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# Dedication

To the whole family

To all my friends

# Abstract

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# Introduction

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# Chapter 1: State of the art

## Machine learning

Machine learning, also known as artificial learning, is a form of artificial intelligence (AI) that allows a system to learn from data and not through explicit programming. As algorithms ingest training data, it becomes possible to create more accurate models based on this data. A machine learning model is the result generated when you train your machine learning algorithm with data. After the training, when you provide input to a model, you receive an output result. For example, a predictive algorithm creates a predictive model. Then, when you provide data to the predictive model, you receive a forecast that is determined by the data that formed the model.

There are mainly three types of machine learning:

## Supervised learning

Supervised learning generally begins with a well-defined data set and some understanding of how that data is classified. The purpose of supervised learning is to identify patterns within the data and apply them to an analytical process. These data have characteristics associated with labels that define their meaning.

## **U**nsupervised learning

Unsupervised learning is used when the problem requires a massive amount of unlabeled data. For example, social media applications, Unsupervised learning leads an iterative process, analyzing data without human intervention.

## **R**einforcement learning

Reinforcement learning is a model of behavioral learning. The algorithm receives feedback from data analysis and guides the algorithm towards the best result. Reinforcement learning differs from other types of supervised learning, as the system is not trained with an example data set. Instead, the system learns through a method of trial and error. As a result, a sequence of successful decisions results in a strengthening of the process, as it most effectively solves the problem.

## deep learning

Deep learning is a specific machine learning method that integrates neural networks in successive layers to learn data iteratively. Deep learning is particularly useful when trying to detect trends from unstructured data. Complex deep learning neural networks are designed to emulate the functioning of the human brain, so that computers can be trained to cope with ill-defined abstractions and problems. Neural networks and deep learning are often used in image recognition, oral communication and computer vision applications.

## Class decomposition

Class decomposition describes the process of segmenting each class into a number of homogeneous sub-classes. This can be naturally achieved through clustering. Utilising class decomposition can provide a number of benefits to supervised learning, especially ensembles. It can be a computationally efficient way to provide a linearly separable dataset without the need for feature engineering required by techniques like Support Ve]ctor Machines (SVM) and Deep Learning. For ensembles, the decomposition is a natural way to increase diversity; a key factor for the success of ensemble classifiers. In this paper, we propose to adopt class decomposition to the state-of-the-art ensemble learning Random Forests. Medical data for patient diagnosis may greatly benefit from this technique, as the same disease can have a diverse of symptoms. We have experimentally validated our proposed method on a number of datasets in that are mainly related to the medical domain.

# Chapter 2: Conception

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# Chapter 3: Experimentation and Results

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# Conclusion and Perspectives

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