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An Analytical Approach for Decision-Making

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***Abstract*— In this complex world, coping with daily problems is quite tedious. The more advancement in technology means more difficulties in decision-making process. Hence some analytical tools are needed to deal with improvement in decisions being made. A classic AHP model enables us to make efficient decision by reducing the complex issues. It takes multiple parameters into consideration. One of the area where decision-making is quite a tough job is Politics. Selection of the electoral party in any elections, be it Lok Sabha elections or Rajya Sabha elections, has been a matter of discussion for the voters as well as the media. The decisions are reflected when uncertainties are added in the opinions of the domain experts due to multiple parameters. In this paper we have proposed a model for rectifying the uncertainties using multi criteria decision analysis and analytic hierarchy process (AHP).**

***Keywords*— Data Analytics, Hadoop and MapReduce, Multi criteria decision analysis, AHP.**

I. INTRODUCTION

We are living in the era of digitization where the data has been constantly generated. This data has been rapidly coming from the heterogeneous data sources. It may be accumulated from internet searches, social networking, meteorological data, satellite imagery, transactional data, financial statistics, stock exchange, etc. To manage and analyse the copious data, classification is essential. If the data is ordered and arranged in rows and columns then the word "structured data" is correct label for classification. In contrast, when it is hard to identify the syntax of data generated through multimedia, symbols, graphs we refer them as "unstructured data". Another category may fall amid of these labels of data. What about the documents which contain the hierarchical representation of records in the form of tags or databases which does not comply the conventional standards of relational databases? Those sources fall under the category preferably known as "semi-structured data" [1].

Fig 1: Classification of data [1, 3]

With the tremendous availability as well as the diversity, data has become an asset for any organization. From the available pool of raw data we can derive valuable piece of information which further aid in decision-making process [2]. But storing, managing, and analysing such a huge pile of data is not an easy task.

There arises a need for efficient tools and methods for analysing and drawing relevant conclusion after discovering relationships and dependencies among the extracted patterns. Therefore the successive section will focus on data analytics, its tools and methods.

II. Data Analytics

Data analytics offers advanced analytics techniques to manage enormous data set. It will effectively handle the real time data. It's main emphasis on capturing, storing, managing, processing and visualising the outcomes to the target users. Its fast capability of processing the data provides benefit to business officials for knowledge discovery and decision-making [1, 3]. The objectives are achieved using the advanced framework, popular techniques and methodologies which are discussed in the following section..

A. *Hadoop and MapReduce*

Hadoop is widely accepted framework in the companies and organizations due to its potential of processing large data set stored in the distributed environment. Data processing is taken care by MapReduce function. It applies parallel processing on the data set distributed over the clusters [4].

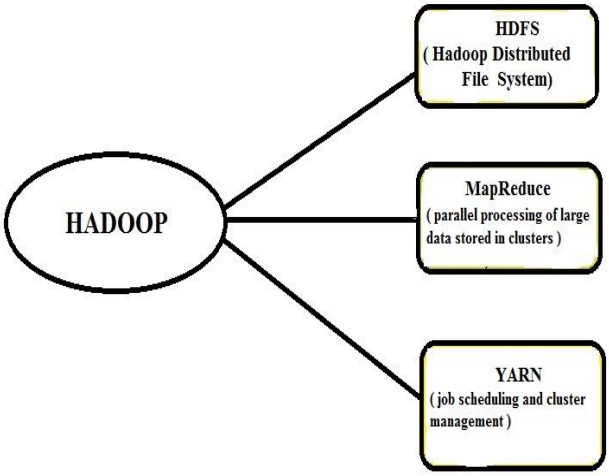

Fig 2: HADOOP Technology [4]

B. *Data Analytics and Decision Making*

Nowadays companies are getting more competitive in utilising its resources as well as investing funds to learn from the pool of data. They are concentrating on improvising their decisions-making process which will eventually be helpful for increasing their profit margin. Data analytics serve as a platter for the decision makers. It is the process of applying the algorithms for analysing the raw data and then derives the useful information after identifying the hidden patterns among the crisp and non-crisp values [3]. The valuable information can serve as a purpose for the decision makers to make complex decisions [2].

