MACHINE LEARNING

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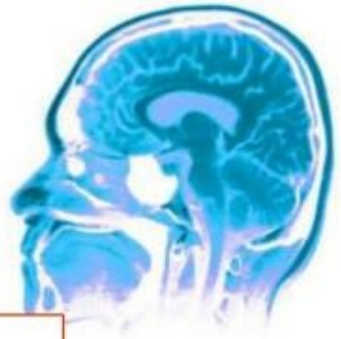

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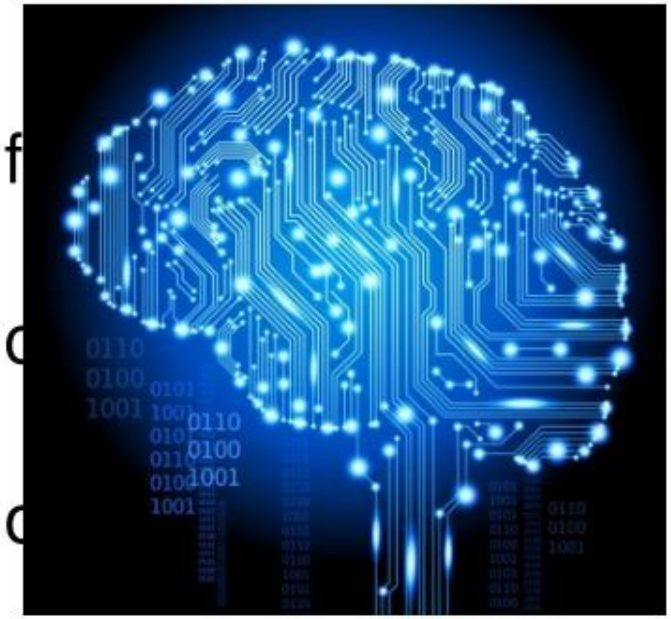
Artificial Intelligence

- **Artificial intelligence** (**AI**) is technology and a branch of computer science that studies and develops intelligent machines and software.



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First AI research was

a conference on the

of Dartmouth College

Artificial Intelligence

- They wrote programs that;

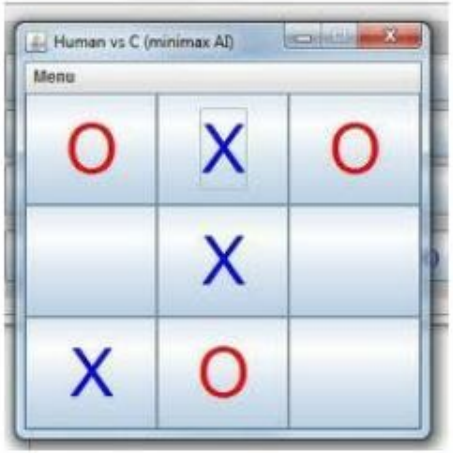
- **Solves** word problems in algebra,
- **Proves** logical theorems,
- **Speaks** English.

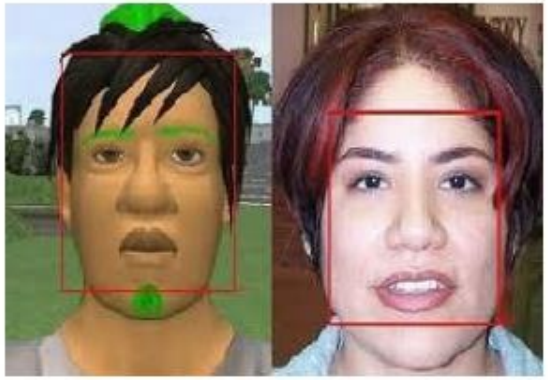
Artificial Intelligence

- Today

Robots

Human vs AI Games





Face Recognition

Advanced Search Engines

Machine Learning

- **Machine learning**, a branch of artificial intelligence, concerns the construction and study of systems that can learn from data.

