A DECISION MAKING APPROACH FOR RANKING PRIVATE UNIVERSITIES IN BANGLADESH

BY

MD. EHTESHAMUL ALAM
ID: 171-15-9313

MUKTA GAIN
ID: 171-15-9310

AND

SUSHMITA MAJUMDER
ID: 171-15-9518

This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

Md. Zahid Hasan
Assistant Professor
Department of CSE
Daffodil International University

Co-Supervised By

Md. Abbas Ali Khan
Sr. Lecturer
Department of CSE
Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY

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APPROVAL

This Project titled "**A Decision Making Approach For Ranking Private Universities in Bangladesh**", submitted by Md. Ehteshamul Alam, ID No: 171-15-9313, Mukta Gain, ID No: 171-15-9310 and Sushmita Majumder ID No: 171-15-9518 to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the Degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 28-01-2021.

BOARD OF EXAMINERS

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Professor and Head

Department of Computer Science and Engineering

Faculty of Science & Information Technology

Daffodil International University

Md. Tarek Habib **Internal Examiner**

Assistant Professor

Department of Computer Science and Engineering

Faculty of Science & Information Technology

Daffodil International University

Saiful Islam **Internal**

Senior Lecturer **Examiner**

Department of Computer Science and Engineering

Faculty of Science & Information Technology

Daffodil International University

Dr. Md Arshad Ali **External Examiner**

Associate Professor

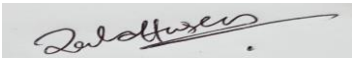
Department of Computer Science and Engineering

Hajee Mohammad Danesh Science and Technology University

DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Md. Zahid Hasan, Assistant Professor** and Co-supervision of **Md. Abbas Ali Khan, Sr. Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:



Md. Zahid Hasan
Assistant Professor
Department of CSE
Daffodil International University

Co-Supervised by:

Md. Abbas Ali Khan

Sr. Lecturer

Department of CSE
Daffodil International University

Submitted by:

Md. Ehteshamul Alam
ID: -171-15-9313
Department of CSE
Daffodil International University

Mukta Gain
ID: -171-15-9310
Department of CSE
Daffodil International University

Sushmita Majumder
ID: - 171-15-9518
Department of CSE
Daffodil International University

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ABSTRACT

Now a days there are many students in our country who decide to admit themselves in the public universities to study on their desirable subjects but many of the students fall down from the admission because of the limitation of seat numbers. After that when they don't get chance to admit in the public universities they make their mind to get admission in the private universities. Almost 103 private universities all over the country. For this reason they get confused to take admission because which university is suitable for their desirable subject. That's why in this paper proposed a decision support system for ranking private university. For ranking private universities there need to follow some procedures. And need multiple attributes to analyze decision framework. This paper uses Weight Allocation (WA) & Generic Features Extraction Approach (GFEA) algorithm for ranking private universities. By using these algorithms finally there come to a definite decision that DIU is better than most other private universities in Bangladesh.

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CHAPTER 1

Introduction

1.1 Introduction

In the period of globalization, university rankings have reached a sort of admirable position. The QS (Quacquarelli Symonds Limited) ranking, World University Academic Ranking (ARWU), and Times Higher Education World University Rankings (THE) are remarkable obliquely the world [1]. Inside countries, prospective clients (students and their families) utilize rankings to take decision regarding which university to study by resolving the offer in as regards of the reputation, cost, and worth of their degrees. Decision makers (high officials in government) may distribute their yearly budgets and resources based on international and national ranking. Therefore, Bangladesh University Grant Commission (UGC) publish all the private and public universities in Bangladesh based on several attributes like other countries. In very harsh scenario in Bangladesh, the ration of number of students and the number of universities is relatively higher. After passing the higher secondary examination, there are many students who are desired to get admitted into renowned universities. In this case, students prefer to take admission in public universities because public universities have highly precedence than other private universities. There are many facilities in public universities as the Government institutions and the study quality is better than other universities. So that the students intend to get admission in public universities but there are huge competitions among candidates against one seat of any program in public universities due to limitation of seat number. Recently in 2019, the number of passing students in higher secondary examination is 9 lakhs 88 thousand 172 hundred [1] and they were all the admission candidates for all universities in Bangladesh. Last year the ratio of participated students in the admission test of Dhaka University [2] of unit 'A' against one seat is 46:1. So maximum students who did not get chance in public universities even did not get their desired subjects, in public universities, have to mutate towards private universities. At that time, students get confused and wondered about which university would be right for them. It is not so easy to get all of the accurate information's of any private university by getting suggestions of different people of different opinions, browsing on Internet, University websites, and even from the university office. There are set of activities to know about any private university for ranking like as number of students entering any program, academic performance, job

status, research, Government job, ratio of going Higher studies, passing out ratio, extra-curricular activities and so on. All of these huge information's for all universities cannot be found so easily as well as their significant performances exposed by rankings are measured as a straight indication of excellence, efficiency of a precise executive plan can be evaluated by means of rankings. Besides, academic institutions have the benefit of evaluating their education systems' position among others, taking strategic decisions associated to resource distribution and enhancing their positions in ranking lists. Universities accept that rankings are essential in building up and assuring reputation. For this reason, this paper proposes a decision support framework that will consider the important decision parameters for taking proper decision easily.

Using a step-by-step decision-making process, anyone can organize relevant information and define options to help them make more deliberate thoughtful decisions. Attribute's weight enunciates that affiliated the importance of quality and description in numerical way to identify the influence of an attribute of a decision-making procedure. The decision-making procedure rely on attribute's weights. Decision support system is a knowledge-based system which is properly designed interaction software-base system helps designated decision-makers to identify and solve problems and gather effective intelligence from a summation of raw intelligence, documents, and individual knowledge or business frames for decision making. Decision attributes in decision crux can be garnished in a hierarchical layer. The root layer attributes reveal the basic decision parameters and intermediate-layer attributes depends significantly on the root-layer attributes.

