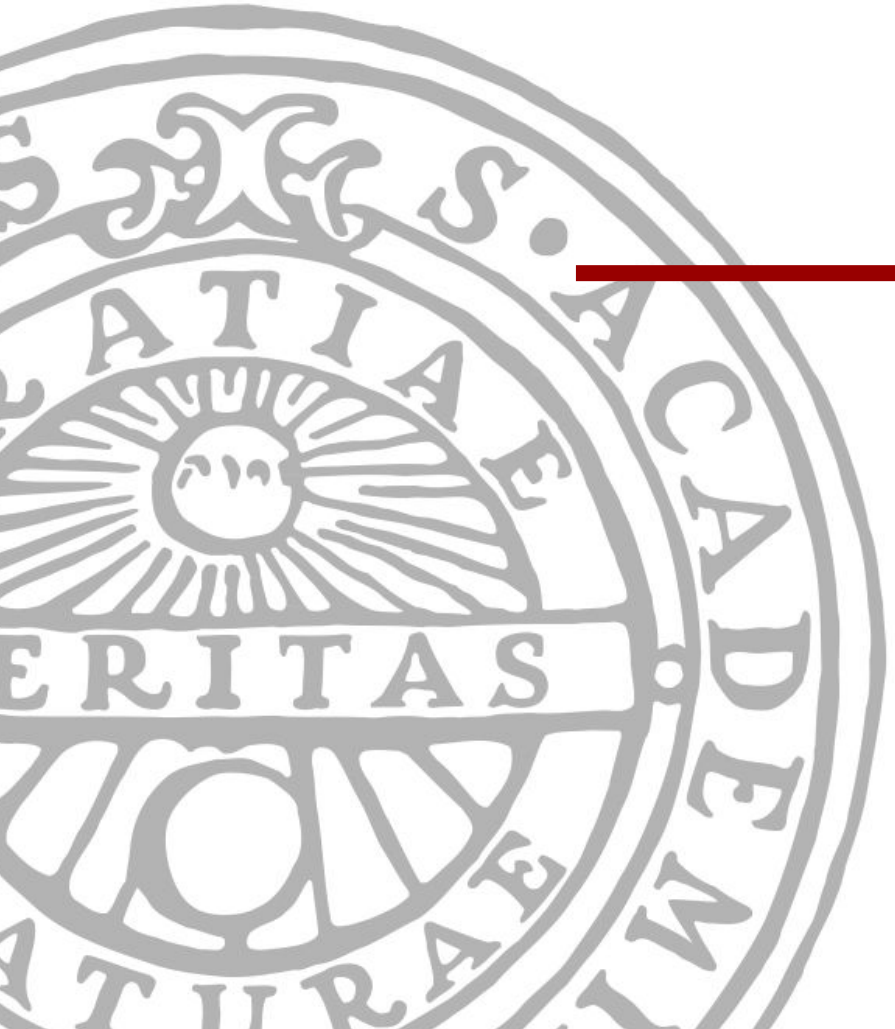

A Tour in Robot Learning

Machine learning algorithms for robots

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What is Machine Learning ?

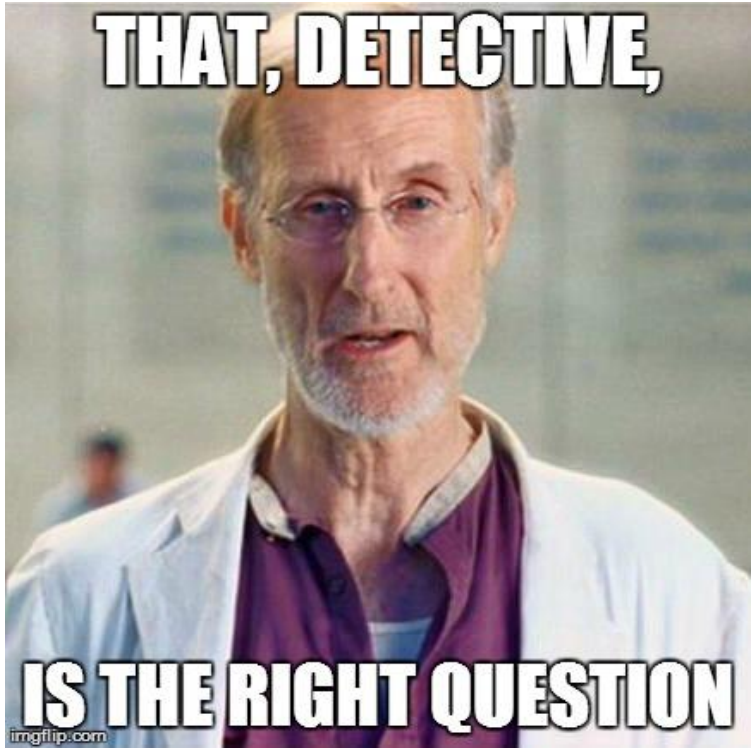
Algorithms that give computers the ability to learn without being explicitly programmed. (William L. Hosch, 2009)

[1]http://www.britannica.com/EBchecked/topic/1116194/machine-learning

Why Do We Need Machine Learning in Robotics ?

