

## MACHINE LEARNING: A CONTRIBUTION TO OPERATIONAL RESEARCH.

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### **Abstract :**

*This paper explores the combination of machine learning and operation research. It helps to solve specific problems when a precise and optimal solution is needed. Build predictive models using different approaches in machine learning and find the best solutions using different approaches in operational research. In another proposal for operation research lessons using the co-existence of different hybrid models using mathematical models Computational intelligence and computer simulations.*

**Keywords : Operational research; Machine learning; Optimization; Hybrid models.**

## 1. Introduction

The topic that extend the original version are the detailed description and some applications and how it is integrated with Computational intelligence, specifically with ML in an OR course[1]. In particular, we should described some Machine learning techniques that greatly extend the possibility and solving problems by addressing them with methods that belong to the CI area and not from the techniques commonly used in operation Research.

The current academic program of the OR course include some analysis technique, data mining and machine learning and artificial intelligence ( MIT and Industrial Engineering an Operation Research- Columbia University-NY) . A solution given by a predictive model can be more reliable if it gets optimized for being a proper solution to the problem.

The operation research is concerned with the large collection of unique methods for specific classes of problems. We have many examples where we can achieve higher accuracy and benefits using the combination of Machine learning and Operation Research[2].

We will also discuss a few notable use cases of this combination. The major points to be covered in this article.

### 1.2 Origin And History Of Operation Research:

According to the history of operational studies, Charles Babbage (1791-1871) is considered the father of operational studies because his work on shipping costs and mail sorting led to the rise of universal penny postage in England in the 1840s.

The name operations research was coined in 1940. During World War II, a team of British scientists (Circus Blackett's) applied scientific methods to study military operations to win the war, and the technology developed was called operations research.

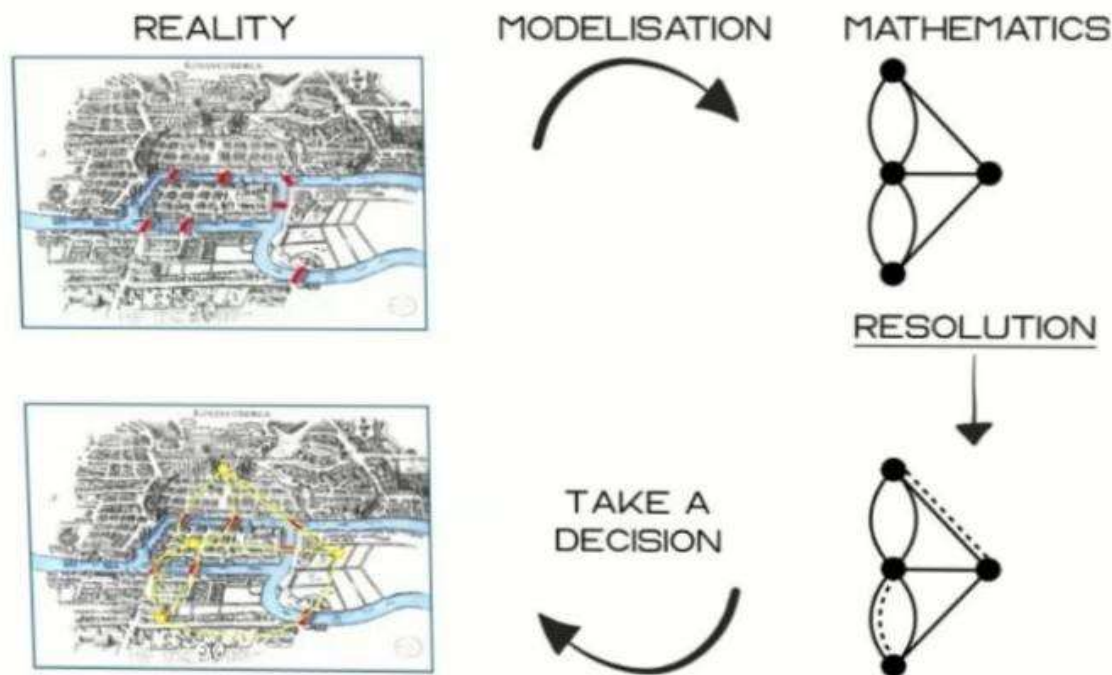
Since then, OR has become a widely used topic in industries such as petrochemicals, logistics, airlines, finance, and government.