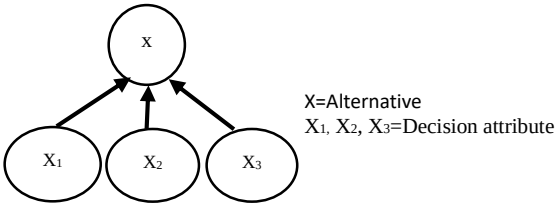

Figure 1.1. Single Layer Decision Problem

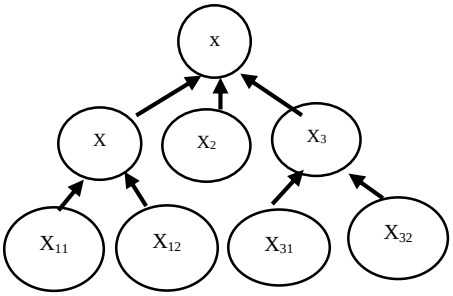

Figure 1.2. Multi-Layer Decision Problem

Whatever all the attributes of a decision solution are not equally important. A value is set for each feature to detect the significance of a feature similar to other features of the decision problem-solving.

It is very important to allocate specific weights for every attribute in the decision-making procedure. However, there is no exact mathematical model that can help decision-makers determine the weight in decision parameters. Most of the decision makers mostly rely on domain specialist to set the attributes weight. But sometimes it generates some doubtfulness in the way of decision-making procedure and then directs to a hostile decision.

The decision-making domain determines the uniform weight for the quality of each decision, rather than relying on experts to make decisions within the decision-making framework of discovery.

However, a certain genuine formula for determining weight in the decision attributes is mentioned in this paper. The paper introduces the term frequency which determines the weight of the cosine uniformity to produce weights for the properties of the main layer and for the properties of the intermediate layer. Both access resolves many historical information to weigh the weight of decision attributes.

That’s how the paper is methodized:

A complete explanation of the existing weight allocation methodologies is provided by section II.

A new generic weight appointment methodology is suggested in section III, which is stand on the investigation of related works.

1.2 Motivation

- **Reserving Literature:** There are numerous papers regarding private universities ranking. This project a demonstration can be made of private universities ranking.
- **Calculating Cost:** Whereas we rank private universities we require several surveys, research, and analysis and sometimes also need man power. Then cost is rich for varsity ranking.
- **Choose Convenient University:** There are so many private universities in Bangladesh but all of those are not appropriate.
- **Confusion:** A student has confusion to select desired private university.

1.3 Rational of the study

Rational of the study have to be explained clearly explained to understand properly. The research might be specific. It is necessary to have these criteria.

1.3.1 Contribution to reduce man power

Nowadays, in Bangladesh, when the students go for get admitted in any private university, they or their guardian have to go to the university office to know the educational system, number of students entering any program, academic performance, job status, research, Government job, ratio of going Higher studies, passing out ratio, extra-curricular activities, etc. of the varsities. Sometimes they have to find out the running students of the varsities and communicate with them to know the information. A decision support system can easily solve these problems and make easy to know all of these without involving these people.

1.3.2 Contribution to reduce coast and time

Select a university from a large number of universities is quite difficult in the Bangladesh. The decision support system can reduce the cost and time duration of visiting any university, cost of browsing on internet, cost of involving another people to get the information.

1.4 Research Questions

Here are some questions which are tried to answer in this research:

- Has any decision support system to choose a well and high ranked private university?
- Has any university selection process with alternative university name?
- Has any process with multiple attributes in decision support system?

1.5 Expected Output

- Get help to select a high ranked university with well education system
- Get information about the future scope of the university provides
- The probability of get a good environment for study in that university
- Reduce the cost
- Reduce the time duration
- Reduce man power
- Get the best decision through this decision support system

1.6 Report Layout

The report is divided into five chapters. Different aspects of each chapter are discussed

"A Decision-Making Approach for Ranking Private Universities in Bangladesh". Each chapter has various parts explaining in detail.

- **Chapter 1: Introduction**
  This chapter discusses the important theoretical concepts behind our project. Here also discusses motivation, rational of study, research question and expected output.
- **Chapter 2: Background**
  This chapter discusses about related works, research abstract, extent of the difficulty and challenges.

- **Chapter 3: Research Methodology**
- This chapter discusses research topics and materials, methods of information collection, application requirements for statistical investigation.
- **Chapter 4: Experimental Results and Discussion**

  This chapter discusses about experimental outcomes, descriptive investigation.
- **Chapter 5: Summary, Conclusion, Recommendation and Implication for Future Research**

  This chapter discusses about summary, conclusions recommendations, further study

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CHAPTER 02

Background

2.1 Introduction

A Generic Decision Support System for ranking Private Universities in Bangladesh is a process for ranking the private universities. For ranking, first of all select some private universities basis on some criteria, like Job status, Academic Performance, Extra-Curricular Activities, Research etc. Different Decision Framework will be discussed for different applications in this section that are related in this paper.

This chapter is having details work present, related work, research summary. Details about extent of the problem. Our goals and challenges we have represented here.

