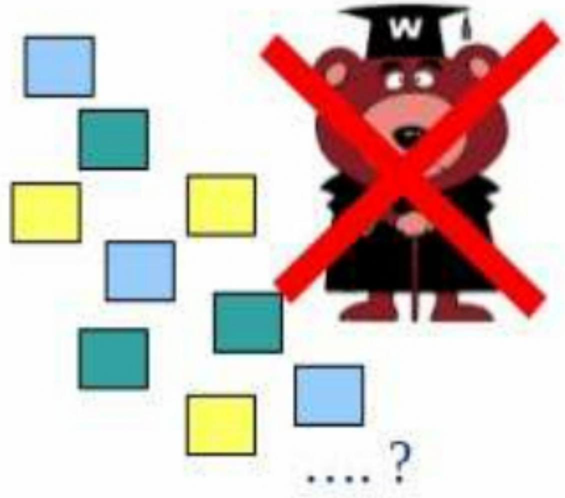
· **Unsupervised Learning:**
In this type not much info is provided and machine gives results using tedious calculations.

Supervised Vs. Unsupervised

- **Supervised**
  - **knowledge of output -** learning with the presence of an "expert" / teacher
    - data is **labelled** with a class or value
    - **Goal:** predict class or value label
      - e.g. Neural Network, Support Vector Machines, Decision Trees, Bayesian Classifiers ....

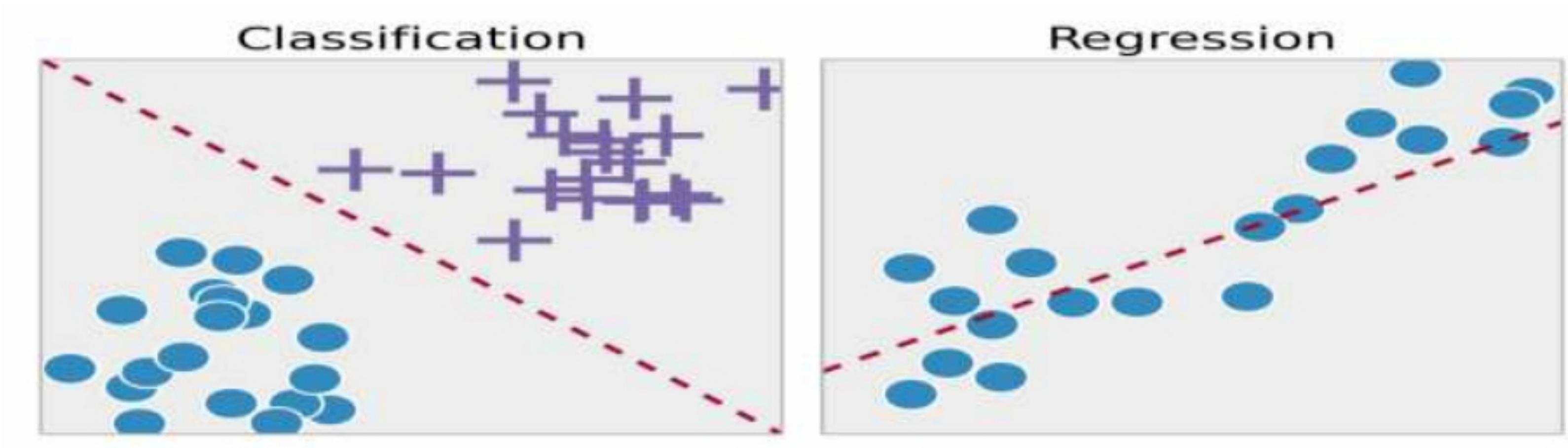


- **Unsupervised**
  - **no knowledge of output** class or value
    - data is **unlabelled** or value un-known
    - **Goal:** determine data patterns/groupings
  - Self-guided learning algorithm
      - (internal self-evaluation against some criteria)
      - e.g. k-means, genetic algorithms, clustering approaches ...



Classification Vs Regression

·**Classification** means to group the output into a class.
·In **Classification** the output value is small and discrete.
Ex: tumor->yes or no.