## 2. The Context Of The Study

This section introduces a new generation of profile students who are experiencing the fourth revolution. Additionally, we briefly discuss the role of OR and ML as part of course programs in engineering careers. Then focus on integrating the two to achieve the desired Synergy.

### 2.1 Operation Research:-

Operation research is used to as an analytical approach, OR method which can help in solving problems and making decisions.



This decision-making and problem-solving approach helps the organization management and interests. The basic approach to solving problems using OR is to start by breaking down the problem into its main components and then use mathematical analysis to solve those broken pieces in defined steps.

The image above reproduces the OR procedure with its main components. It can be said that OR is an optimization science that can bring a lot of improvements in all fields.

### 2.2 Machine Learning:-

In computer science, a branch of artificial intelligence known as machine learning has become increasingly popular in recent years for a wide variety of applications, including image processing, DNA

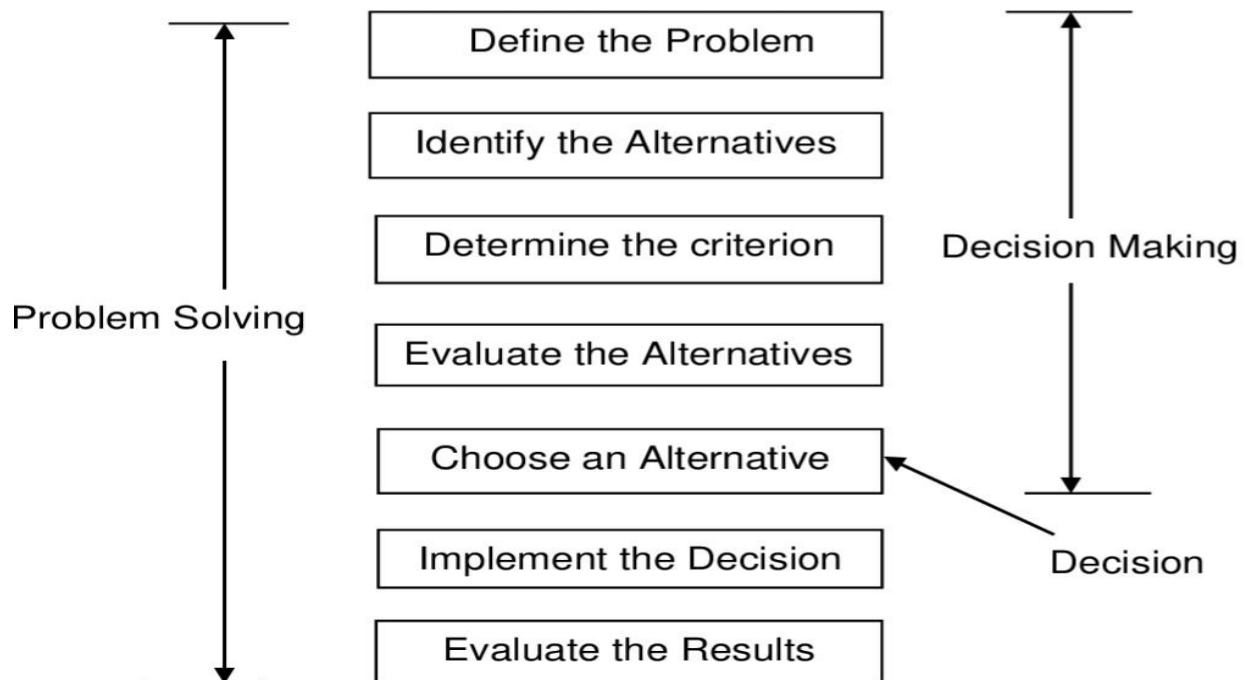
sequence classification, financial analysis such as card fraud detection, and search. Is. Areas of engine algorithms etc.[3],[4].

Machine learning can be divided into three types: supervised learning, unsupervised learning and reinforcement learning [5].

The term learning should be understood as the achievement of a computational research method of program manipulation that improves the performance of some tasks through experience.