2.2 Related Works

In recent times, ranking of universities and institutions has paying attention worldwide and researcher has been developed several systems to rank universities. Two most widely popular university ranking system (World University and Times Higher Education Academic Rankings) uses different criteria to rank academic institutions [3] although they do not consider many academic parameters which can properly rank the institution. In addition to, the local community in a country have no system to rank their local institutions for choosing academic institutions for taking admission. Therefore, the strategy of choosing another in line with the ideal solution (TOPSIS) [4] method was proposed by Hartono et al. [5] to decide the best rank of senior high school in Pekanbaru based on educational parameters. Weight was estimated for those attributes in this problem by using Weight allocation. On the other hand, Grey theory with TOPSIS-DEA method proposed by Jianfen Liu to measure the education quality of college [6]. In another study, Hani M. Arwag et al. tried to rank the universities of Egypt [7] using fuzzy logic. They have decided fifteen decision attributes to rank the universities with the help of fuzzy algorithm. They compared their result with some benchmark data such as QS, Webmatrix, etc. C. L. Martins proposed a decision support framework in year 2017 [8], the model can allocate internal resources for the public universities in Brazil. In this work, the Federal university was considered as the decision maker and how they allocate resources efficiently by using this model. The decision framework followed three steps such as identify existed model, find the similarities

between them and categorize according to similarities. In the year 2016, AHP (Analytical Hierarchical Process) [10] based framework was proposed to analyze the performance of a school. The criteria weights were determined by using pairwise comparison matrix and measurement scale. The findings of this work to address the performance ranking with other institutions and identify which service elements need for attention [9].

To improve and assure the educational quality of higher education and training in a university, an accreditation training process is required. In year 2019, Benmoussa N. et al. proposed a multi criteria decision framework which can minimize the accreditation revisions process. The method analyzes the internal and external criteria using the TOPSIS tool, and prioritize the coefficients required to take an effective decision. It will also help the university authority to design innovative training programs based on identify the value of different decision elements [11]. In some other study, it is seen that the additive approach produces the overall score to rank the universities of recently published rankings. Normalized procedure is used with this method to assess individual measures and combined them to get the final score. Unfortunately, it generates different results for the same data. Therefore, a multiplicative approach with aggregation function overcomes the difficulties to rank universities with additive approach [12].

2.3 Comparative Analysis & Summary

In Bangladesh, the Ministry of Education's evaluations of the officially listed private universities were determined by an evaluation committee. This board conveyed a complete analysis of the university's quantitative criteria, qualitative criteria, and statistical tables utilized in the questionnaire, field study results, and so on. This study selected a Weight allocation expert questionnaire method to calculate the weight of each index, used the Cosine Similarity method to calculate the weight, and ranked the university by classifying the 4 universities through a quartile difference approach.

This paper uses Analytical Hierarchy Process. We select Four (4) criteria and every criterion have some sub criteria. All criteria and sub-criteria shown in table 2.3.

Now primarily select 4 or more university for Ranking. And get one university which are best.

Table 2.1: All Criteria and Sub-criteria for Weight Allocation & GFEA.

Criteria	Sub-criteria
Job status	The no of Government Job, the no of Corporate Job,
Academic Performance	Ratio of Going Higher Studies, drop out Ratio, Passing out Ratio
Extra-Curricular	Debating, National Programming Contest, International Programming Contest
Research	No. of Publication, No. of Citation

2.4 Scope of the Problem

- As there is no previous documentation or research paper, so no data was found.
- As raw material for our research as our research data was kind of private information of the universities, so many problems have been faced to collect data from there.
- The implementation of this decision support system was quite difficult.
- Processing of the raw data and the calculations of the equations in this research were lengthy.

2.5 Challenges

- We need to contact with some university to collect data, also we have to explain them that what actually we want to do in our research, what the importance of our work is.
- Many data are secured by universities.
- Attribute selection is a big challenge.
- Each decision is given a weight.
- All data are not actual or fixed. Those are changed day by day.
- Data synchronization was also taking time to plan.
- Select decision framework in this system is a challenge.
- Finally, we told that actual data collection is main challenge.

CHAPTER 03

Research Methodology

3.1 Introduction

The Weight Allocation (WA) & Generic Features Extraction Approach (GFEA) are an algorithm like other algorithms. (WA & GFEA) plays an important role like other algorithms available in computer science. This report discusses the theory part and the implementation of the choosing process using the (WA & GFEA) algorithm. This process is developed very carefully with all the process. We have built this project step by step.

3.2 Data Collection Procedure

This is a selection process not needs any survey. This work requires some information about some university. First of all, choose the university is a big challenge. We select DIU, UAP, ULAB, and SU. Then we select some criteria and then all the criteria are divided by sub-criteria. Those criteria and sub-criteria are shown in fig 3.1. Then we need those 4 universities all sub-criteria's information.

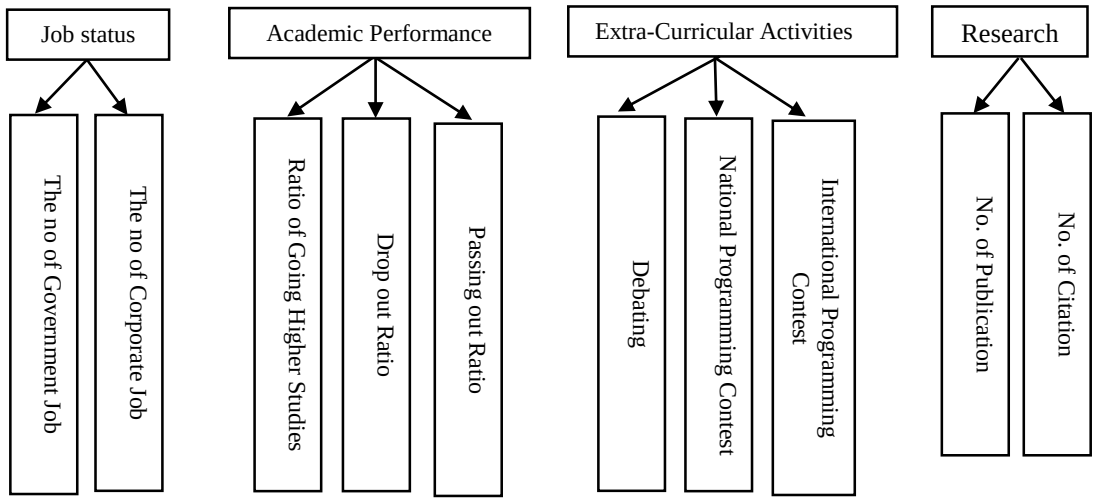

Figure 3.1. Criteria & Sub-Criteria

3.2.1 Job Status:

Job status will describe the number of getting government job and the number of corporate jobs by the students.