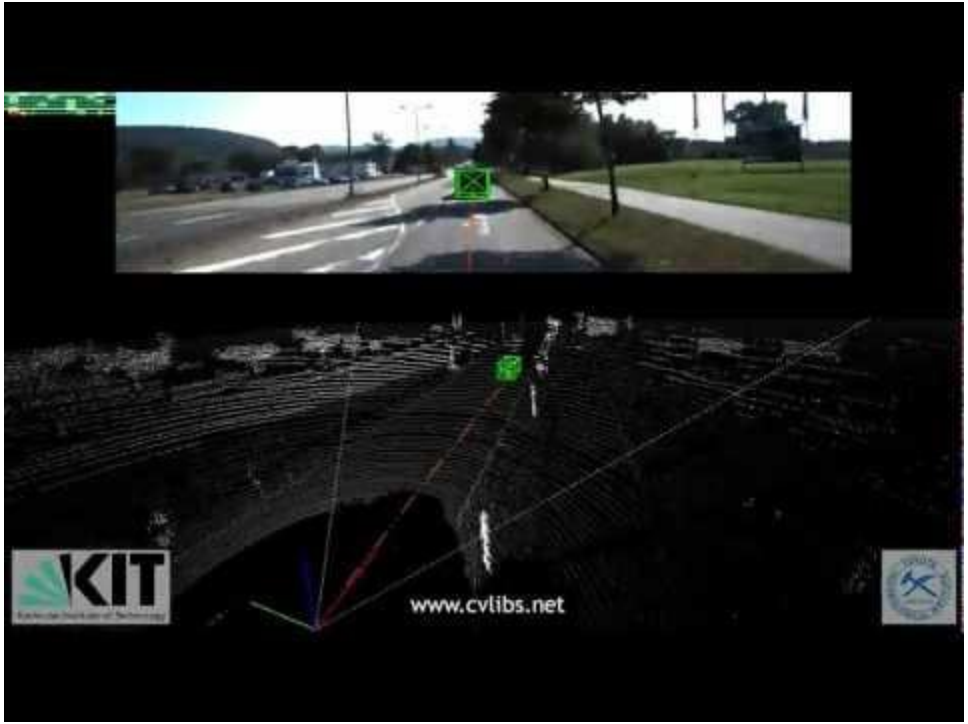
We need techniques allowing a robot to acquire novel skills or adapt to its environment through learning algorithms.

Where are they used?