- "Field of study that gives computers the ability to learn without being explicitly programmed" (Arthur Samuel, 1959)
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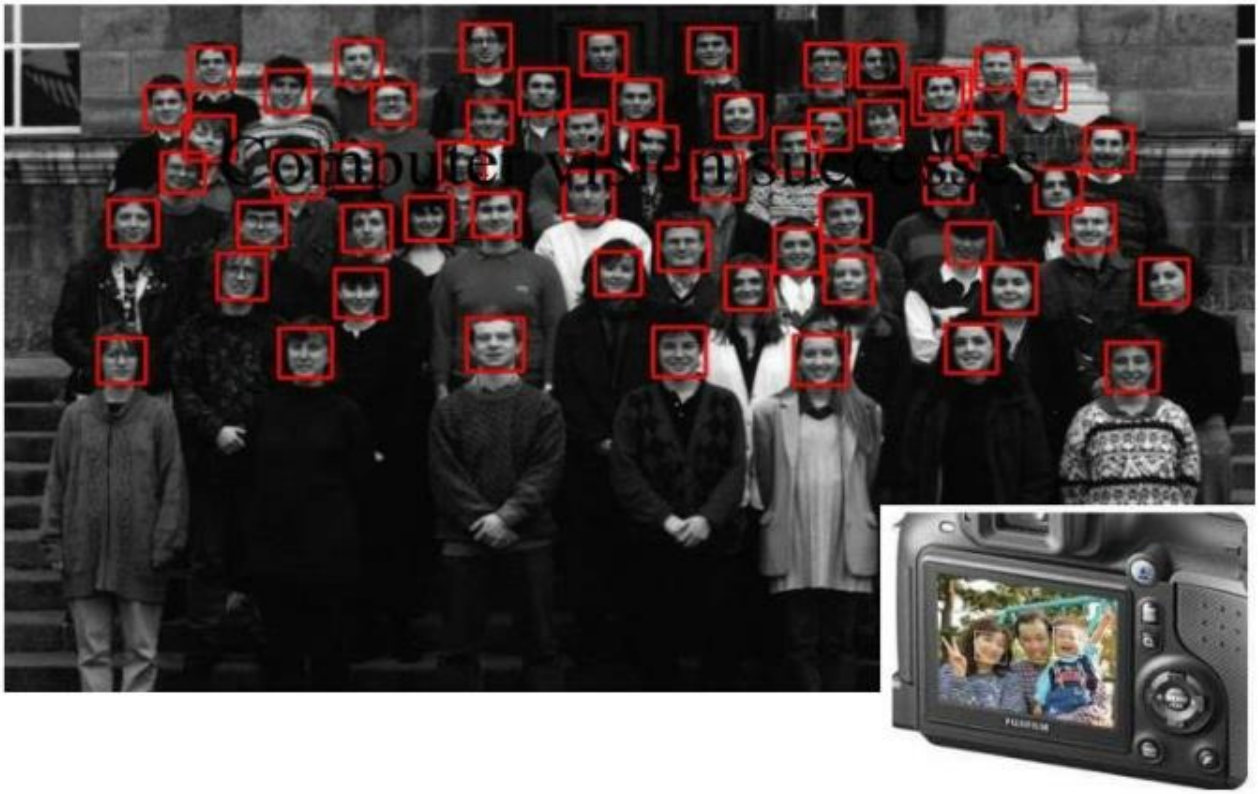
Machine Learning

- -Learning to recognize spoken words (Lee, 1989; Waibel, 1989).
- -Learning to drive an autonomous vehicle (Pomerleau, 1989).
- -Learning to classify new astronomical structures (Fayyad et al., 1995).
- -Learning to play world-class backgammon (Tesauro 1992, 1995).

- Machine learning also deals with representation of data instances and functions evaluated on these instances and generalization that the system will perform well on unseen data instances. It focuses on prediction based on known properties learned from the training data.