3.2.2 Academic performance:

The academic performance will show the ratio of student going higher studies. It will also include the drop out ratio and the passing ratio of the students.

3.2.3 Extracurricular activities:

The students performing in debating, national programming contest, international programming contest will be counted as extracurricular activities.

3.2.4 Research:

The number of publications and the number of citations will be added into the criteria named research.

3.3 Statistical Analysis

After completing the H.S.C. examination the students became worried about the future study life and the university in which they will get admission. The students who are so much determined and focused on their passion and life goal, they try their best to get their favorite subject to get their desired profession. But, if they can't get a chance to admit themselves in the public universities according to their desired subject, they try to find a better private university for further study. In that situation, those students and their guardians became so much confused about which university should be proper and best for them. Sometimes, some of those students can't find or choose a perfect and proper university according to their desired subject. Then, they admit themselves to the universities but get frustrated after a few days or months. Generally, this happens for not getting expected facilities or outcomes or sometimes both of these. Sometimes, this happens also for the financial support to that or those students doesn’t match with the rules which have been told before admission. In that situation, students get the drop of the semester or sometimes they quit their study or quit their universities.

3.4 Proposed Methodology

3.4.1 Weight denotation for Root-layer Attributes

Loads for the essential properties of a choice issue can be produced by investigating the chronicled information. Here, term frequency (TF) indicates the significance of a definite term within the overall document. Term frequency of a term‘t’ can scientifically depict to as

Term Frequency, TF = $\frac{ft,d}{\sum t' \in d ft',d}$ (1)

Whatever, each alternative has some multiple attributes. For this reason, average estimation is computed of the Term frequencies. The normal term recurrence of a property can be depicting to as:

$AvgTF_a = \frac{\sum_{i=1}^{N} TFa}{L}$ (2)

Here, a= {a_1, a_2, a_3, …., an} Along these lines, the normal TF will be observed as the last loads of the root-level properties.

3.4.1.1 For Calculating Weight for Root -Layer Attributes by making Average Term Frequency. How many students are experiencing a particular attribute that is calculated by the Term frequency calculates over the whole number of students in a generic dataset. Based on how many times an attribute is present in a dataset, the weight for that attribute is determined. The following algorithm provides a clear direction to the computation of the weights for the root layer attributes.

Algorithm-1: TF calculation

1. Start
2. Define

d ←dataset

t←rootlevelattributes

n←numberofattrbuteappearsinadataset

m←totalnumberofstudentinadataset

TF←attribute`s weight

3. Compute TF← $\frac{n}{m}$
4. End

Algorithm-2: Weight Calculation for Root-layer attributes

Step 1: Start

Step 2: Define← $number\ of\ dataset$

j← $number\ of\ attributes$

TF← $Term\ Frequency$

M← $total\ number\ of\ TF$

N← $avarage\ TF$

Step 3: Set TF←0

M← 0

N← 0

a← 1

b← 1

Step 4: M = M + TF

Increase by 1

Go to Step 3 until i = a and j = b

Step 5: Compute N = $\frac{M}{i}$

Print N

Step 6: End

3.4.2 Weight generation for Intermediate-Layer Attributes

Most of the time, intermediate level attributes are needed to consider a definite attribute so that the decision attributes can be ranked. Attributes at the intermediate level are not generally appeared to be available straightforwardly in the datasets. Be that as it may, their subsidiaries for the most part decide their importance in decision-making tasks. Weight generation for the properties of the intermediate of the road level can be computed by utilizing Cosine Similarity. Cosine similarity is a measure of similarity between two non-zero vectors of an inner product space that measures the cosine of the angle between them [1]. Assume, α and β are two non-zero vectors in a vector space model. In this way, cosines likeness between α and β can be exhibited as,

$$\text{Cosine Similarity} = \frac{\alpha \,.\, \beta}{\|\alpha\| \, \|\beta\|} \qquad (3)$$

To propagate loads for the transitional level qualities, one of the non-zero vectors, α is built with the numeric qualities estimated from the essential properties of the choice issues which is constantly 1. The other vector, β is developed with the Term Frequency of the characteristics.

$$\text{Weight of Attribute } A_j = \frac{\sum_{i=1}^{N} \alpha_i \beta_i}{\sqrt{\sum_{i=1}^{N} \alpha_i^2} \sqrt{\sum_{i=1}^{N} \beta_i^2}} \qquad (4)$$

3.4.2.1 Weight Calculation for Intermediate-Layer Attributes by using Cosine Similarity Attribute weights for intermediate layer are defined by the cosine similarity. Cosine similarity measures the cosine angle among two non-zero vectors. Intermediate layer attribute weight is denoted by the according algorithm displayed in Table V. In Table V, the two non-zero vectors α and β are defined following to the Section 3.3.