The contribution of renowned theoretician Thomas L. Saaty (July 18, 1926 – August 14, 2017)[in the development of decision-making framework is commendable. He proposed various algorithms for making precise judgements on the basis of different criteria and available alternatives. Some of the common algorithms are [5]-

- Analytic Hierarchy Process (AHP)
- Analytic Network Process (ANP)
- Neural Network Process (NNP)

The next section of the paper mainly attempts to offer the significance and related work of analytic hierarchy process in various domains.

III. Analytic Hierarchy Process (AHP)

The AHP framework is the most successful and widely accepted framework for making effective decisions on the complex problems involving multi criteria. Multi criteria decision analysis (MCDA), the current emergent concept is used where the decision is made after resolving the conflicts among the criteria. AHP is one of the best approaches of MCDA because of its precise judgements by ranking the alternatives and selecting one of the best options [5].

A. *AHP Algorithm*

The flow of algoritm is identified by some major steps discussed below:

Step 1:- Decomposition of the problem into hierarchical representation with the overall goal as a parent node, all the criteria are organised as its children, and finally the alternatives are labelled as leaf nodes.

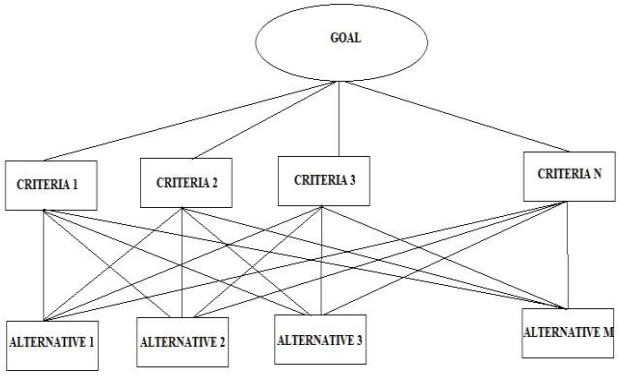

Fig 3: Reduction of the problem into tree structure [5]

Step 2:- Making pairwise comparisons of each criteria for determining its contribution to the achievement of overall goal. The comparisons are made on the scale of 1 to 9 (Given by Saaty) to indicate the preferences for the two criteria.

TABLE 1
DEFINED SCALE AND THEIR CORRESPONDING DEFINITION [5]

Saaty Scale	Description
1	Equally Important
3	Weakly Important
5	Fairly Important
7	Strongly Important
9	Absolutely Important
2,4,6,8	The intermediate values between two scales

Step 3:- Indicating the priority to each alternatives in terms of its contribution to each criteria.

Step 4:- Higher the priority, higher the rank. Arrange all the alternatives according to their priority and select the option with the highest rank and meeting the overall criteria.

Step 5:- Finally consistency is checked to review our decision making process. Consistency check is a vital step in terms of quality of the ultimate judgements being made.

IV. Related Work

The paper covers the work of past 6 years in almost each area such as management, agriculture, banking, academics, financing. Each application of AHP in the respective fields has been gone through, one by one.

- In April 2017, the application of AHP has been discovered in evaluating pavement performance index [6]. The survey data for severity and extent was collected from Jaitala to Mokhare College in Nagpur city.
- In June 2017, the author prescribed the AHP model in the field of power generation [7]. Model is based on choosing the cost-effective technology for power generation in Libya.
- The successive work in the same year was to assess multiple hospital websites in Hyderabad [8]. The researchers developed the algorithm taking parameters like clinical services, treatment and drugs availability into account.
- AHP also has the potential to assess the natural factors affecting the ecosystem. In the year 2017, the objective of the research was to evaluate the ecological sensitivity in Kizilirmak delta [9]. The factors taken into consideration were water systems, soil, land use, density of population and settlements. AHP is used to classify sensitivity and risk values computed through above factors into certain labels.
- In 2016, the author attempt to enhance the functionality of AHP by integrating it with Intuitionistic Multiplicative Information [10]. This gives AHP to better tackle the decision-making problems.
- In the same year, the AHP tool was applied in management and sustainable development of environment. The approach presented was to characterize the most promising non-wood forest products in the region of Alentezo [11].
- In 2015, the respected author modelled the AHP selection based framework for procurement methods in the maintenance organization [12].
- In the same year, the research scholars found the significance of AHP in prioritizing the features of smart phones Indian consumers must considered while purchasing [13].
- In 2014, the author emphasizes the issue of traffic in urban areas. The main idea of the article is to assess each variant of integration of public transportation and rank them after applying AHP tool [14].
- In the same year, aircraft selection process is monitored [15]. The work involved for the improvement of the services being offered using AHP analysis.
- In the same year, the model of AHP is applied for choosing the best test batsman [16] on the basis of the player's performance or his overall span of career.
- In the year 2013, the researchers extend the functionalities of AHP in the science learning. First of all, they evaluated the existing methods of students' creative products by the means of AHP. Secondly, they modified the work using an advanced model called direct-rating AHP [17].
- In 2011, the work of AHP was used as evaluator for knowledge management platform. The behaviours involved among elementary school students were knowledge creation, transfer and sharing [18].
- Even the banking sector has not been left uncovered. In 2010, the concerned author proposed his model for portfolio selection in the Nigerian bank [19].
- In March 2010, very popular application of AHP in the selection process is made that is, supplier selection [20]. On the basis of supplier's performance, decision is made that which supplier is suitable for the current scenario.