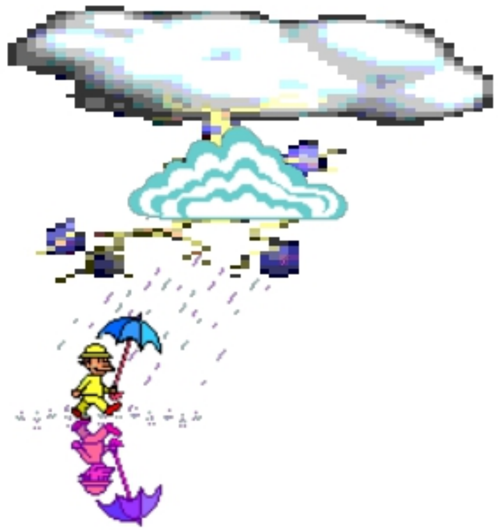


·**Regression** means to predict the output value using training data.(gives more detailed and approximate output).
·**In Regression** the output is continuous.
Ex: tumor ->harmful or not harmful.

Techniques in ML

- Naïve Bays
- Support Vector Machines
- Maximum Entropy

Naïve Bayes



- Based on Bayesian theorem
- Bays theorem:

$$P(c \mid d) = \frac{P(c)\, P(d \mid c)}{P(d)}$$

c= event of Raining
d=event of Dark clouds

- We make assumption that Events are conditionally independent

Given all the previous patients I've seen (below are their symptoms and diagnosis)...

chills	runny nose	headache	fever	flu?
Y	N	Mild	Y	N
Y	Y	No	N	Y
Y	N	Strong	Y	Y
N	Y	Mild	Y	Y
N	N	No	N	N
N	Y	Strong	Y	Y
N	Y	Strong	N	N
Y	Y	Mild	Y	Y

Do I believe that a patient with the following symptoms has the flu?

chills	runny nose	headache	fever	flu?
Y	N	Mild	Y	?

P(Y)=5/8=0.625   P(N)=3/8=0.375

Given all the previous patients I've seen (below are their symptoms and diagnosis)...

chills	runny nose	headache	fever	flu?
Y	N	Mild	Y	N
Y	Y	No	N	Y
Y	N	Strong	Y	Y
N	Y	Mild	Y	Y
N	N	No	N	N
N	Y	Strong	Y	Y
N	Y	Strong	N	N
Y	Y	Mild	Y	Y

Do I believe that a patient with the following symptoms has the flu?

chills	runny nose	headache	fever	flu?
Y	N	Mild	Y	?

P(Chills=yes and flue =yes)= 3/5= 0.6

First, we compute all possible individual probabilities conditioned on the target attribute (flu).

P(Flu=Y)	0.625	P(Flu=N)	0.375
P(chills=Y|flu=Y)	0.6	P(chills=Y|flu=N)	0.333
P(chills=N|flu=Y)	0.4	P(chills=N|flu=N)	0.666
P(runny nose=Y|flu=Y)	0.8	P(runny nose=Y|flu=N)	0.333
P(runny nose=N|flu=Y)	0.2	P(runny nose=N|flu=N)	0.666
P(headache=Mild|flu=Y)	0.4	P(headache=Mild|flu=N)	0.333
P(headache=No|flu=Y)	0.2	P(headache=No|flu=N)	0.3333
P(headache=Strong|flu=Y)	0.4	P(headache=Strong|flu=N)	0.333
P(fever=Y|flu=Y)	0.8	P(fever=Y|flu=N)	0.333
P(fever=N|flu=Y)	0.2	P(fever=N|flu=N)	0.666

And then decide:

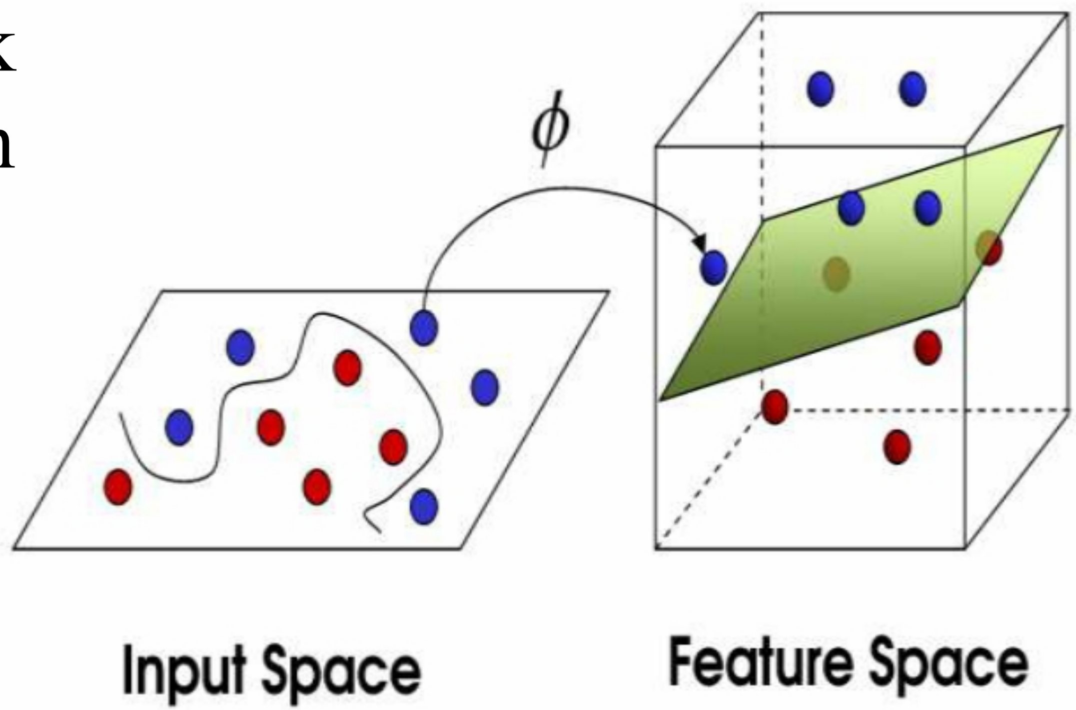
$$argmaxP(flu = Y)P(chills = Y|flu = Y)P(runny\ nose = N|flu = Y)P(headache = Mild|flu = Y)P(fever = N|flu = Y)$$
$$= 0.006$$

vs.

$$argmaxP(flu = N)P(chills = Y|flu = N)P(runny\ nose = N|flu = N)P(headache = Mild|flu = N)P(fever = N|flu = N)$$
$$= 0.0185$$

Support Vector Machines

·Subject is divided into through Hyper plane which forms basis of classification
·Designed by Vampik
·Linear Classification



Maximum Entropy

·Maximum Entropy is a Probability distribution estimation Technique..

·The principal of Entropy is that without external knowledge one should Prefer distribution that are uniform

·Here in probability events are Dependent

Comparison

Naïve Bays	SVM	Maximum Entropy
Easy to Implement	Harder to Implement	Harder to Implement
Less Efficient, Efficient due to working with large sets of Words	Efficiency is maximum	Efficiency is moderate
Limited Use	Versatile Used in Comp Vision, Text Cat, IP	Hardly used

Observations :

	Features	# of features	frequency or presence?	NB	ME	SVM
(1)	unigrams	16165	freq.	**78.7**	N/A	72.8
(2)	unigrams	"	pres.	81.0	80.4	**82.9**
(3)	unigrams+bigrams	32330	pres.	80.6	80.8	**82.7**
(4)	bigrams	16165	pres.	77.3	**77.4**	77.1
(5)	unigrams+POS	16695	pres.	81.5	80.4	**81.9**
(6)	adjectives	2633	pres.	77.0	**77.7**	75.1
(7)	top 2633 unigrams	2633	pres.	80.3	81.0	**81.4**
(8)	unigrams+position	22430	pres.	81.0	80.1	**81.6**

Conclusion

·The machine learning can prove efficient over traditional techniques for Sentiment Analysis

·The Naïve Bayes can be useful in sentiment analysis of text categorization.

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