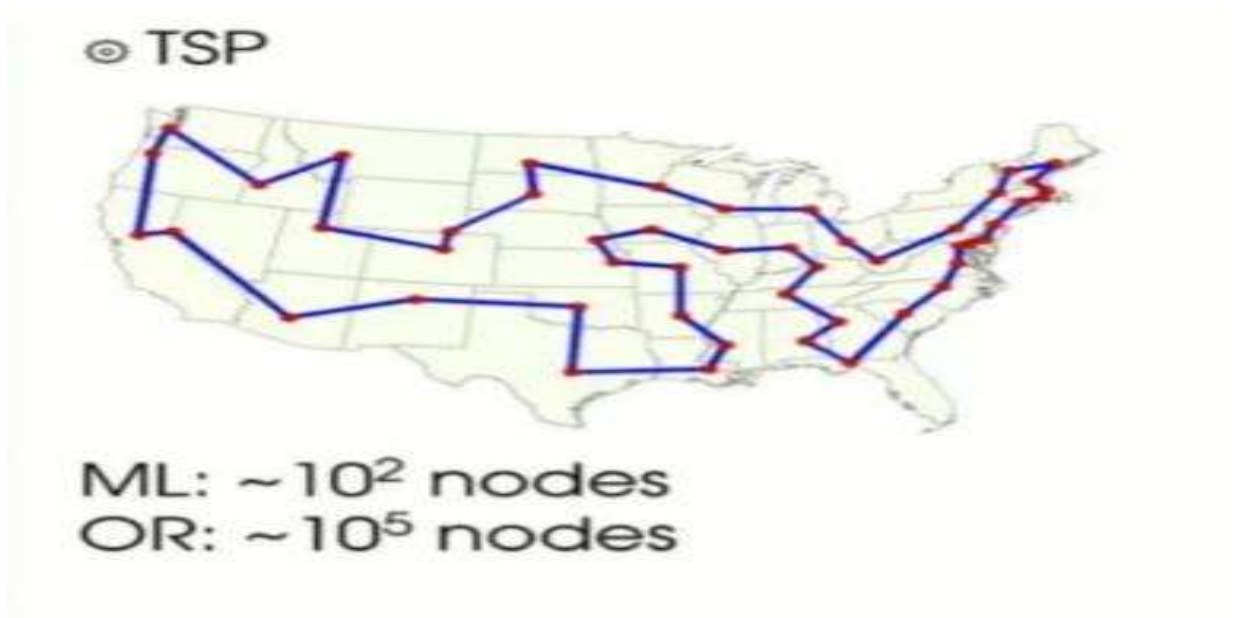
### 2.3 The Relationship Between Problem-Solving And Decision Making In Operation Research:

It can be said that both OR and ML are trying to find better solutions to problems that can also use machine learning models to make decisions.



### 2.4 Quick Comparison Between Operation Research And Machine Learning :

- Some Machine Learning blocks
  - Gradient Descent
  - Back Propagation
  - Bellman's Equation
  - Euclidean Distance.



## 2.5 Hybrization Of Machine Learning And Operation Research:

The combination of machine learning and operational research can be done in four ways:

- **ML then OR** – Here ML can help you find a point or solution and after using OR you can optimize the solution points.
- **ML in OR** - Here it can be said that ML helps us to perform the following tasks of OR. This can be considered an OE method.
- **OR in ML** - Here it can be said that OR helps the ML procedure to perform its tasks. This can be seen as an ML method.
- **New hybridization of ML and OR** - Here we see it as a perfect combination of ML and OR getting some new algorithms.

## 2.6 Examples Of Combining Operations Research And Machine Learning :

Consider a example of a road construction company that has received an offer from the government. The duty of this company is to repair road defects. This can be done with a combination of ML and OR. ML models help to identify various types of road defects such as road fractures in narrow, medium or large areas.

You can then use OR to find profitable policies for road replacement and reconstruction. This is a working method for development using ML and OR together. Likewise, there are various areas that both technologies need to work on in order to approach the problem in a better way.

### 3. Future Research

Considering that due to the scalable nature of the proposed study, future work should be a graduate course because of the required student-level computing background, we integrate adaptive learning into Markov chain OR- is to challenge the combination of ML. No, the computer is definitely an essential and integral part of the OR. Nowadays, OR methods and computational methodology are growing in parallel. In the coming years, it seems that the dividing lines between these two methods will disappear and these two sciences will merge and form a more general and comprehensive science.[10]

### 4. Conclusion

In this article, we have discussed the principles of OR and how to combine it with ML. A point to note here is that ML models are concerned with predicting a single task, while OR is concerned with a large set of unique methods for a specific class of problems. As we have seen in the example, using ML in combination can achieve higher accuracy and benefits.

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