Algorithm-3: Weight Calculation for Intermediate-layer attributes

Step 1: Start

Step 2: Define W ← weight

Step 3: Set d← 0

n← 0

e← 0

$f \leftarrow 1$

for all j= 1 to n

for all i = 1 to n

Computed ← $a_i \times b_i$

Increase I by 1

End for

Computer = n + d

End for

Step 4: Set$m \leftarrow 0$

for all j = 1 to n

$m \leftarrow a_i \times a_i$

$e \leftarrow sqrt\ (m)$

End for

Step 5: Set$m \leftarrow 0$

for all i = 1 to n

$m \leftarrow b_i \times b_i$

$f \leftarrow sqrt\ (m)$

End for

Step 6: W = $\frac{n}{e \times f}$

Step 7: Print W

Step 8: End

3.2.4 Handling Uncertainty due to incomplete information.

Highlight extraction approach investigates the properties of all the gave choices to pick the most ideal option for an activity. Assume there are *N* an diverse options A_j (j=1,… .., N)for a specific activity. In this way, the choices can be characterized to as,

$$A = \{A_1, A_2, \ldots, A_j, \ldots, A_N\} \qquad (5)$$

Assume, there are *L* elementary attributes y_z (*z=1,.....,L*) linked with every simple substitute. The elementary attributes can be expressed as follows:

$$Y = \{y_1, y_2, \ldots, y_z, \ldots, y_L\} \qquad (6)$$

In this way, the fundamental properties for y_z (z=1,… .., L) of an option can be scientifically articulated to as y_{jz}; where, j (j=1,… ,N) is the number of alternatives and

z (z=1,… .,L) is the quantity of attributes .y_z denotes the z^{th} characteristic (y_z) of j^{th} elective (A_j).

Once more, the qualities of an option can be articulated to utilizing some conviction degrees against a predefined assessment grade.

3.2.5 Attribute Type

There are fundamentally two kinds of qualities in a decision support system.

3.4.4.1 Qualitative: Subjective qualities are abstractly critical. The space specialists set the numerical qualities against the emotional assessment. For example:

Average can be transformed into 0.1,

Good can be transformed into 0.5 and

Excellent can be transformed into 1.

The size and numerical assessment of the abstract evaluations of a characteristic can fluctuate contingent upon specialists' suppositions.

3.4.4.2 Quantitative: Quantitative properties depict numerical qualities. For example, the price of a computer is 100.

It is very important to handle uncertain attributes while the information of a decision problem is processed. Most probably uncertainty may obtain due to human ignorance while providing inputs. In most of the cases the input provider fizzles out to provide the downright information. Therefore, the final result using some partial data need to be concluded.

For occurrence, “quality of university” as the input for the attributes that might be attained as (Good, 0.8). It states that the quality of university is good while the input provider is 80% sure. Therefore, in this case remaining 20%, is opaqueness.

Now it can be calculated information base is developed utilizing a few on the off chance that rules. These in the event that rules are set by a gathering of area specialists.

The fundamental principles can be spoken to as follows:

$$C_G^F : if \{(I_1, J_1) \wedge \{(I_2, J_2) \wedge \dots \dots (I_n, J_T)\} \text{ then } \{(L_1, \bar{J}_1), (L_2, \bar{J}_2), \dots \dots, (L_n, \bar{J}_n)\} \quad (7)$$

Where C_G^F, {(G= (1,2,… ,N) is the quantity of rules and F= (1,2,… ,N) expresses to the quantity of attributes} expresses to the standard for the information base. I_i={I_1,I_2,...,I_T}presents properties' assessment evaluation and J_i{i∈(1,...,N)} is the level of confidence as far as I_i. L_i (i =1,2,… ,N) is the standard result and $\bar{J}_{ik}$ {(i=1,2,…,N), (k=1,2,….,N)} is the level of Belief as far as L_k.Here, $\sum J_{ik} \leq 1$and $\sum \overline{J_{ik}} \leq 1$.

Level of conviction B_{ik} can be spoken to by a fluffy enrollment work. All things considered, eq (7) can be composed as

$$C_G^F : if\{(I_1^k, J_{1kn} \text{ to } J_{1km}) \wedge (I_2^k, J_{2kn} \text{ to } J_{2km}) \wedge \dots \dots \wedge (I_T^k, J_{Pkn} \text{ to } J_{Pkm})\}$$

$$\text{then } \{(L_1, \bar{J}_{1k}), (L_2, \bar{J}_{2k}), \dots, (L_n, \bar{J}_{nk})\} \quad (8)$$

The minimum value of the attribute j for the represented alternatives is known plane value and that could be exhibited as,

$$\alpha_j = \min (e_{i,j}) \quad (9)$$

Here, i is the number of alternatives and j is the number of attributes. And α_j is the minimum value of j^{th} attribute.

Feature extraction is the simplest way to elucidate the attributes,

$$\beta_{i,j} = e_{i,j} - \alpha_j \quad (10)$$

Arithmetic difference between the smallest value of a certain attribute and similar attribute of all the alternatives is performed by computing. Where, $\beta_{i,j}$ determines the feature of j^{th} attribute of i^{th} alternatives with respect to j^{th} smallest value (α_j).

By using the following formula, the probability of mass of an attribute can be computed.

$$m_{i,j} = \prod_{i=1,j=1}^{i=N,j=L} (\beta_{i,j}, w_j) \quad (11)$$

Where, weights are represented as w, j(j= 1…….L) is the number of attributes states the weight of j^{th} attribute (e_j) with $0 < w_j \leq 1$.

The fundamental arithmetic summation formula is used to aggregate the probability masses.

$$C_i = \sum_{i=0,j=0}^{i=N,j=L} m_{i,j} \quad (12)$$

Where, C_i (i=0,….,N) is the utility of i^{th} alternative.

To make the final decision the best alternative can be approved as,

$$C = \begin{cases} \max (C_i), & for\ benefit\ attribute \\ \min (C_i), & for\ cost\ attribute \end{cases} \quad (13)$$

Here, *i* (*i*=1,2,…..N) is the number of alternatives.

