

## Is this a benign or malignant cell?



ID	Clump	UnifSize	UnifShape	MargAdh	SingEpiSize	BareNuc	BlandChrom	NormNucl	Mit	Class
1000015	6	1	1	1	7	1	3	1	1	

Benign or Malignant ?

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## Machine learning helps with predictions!



ID	Clump	UnifSize	UnifShape	MargAdh	SingEpiSize	BareNuc	BlandChrom	NormNucl	Mit	Class
1000025	5	1	1	1	2	1	3	1	1	benign
1002945	5	4	4	5	7	10	3	2	1	benign
1015425	3	1	1	1	2	2	3	1	1	malignant
1016277	6	8	8	1	3	4	3	7	1	benign
1017023	4	1	1	3	2	1	3	1	1	benign
1017122	8	10	10	8	7	10		7	1	malignant
1018099	1	1	1	1	2	10	3	1	1	benign
1018561	2	1	2	H	2	1	3	1	1	benign
1033078	2	1	1	1	2	1	1	1	5	benign
1033078	4	2	1	1	2	1	2	1	1	benien

ID	Clump	UnifSize	UnifShape	MargAdh	SingEpiSize	BareNuc	BlandChrom	NormNucl	Mit	Class
1000015	6	1	1	1	7	1	3	1	1	Benign

Modeling

Prediction

Accuracy = 89%

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# What is machine learning?

**Machine learning** is the subfield of computer science that gives “**computers the ability to learn without being explicitly programmed.**”

## Arthur Samuel

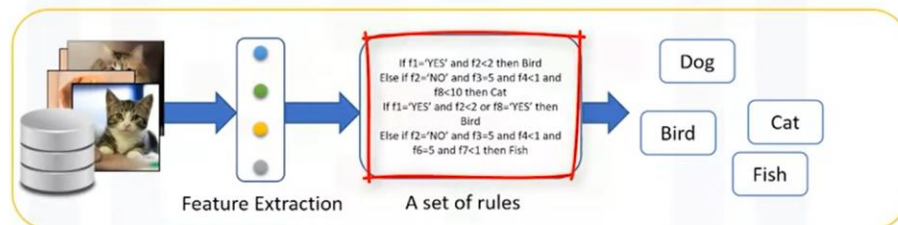
American pioneer in the field of computer gaming and artificial intelligence, coined the term "machine learning" in 1959 while at IBM.

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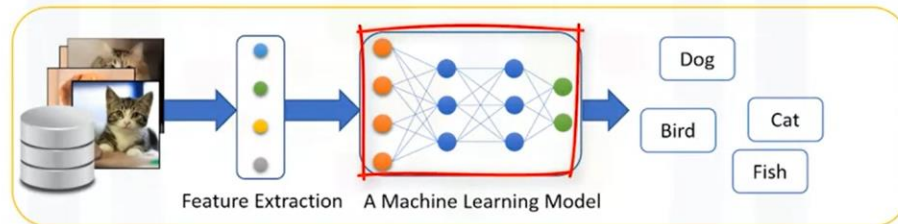
# How machine learning works?



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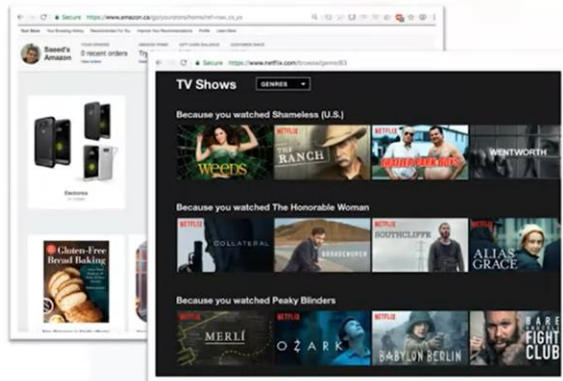
# How machine learning works?



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# Examples of machine learning



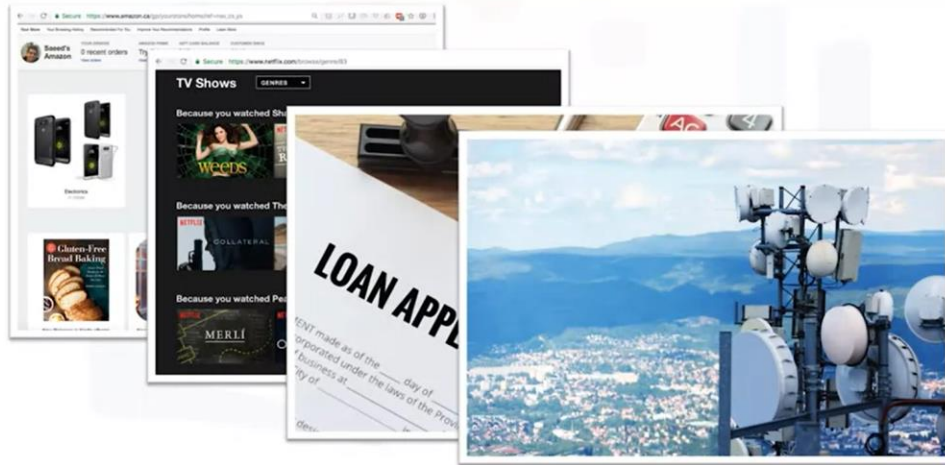
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## Examples of machine learning

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## Major machine learning techniques

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- **Regression/Estimation**
  - Predicting continuous values
- **Classification**
  - Predicting the item class/category of a case
- **Clustering**
  - Finding the structure of data; summarization
- **Associations**
  - Associating frequent co-occurring items/events

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## Major machine learning techniques

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- **Anomaly detection**
  - Discovering abnormal and unusual cases
- **Sequence mining**
  - Predicting next events; click-stream (Markov Model, HMM)
- **Dimension Reduction**
  - Reducing the size of data (PCA)
- **Recommendation systems**
  - Recommending items

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## Difference between artificial intelligence, machine learning, and deep learning

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- **AI components:**
  - Computer Vision
  - Language Processing
  - Creativity
  - Etc.
- **Machine learning:**
  - Classification
  - Clustering
  - Neural Network
  - Etc.

- • **Revolution in ML:**
- Deep learning



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