Why Machine Learning is Important?

- Some tasks cannot be defined well, except by examples (e.g., recognizing people).



Why Machine Learning is Important?

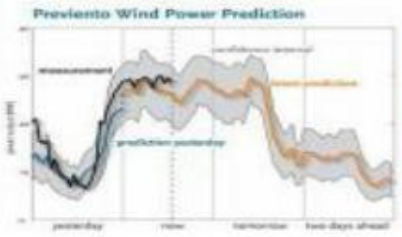
- Relationships and correlations can be hidden within large amounts of data. Machine Learning may be able to find these relationships.

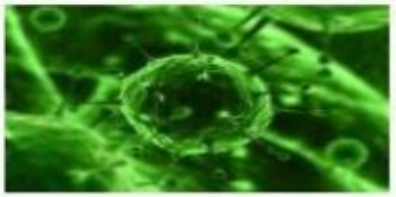
Why Machine Learning is Important?

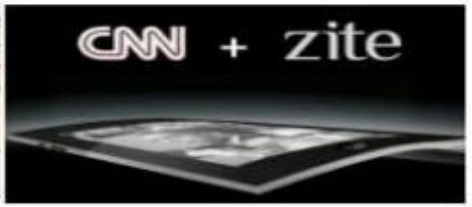
- New knowledge about tasks is constantly being discovered by humans. It may be difficult to continuously re-design systems “by hand”.
- The amount of knowledge available about certain tasks might be too large for explicit encoding by humans (e.g., medical diagnostic).

Machine Learning

- Machine learning deals with the problem of extracting features from data so as to solve many different predictive tasks:
- Forecasting (Energy demand prediction, sales)
- Imputing missing data (Netflix recommendations)
- Detecting anomalies (Virus mutations)
- Classifying (Canser diagnosis)
- Ranking (Google search)
- Summarizing (Social media sentiment)
- Decision making (Robotic, AI)

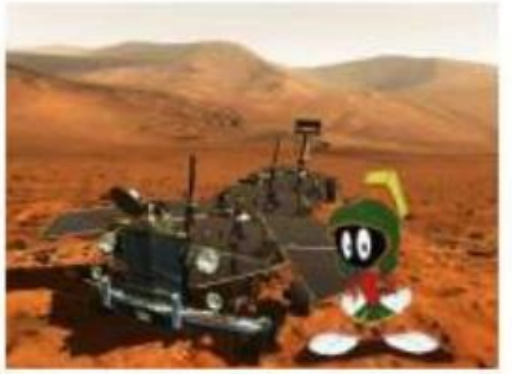




When to Apply Machine Learning

- Human expertise is absent.
- (Navigating on Mars)
- Humans are unable to explain their
- expertise. (Speech recognition)
- Solution changes with time.
- (Temperature control)
- The problem size is to vast for our
- limited reasoning capabilities.
- (Calculating webpage ranks)