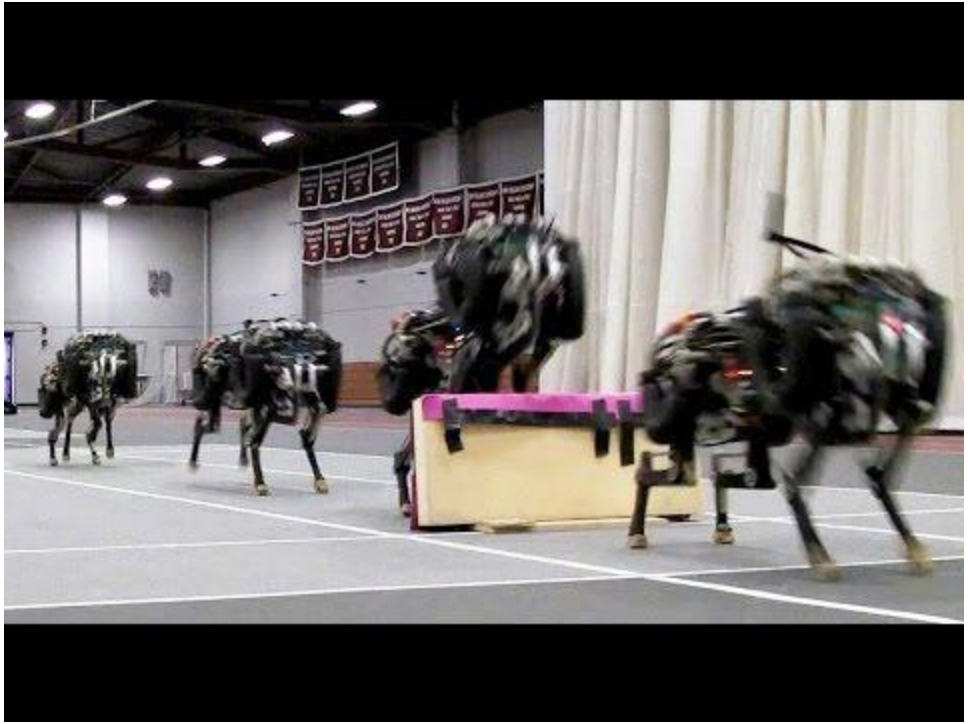


(I Robot, 2004)