CHAPTER 04

Implementation and Result Analysis

4.1 Introduction

In this research, this paper selects 4 universities for ranking. This process uses the Weight Allocation (WA) & Generic Features Extraction Approach (GFEA). In this section, we apply an algorithm for ranking and finally get results.

4.2 Experimental Results & Analysis

To grade the best university, the greatest effectiveness is taken into accounting this experiment as the highest effectiveness state the best quality. (Figure 1).

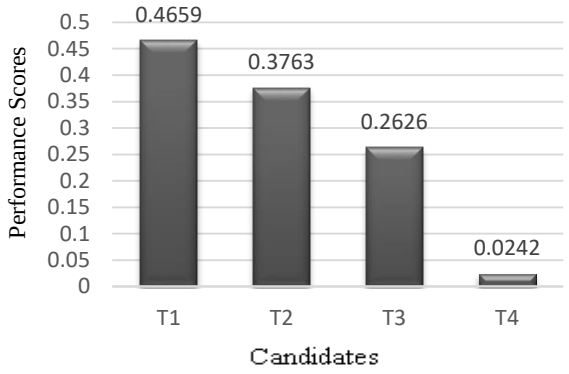

Figure 4.1. Universities Performance Evaluation

From the above graph, it becomes clear that T_1 quality is better than all the rest substitute and so, T_1 is approved as the greatest university. To reveal the exactness of the proposed methodology a relative evaluation between the system-attained results and founded benchmark score is represented in table 16 and graphical statement is displayed in Figure 2. The benchmark results are gathered from the Benchmark Admin (BA) department at DIU University.

Table 4.1. A cross-validation between experimental results and benchmark results

Location	System Obtained Results	Benchmark Results	System Inference	BA at 'P' Inference
T_1	0.4659	0.5345	T_1	T_1
T_2	0.3763	0.4342		
T_3	0.2626	0.3126		
T_4	0.0242	0.1242		

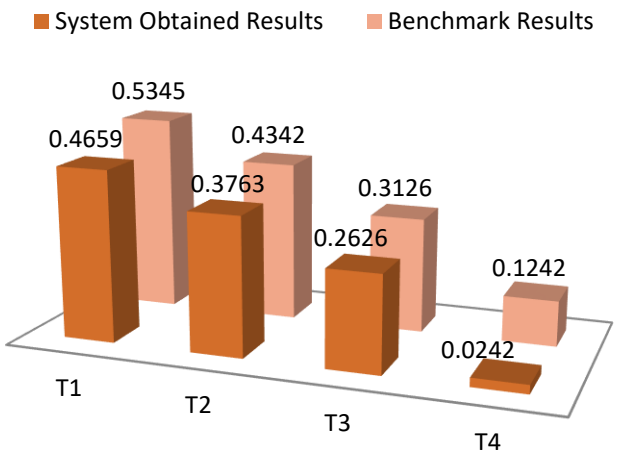

Figure 4.2. Graphical representation of cross-validation between experimental results and benchmark results

4.2.1 Numerical Study

To direct a numerical examination, various arrangements of information from four diverse private University in Bangladesh have been gathered. An aggregate sum from 38500 private colleges' understudies has been contemplated right now.

To make the trial straightforward and versatile, the sources of info and yields of the trial are communicated as follows:

X: No of Students Enrolling the program

X_1: Job status

X_2: Academic Performance

X_3: Extra-Curricular Activities

X_4: Research

X_{11}: The no of Government Job

X_{12}: The no of Corporate Job

X_{21}: Ratio of Going Higher Studies

X_{22}: Drop out Ratio

X_{23}: Passing out Ratio

X_{31}: Debating

X_{32}: National Programming Contest

X_{33}: International Programming Contest

X_{41}: No. of Publication

X_{42}: No. of Citation

By rule to rise weights to attributes, the dataset is diligently analyzed. To build the survey convenient, decision problem is arranged in a hierarchical formation. Decision attributes are organized in two layered architecture form on attribute nature and their effect on quality assessment of education (see Fig. 1).

