"The field of pattern recognition is concerned with the automatic discovery of regularities in data through the use of computer algorithms and with the use of these regularities to take actions such as classifying the data into different categories."

→ Consider the example of recognizing handwritten digits [see attached Fig 1]. The goal is to build a machine that takes an image as input and outputs its label 0,..9. It could be tackled using handcrafted rules or heuristics for distinguishing the digits based on the shapes of the strokes, but in practise such a approach fails due to huge variability in shapes of digits.

→ Better approach is Machine Learning in which a large set of N digits $\{x_1, x_2 \cdots x_N\}$ called a training set is used to tune the parameters of an adaptive model. We express the category of the digit using target vector t, which is known in advance by hand labelling of the images.

→ An ML model is a function $y(x)$ which takes input a digit image x and outputs the target vector. The $y(x)$ will be determined precisely during training phase on the basis of training data. Once model is trained, it can then determine the identity of new digit images, which are said to comprise a test set. The ability to categorize correctly new examples that differ from those used in training is known as Generalization.

→ Generalization is the central goal in pattern recognition