Machine Learning

Machine Learning

-Grew out of work in AI

-New capability for computers

Definition of Machine Learning

* Field of study that gives computers the ability to learn without being explicitly programmed.
* Tom Mitchell provides a more modern definition: "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."

Machine Learning Algorithms:

* Supervised learning (teach computer how to do something)
* Unsupervised learning (let computer learn something by itself)

**Supervised learning**

* Supervised learning problems are categorized into "regression" and "classification" problems
* In a regression problem, we are trying to predict results within a continuous output, meaning that we are trying to map input variables to some continuous function.
* In a classification problem, we are instead trying to predict results in a discrete output. In other words, we are trying to map input variables into discrete categories.
* **Example 2**:
* (a) Regression - Given a picture of a person, we have to predict their age on the basis of the given picture
* (b) Classification - Given a patient with a tumor, we have to predict whether the tumor is malignant or benign.

**Unsupervised learning**

* -Unsupervised learning allows us to approach problems with little or no idea what our results should look like.
* We can derive structure from data where we don't necessarily know the effect of the variables.
* We can derive this structure by clustering the data based on relationships among the variables in the data.
* With unsupervised learning there is no feedback based on the prediction results.

Notations:

m = Number of training examples

x’s = “input variable” / features

y’s = “output variable”/ “target” variable

(x, y) = single training example

When the target variable that we’re trying to predict is continuous, we call the learning problem a **regression problem**.

When y can take on only a small number of discrete values (such as if, given the living area, we wanted to predict if a dwelling is a house or an apartment, say), we call it a **classification problem**.

Univariate linear regression = Linear regression with one variable

**Cost Function**

We can measure the accuracy of our hypothesis function by using a **cost function**. This takes an average difference (actually a fancier version of an average) of all the results of the hypothesis with inputs from x's and the actual output y's.

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This function is otherwise called the "**Squared error function**", or "Mean squared error".

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A contour plot is a graph that contains many contour lines. A contour line of a two variable function has a constant value at all points of the same line.

Chart, diagram

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Taking any color and going along the 'circle', one would expect to get the same value of the cost function.

**Gradient descent**

:= - assignment

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# Matrices and VectorsText, application Description automatically generatedTo add or subtract two matrices, their dimensions must be **the same**.

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