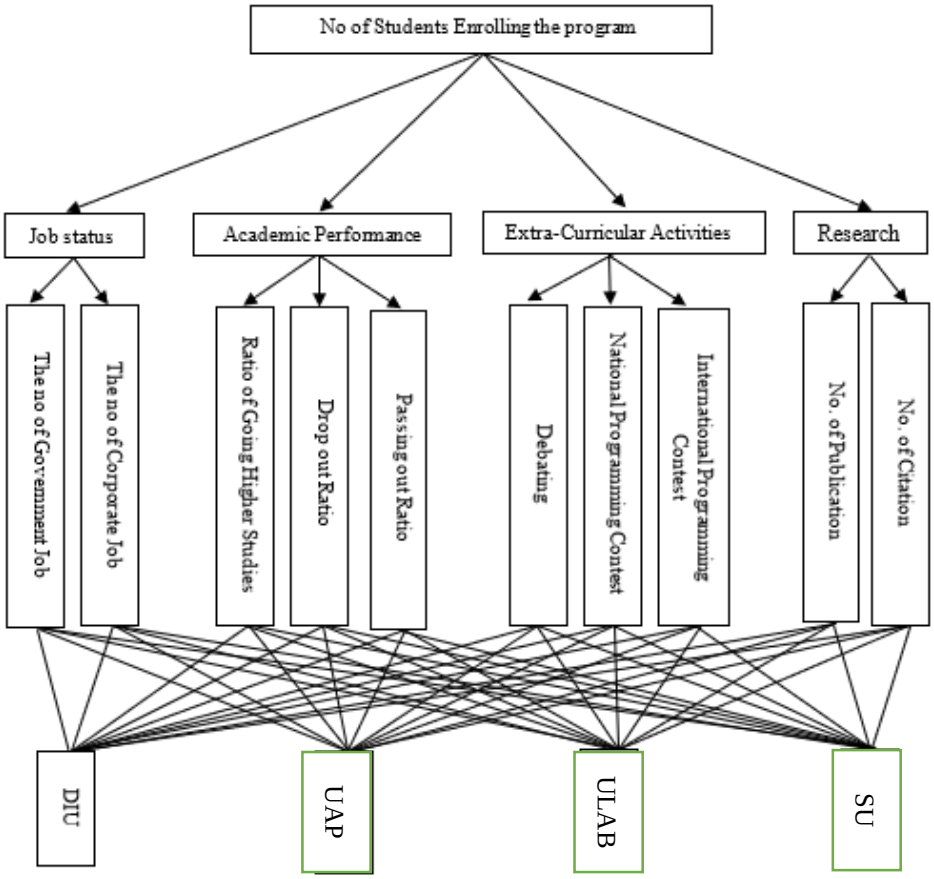

Figure: 4.3. Expression of Decision Problem in Hierarchical Structure.

For model, for a dataset as displayed in Table I, the rate of TF for $X_{23}$is deliberated as 11425/12750 =0.896 where 12750 is the whole number of students and 11425 is the number of students experiencing the attribute "Passing out Ratio". Therefore, the TF of the attribute X_{23} is 0.6498 in crib of dataset 1. Although; the average TF of X_{23} furnish its real weight which 0.8898as shown in Table IV.

The following tables (Table. I-VI) display the weighs of several attributes based on the TF calculation from several datasets. The TF of an attribute is calculated by using equation (1) and the weight is calculated by using equation (3). Algorithm-2 in the next page gives an indication for the implementation of equation (3) to generate weights for root-level attributes.

TABLE. 4.2. Enrolling Students in Daffodil International University (12750 Students in 2018)

	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
Attribute's Density	370	6075	125	775	11425	325	185	75	155	125

Term Frequency	0.0290	0.4765	0.0098	0.0608	0.8961	0.0255	0.0145	0.0059	0.0122	0.0098

TABLE. 4.3. Enrolling Students in University of Asia Pacific (10025 Students in 2018)

	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
Attribute's Density	469	3734	98	1070	8955	311	115	45	135	98
Term Frequency	0.0468	0.3725	0.0098	0.1067	0.8933	0.0310	0.0115	0.0045	0.0135	0.0098

TABLE.4.4. Enrolling Students in University of Liberal Arts Bangladesh (8775 Students in 2018)

	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
Attribute's Density	380	4045	79	1325	7825	254	111	34	113	75
Term Frequency	0.0433	0.4610	0.0090	0.1510	0.8917	0.0290	0.0126	0.0039	0.0129	0.0085

TABLE.4.5. Enrolling Students in Stamford University (6890Students in 2018)

	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
Attribute's Density	515	3995	87	840	6050	213	125	38	95	64
Term Frequency	0.0762	0.5798	0.0126	0.1219	0.8781	0.0335	0.0181	0.0055	0.0138	0.0093

TABLE.4.6. Root-Level Attributes Weight Calculation

Attributes	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
Attribute's weights	0.0488	0.4725	0.0103	0.1101	0.8898	0.0298	0.0142	0.0049	0.0131	0.0094

TABLE.4.7. Weight Calculation of Intermediate-Layer Attributes

Intermediate-level Attributes	X_1		X_2			X_3			X_4	
Root-Level Attributes	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
α	1	1	1	1	1	1	1	1	1	1
β	0.0488	0.4725	0.0103	0.1101	0.8898	0.0298	0.0142	0.0049	0.0131	0.0094
Attribute's weight	0.7760		0.6505			0.8460			0.9867	

Table4.8: Dataset for Different Universities (Year 2019)

	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
DIU	385	5975	103	812	8658	313	106	85	155	125
UAP	488	3859	140	1073	9112	348	119	55	132	94
ULAB	410	4169	85	1337	7825	242	94	38	109	75
SU	512	3797	91	869	5942	209	125	43	93	63

Table4.9. Transformation of Evaluation Grades into Numerical Values

E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}	E_{11}	E_{12}	E_{13}	E_{14}	E_{15}	E_{16}	E_{17}	E_{18}	E_{19}	E_{20}
0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0

Table 4.10. System input Acquisition

	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
T_1	$E_{15,}$ 1.0	$E_{20,}$ 1.0	$E_{15,}$ 1.0	$E_{12,}$ 1.0	$E_{19,}$ 1.0	$E_{18,}$ 0.9	$E_{17,}$ 1.0	$E_{20,}$ 1.0	$E_{20,}$ 1.0	$E_{20,}$ 1.0
T_2	$E_{19,}$ 1.0	$E_{13,}$ 1.0	$E_{20,}$ 1.0	$E_{16,}$ 1.0	$E_{20,}$ 1.0	$E_{20,}$ 1.0	$E_{19,}$ 0.95	$E_{13,}$ 1.0	$E_{17,}$ 1.0	$E_{15,}$ 0.75
T_3	$E_{16,}$ 1.0	$E_{14,}$ 1.0	$E_{12,}$ 0.6	$E_{20,}$ 1.0	$E_{17,}$ 1.0	$E_{14,}$ 1.0	$E_{15,}$ 1.0	$E_{9,}$ 1.0	$E_{14,}$ 1.0	$E_{12,}$ 1.0
T_4	$E_{20,}$ 1.0	$E_{13,}$ 1.0	$E_{13,}$ 1.0	$E_{13,}$ 0.65	$E_{13,}$ 1.0	$E_{12,}$ 1.0	$E_{20,}$ 1.0	$E_{10,}$ 0.5	$E_{12,}$ 0.6	$E_{10,}$ 1.0