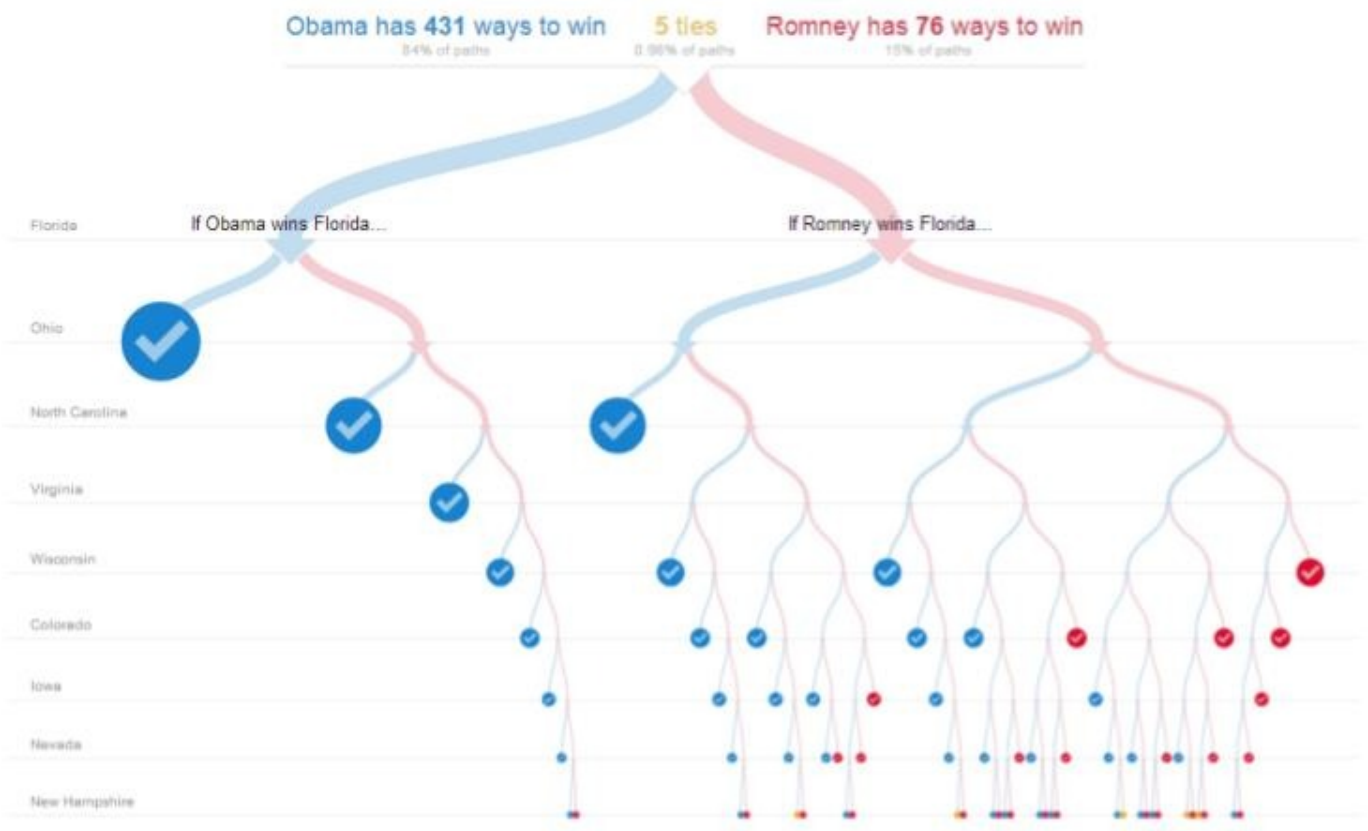
Algorithm Types

- Machine learning algorithms can be organized into a taxonomy based on the desired outcome of the algorithm or the type of input available during training the machine.

- Supervised Learning
- Unsupervised Learning
- Semi-Supervised Learning
- Transduction
- Reinforcement Learning
- Learning to Learn