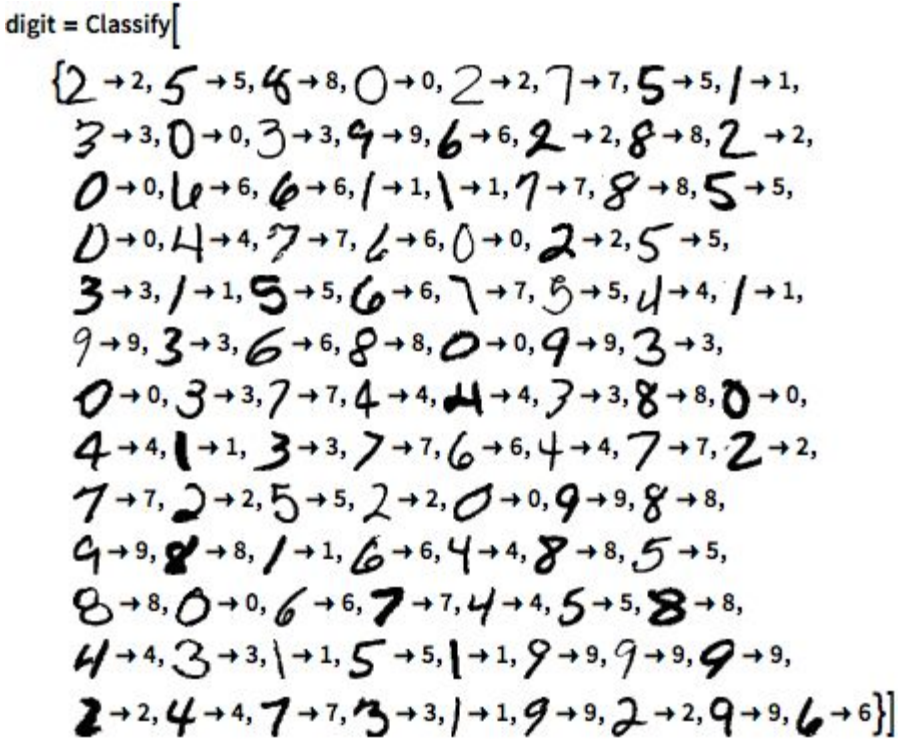
Perception



Control

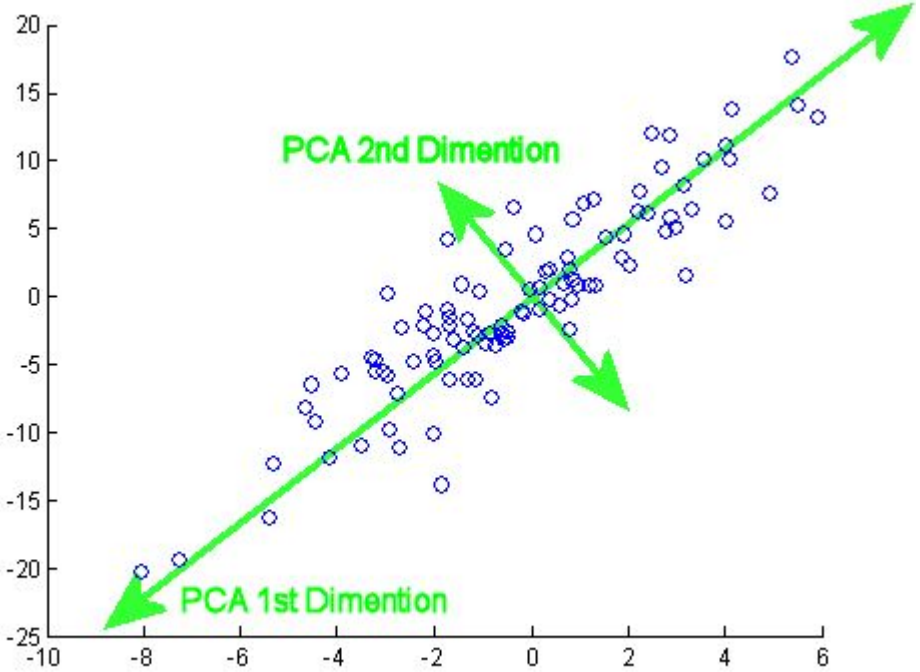


Digit Classification



- A dataset that consists digital image arrays and their labels
- Our task is to learn a model to classify these digits.
- We will use k-Nearest Neighbors(kNN) and Support Vector Machines(SVM) to solve this problem.
- You will also have a chance to try deep learning.

Principal Component Analysis



- PCA preserves the most important information. E.i. Variances

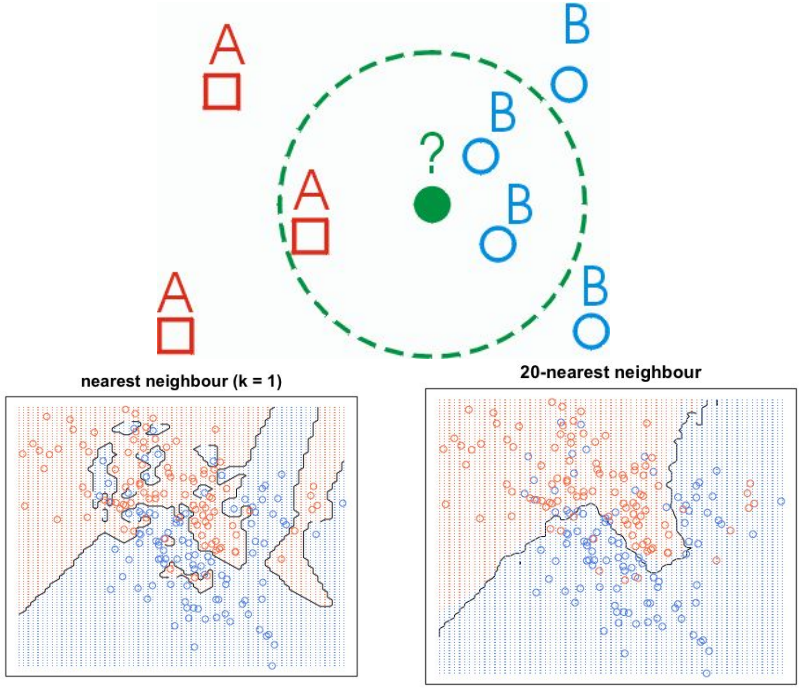