V. Proposed Work

From the literature work presented above, we concluded that the algorithm has been a big hit in the field of management, finance, healthcare, environment, banking, and manufacturing etc. This article proposes the algorithm which highlights the significance of AHP in the political background. The study comes out with the suitable findings for choosing the best government.

Whether it is state elections or central elections, only one thing is highlighted by the media: Which political party will be going to form a government"? And the voters follow up their analysis and cast their vote. This paper aims at giving the complete picture of political party's achievements to the target voters and ranks them on the basis of their evaluated priority.

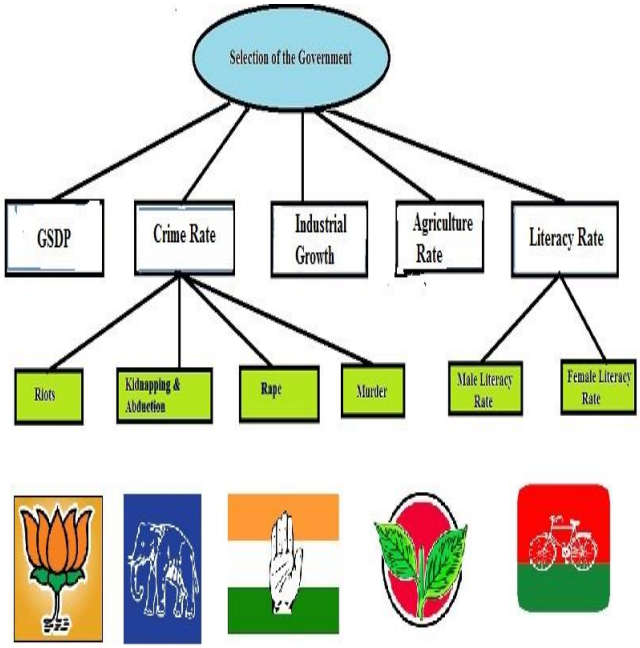

Fig 4: Decomposition of the problem statement into tree structure

A. *Major steps of proposed algorithm*

The major steps of the algorithm are identified and captured in tabular format illustrated below:-

Step 1	Interpretation of dataset available in the form of bar graphs and then transform it into our required format. In our case, it is YAML format.
Step 2	Implementation of AHP on the transformed dataset which is extracted in the above step.
Step 3	Using Saaty Table for scaling the criteria, preference matrix is designed for pairwise comparison of two items.
Step 4	Likewise, preference matrix is prepared for each alternatives that is, political parties.
Step 5	Creation of same matrix for each alternative in terms of underlying criteria for overall achievement of the goal.
Step 6	Computation of the priority vector against each row in all the preference matrices prepared above.
Step 7	Finally ranks are given to each political party on the basis of their computed priority. Higher the priority, higher will be the rank.
Step 8	Visualization of the analysis and the outcomes to the target voters in the row and column manner.
Step 9	All the steps of algorithm for multi criteria decision making has been implemented with the aid of AHP tool.

VI. CONCLUSION

From the perspective of the voters, the selection of the appropriate political party to form the government is a difficult task. It becomes more complicated when they are not aware about the party's reputation and their achievements. The AHP model will analyse different aspects of the politics. It will perform pairwise comparisons among the areas they worked well, among the political parties based on those areas and assigning the priorities to parties. Finally the preference is given to one of the electoral party with the highest priority. We can further apply this AHP model to answer - "Which party will be suitable to form the government in upcoming elections?"

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