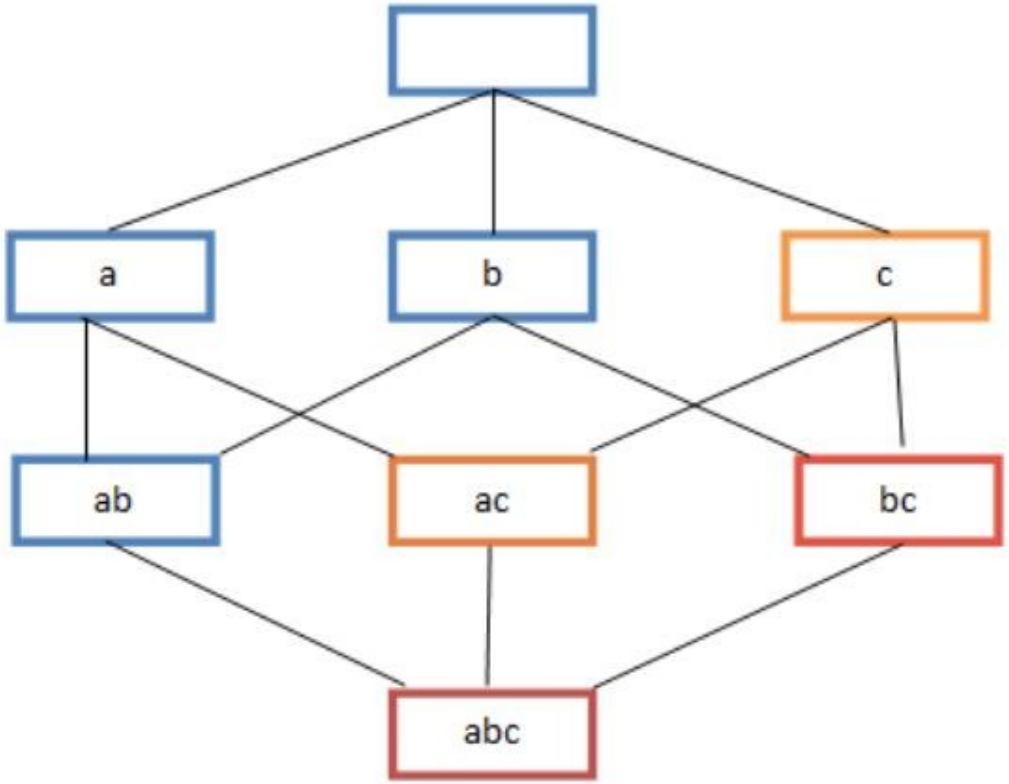
Approaches

- Decision Tree Learning



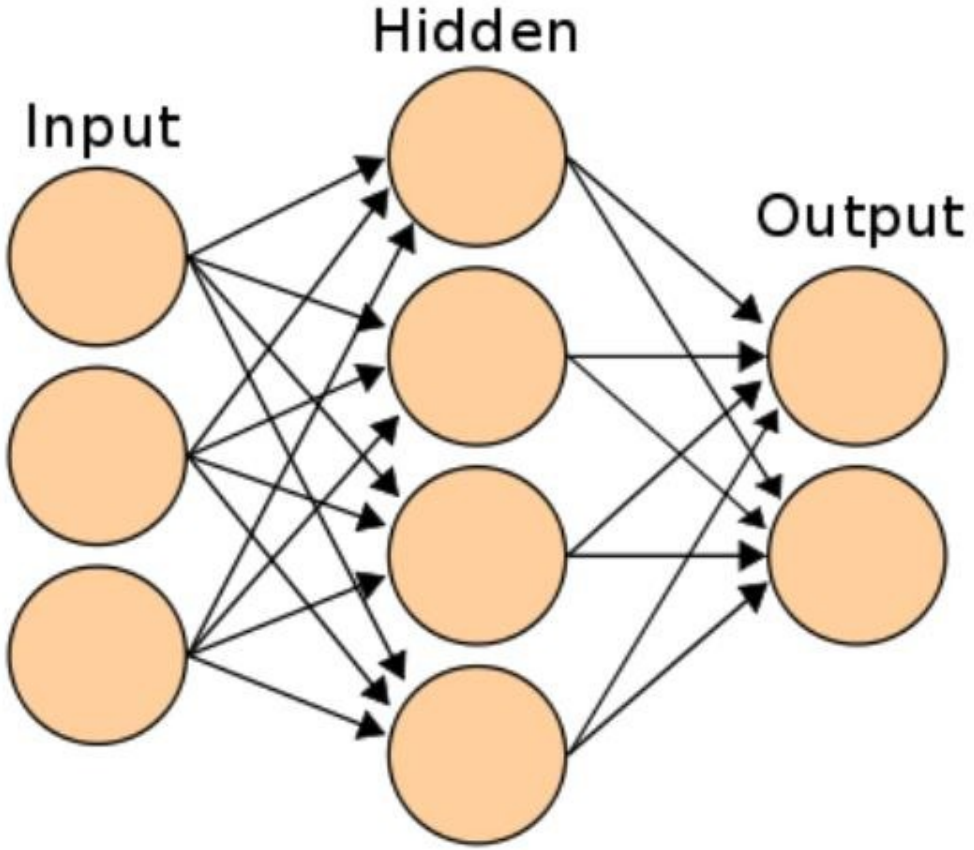
Approaches

- Association Rule Learning



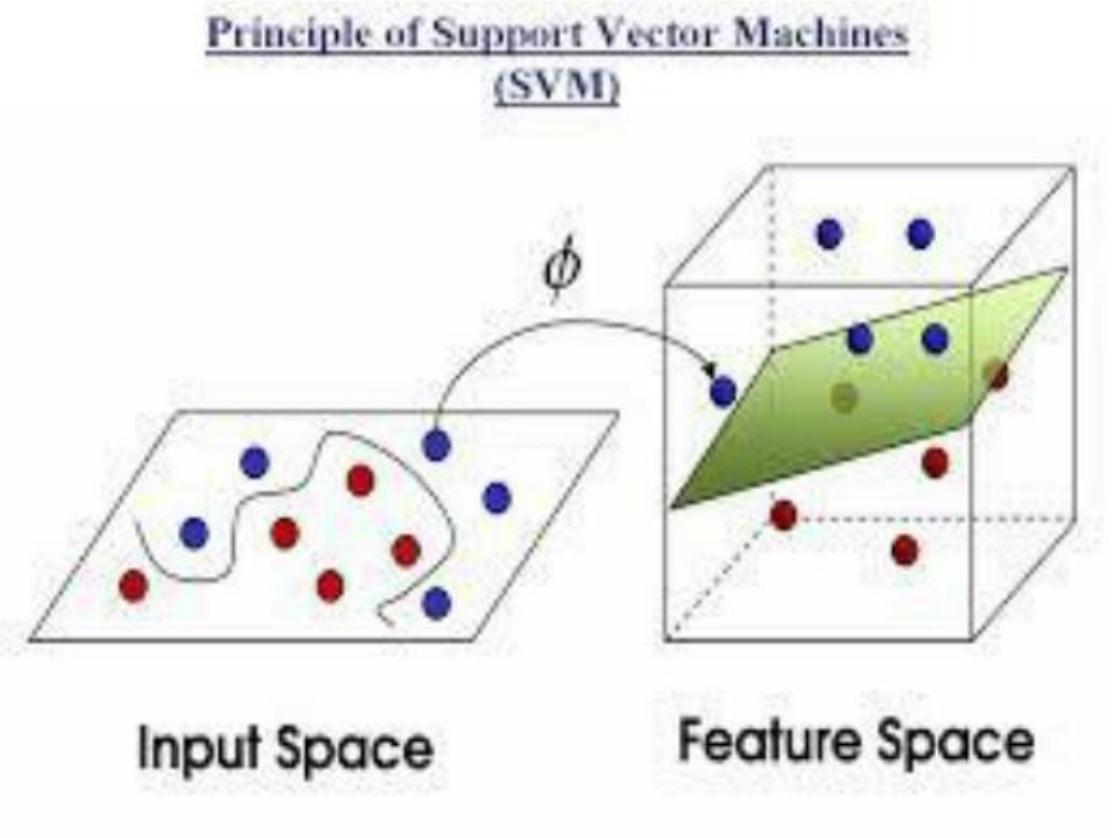
Approaches

- Artificial Neural Networks



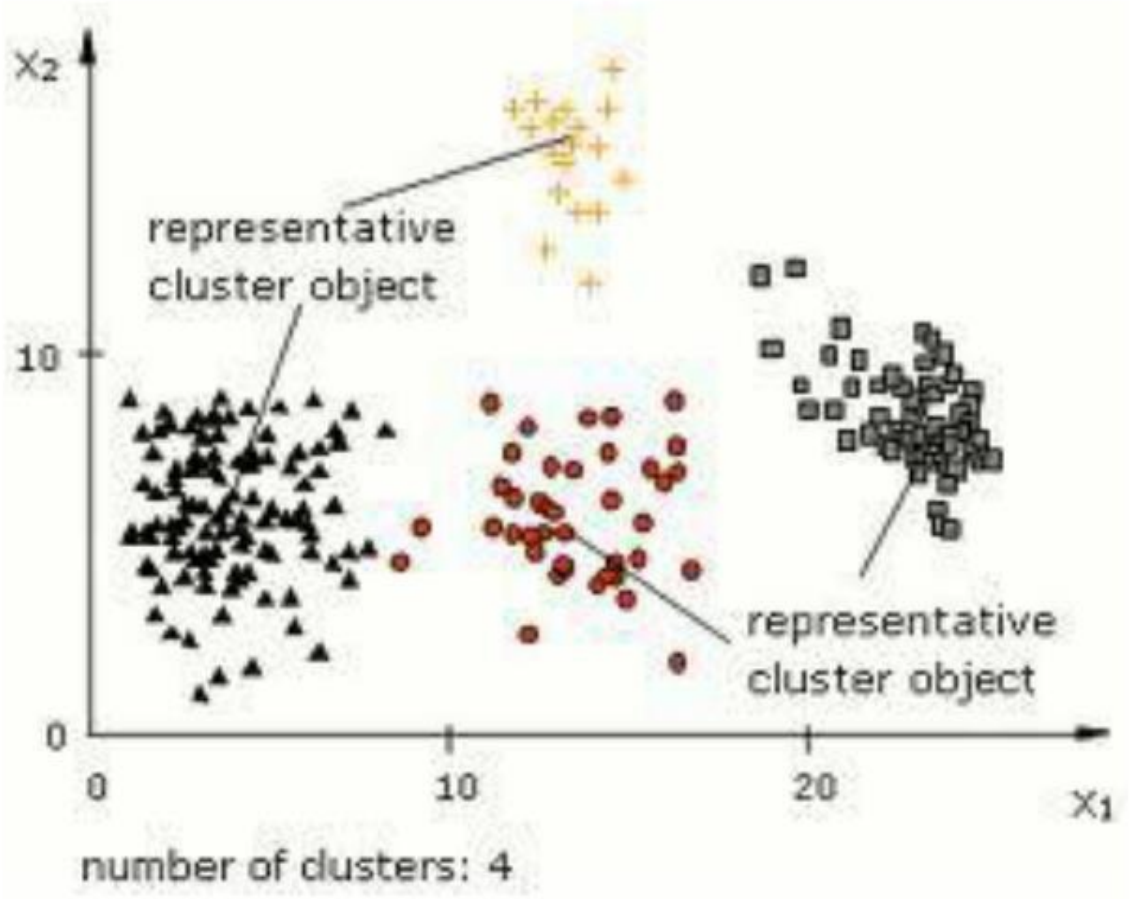
Approaches

- Support Vector Machines



Approaches

- Clustering



Approaches

- Similarity and Metric Learning

Approaches

- Representation Learning
- Bayesian Networks
- Reinforcement Learning
- Inductive Logic Programming

- http://www.youtube.com/watch?v=Gj4-5W8OCAA

Resources

- http://www.cs.ubc.ca/~nando/540-2013/lectures/l1.pdf
- http://www.youtube.com/watch?v=w2OtwL5T1ow
- http://www.youtube.com/watch?v=-rMMTv7XLYw
- http://en.wikipedia.org/wiki/Machine_learning
- http://simple.wikipedia.org/wiki/Artificial_intelligence