$$\mathbf{w}_{(1)} = \arg\max_{\|\mathbf{w}\|=1} \{\|\mathbf{X}\mathbf{w}\|^2\} = \arg\max_{\|\mathbf{w}\|=1} \{\mathbf{w}^T\mathbf{X}^T\mathbf{X}\mathbf{w}\}$$

$$\mathbf{w}_{(1)} = \arg\max \left\{ \frac{\mathbf{w}^T\mathbf{X}^T\mathbf{X}\mathbf{w}}{\mathbf{w}^T\mathbf{w}} \right\}$$

t-distributed Stochastic Neighbor Embedding (t-SNE)

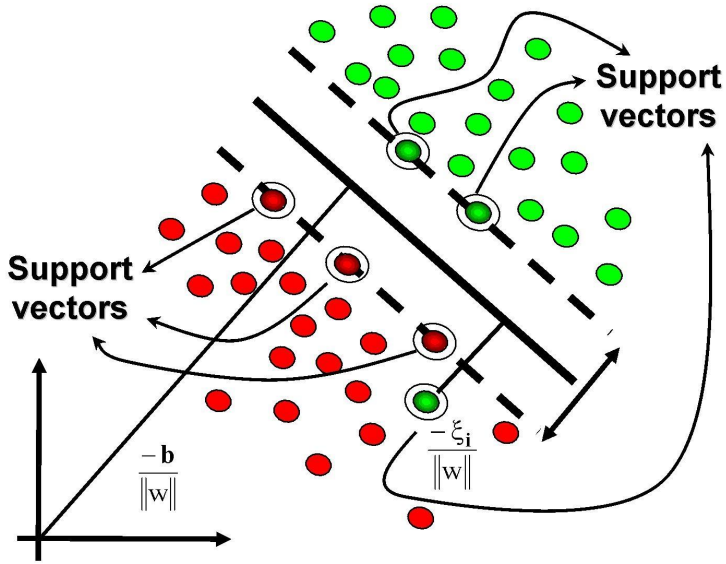
- Dimension Reduction using underlying variances information in feature vectors.
- t-SNE has been used in a wide range of applications, including computer security research, music analysis, cancer research, bioinformatics and biomedical signal processing.

k-Nearest Neighbors algorithm



In the classification setting, the K-nearest neighbor algorithm essentially boils down to forming a majority vote between the K most similar instances to a given “unseen” observation.

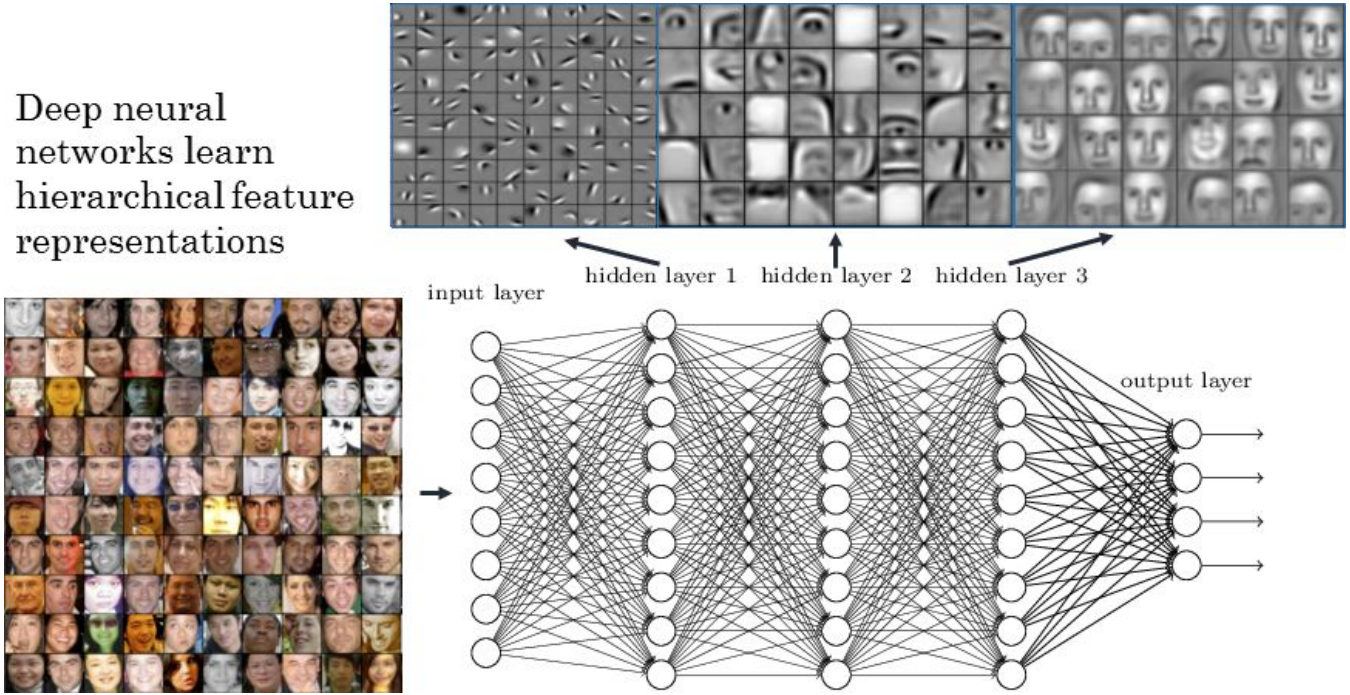
Support Vector Machine



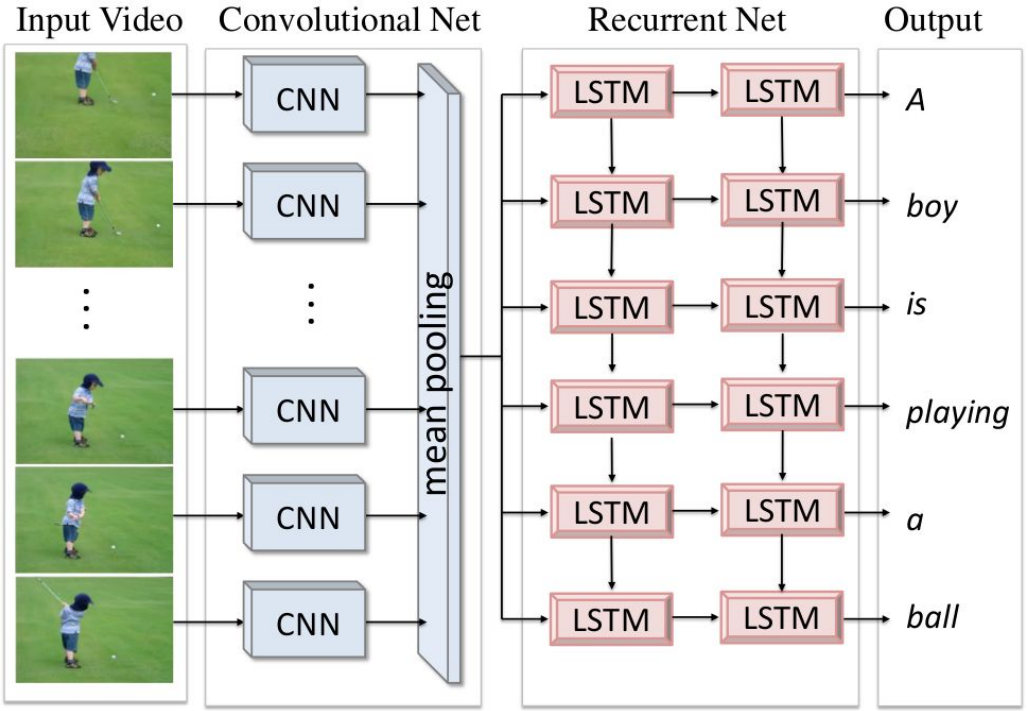
A Support Vector Machine (SVM) is a discriminative classifier formally defined by a separating hyperplane. In other words, given labeled training data (supervised learning), the algorithm outputs an optimal hyperplane which categorizes new examples.

Deep Learning (image)

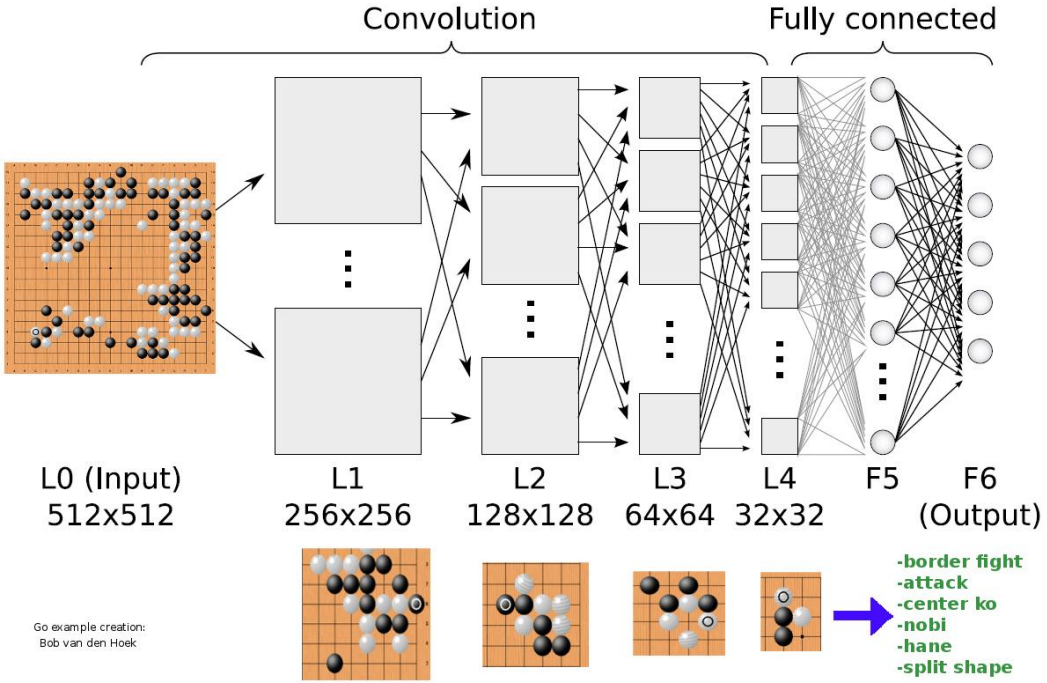
Deep neural networks learn hierarchical feature representations



Deep Learning (NLP)



Deep Learning (GameAI)



A journey of a thousand miles begins with a single step.

Let us start …