Table 4.11. Rules set up for knowledgebase Construction

Rule No.	**Antecedent**	**Consequence**
1.	if ($E_{12,}$0.6)	then (E_{16}, 0.15), (E_{12} 0.8), (E_{15} 0.05)
2.	if (E_{13} 0.65)	then (E_{13},0.7),(E_{14},0.2),(E_{15},0.1)
3	if (E_{18}, 0.9)	then (E_{17},0.25), (E_{16},0.5), (E_{19},0.25)
4.	if (E_{19}, 0.95)	then (E_{19},0.5), (E_{18},0.3), (E_{15},0.2)
5.	if (E_{10}, 0.5)	then (E_{10},0.7), (E_{14},0.2), (E_{15},0.1)
6.	if (E_{15}, 0.75)	then (E_{13},0.15), (E_{15},0.8), (E_{16},0.05)
7.	if ($E_{12,}$0.6)	then (E_{11}, 0.25), (E_{12} 0.5), (E_{10} 0.25)
8.	if ($E_{17,}$0.3)	then (E_{16}, 0.3), (E_{17} 0.5), (E_{13} 0.2)
9.	if ($E_{14,}$0.65)	then (E_{12}, 0.25), (E_{12} 0.7), (E_{13} 0.05)
10.	if ($E_{11,}$0.7)	then (E_{12}, 0.2), (E_{11} 0.7), (E_{13} 0.1)
11	if ($E_{6,}$0.75)	then (E_{9}, 0.15), (E_{6} 0.6), (E5 0.25)
12	if ($E_{5,}$0.95)	then (E_{7}, 0.1), (E_{5} 0.8), (E_{9} 0.1)
13	if ($E_{9,}$0.79)	then (E_{11}, 0.1), (E_{9} 0.8), (E_{13} 0.1)
14	if ($E_{4,}$0.5)	then (E_{5}, 0.1), (E_{4} 0.75), (E_{3} 0.15)
15	if ($E_{12,}$0.9)	then (E_{10}, 0.1), (E_{12} 0.8), (E_{18} 0.1)

$$E_{12,\,0.6} = (E_{16}, 0.15), (E_{12}\ 0.8), (E_{15}\ 0.05)$$

$$= (0.8*0.15) + (0.6*0.8) + (0.75*0.05)$$

$$=0.638$$

Table 4.12. Initial Input transformation with incomplete information

	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
T_1	0.75	1.0	0.75	0.6	0.95	$E_{18,}$ 0.9	0.85	1.0	1.0	1.0
T_2	0.95	0.65	1.0	0.8	1.0	1.0	$E_{19,}$ 0.95	0.65	0.85	$E_{15,}$ 0.75
T_3	0.8	0.7	$E_{12,}$ 0.6	1.0	0.85	0.7	0.75	0.45	0.7	0.6
T_4	1.0	0.63	0.65	$E_{13,}$ 0.65	0.65	0.6	1.0	$E_{10,}$ 0.5	$E_{12,}$ 0.6	0.5

Table 4.13. Final Input transformation

	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
DIU	0.75	1	0.75	0.6	0.95	0.85	0.85	1	1	1
UAP	0.95	0.65	1	0.8	1	1	0.895	0.65	0.85	0.737
ULAB	0.8	0.7	0.638	1	0.85	0.7	0.75	0.45	0.7	0.6
SU	1	0.63	0.65	0.67	0.65	0.6	1	0.565	0.56	0.5

Table 4.14. Attributes' minimum value calculation

	X_{11}	X_{12}	X_{21}	X_{22}	X_{23}	X_{31}	X_{32}	X_{33}	X_{41}	X_{42}
DIU	0.75	1	0.75	0.6	0.95	0.85	0.85	1	1	1
UAP	0.95	0.65	1	0.8	1	1	0.895	0.65	0.85	0.737
ULAB	0.8	0.7	0.638	1	0.85	0.7	0.75	0.45	0.7	0.6
SU	1	0.63	0.65	0.67	0.65	0.6	1	0.565	0.56	0.5
Min	0.75	0.63	0.638	0.6	0.65	0.6	0.75	0.45	0.56	0.5

Table 4.15. Attributes' Feature Extraction

	X_{11}	**X_{12}**	**X_{21}**	**X_{22}**	**X_{23}**	**X_{31}**	**X_{32}**	**X_{33}**	**X_{41}**	**X_{42}**
DIU	0	0.37	0.11	0	0.3	0.25	0.1	0.55	0.44	0.5
UAP	0.2	0.02	0.36	0.2	0.35	0.4	0.15	0.2	0.29	0.24
ULAB	0.05	0.07	0	0.4	0.2	0.1	0	0	0.14	0.1
SU	0.25	0	0.01	0.07	0	0	0.25	0.12	0	0

Table 4.16. Alternatives' Utility Calculation

	X_{11}	**X_{12}**	**X_{21}**	**X_{22}**	**X_{23}**	**X_{31}**	**X_{32}**	**X_{33}**	**X_{41}**	**X_{42}**	**Utility**
DIU	0	0.175	0.0011	0	0.267	0.0075	0.0014	0.0027	0.0065	0.0047	0.4659
UAP	0.0098	0.0095	0.0037	0.022	0.311	0.0119	0.0021	0.00098	0.0031	0.0023	0.3763
ULAB	0.0024	0.033	0	0.044	0.178	0.0030	0	0	0.0013	0.0009	0.2626
SU	0.0122	0	0.0001	0.0077	0	0	0.0036	0.00058	0	0	0.0242

4.3 Inference Using Feature Extraction Approach

After successfully converting attribute's inputs into the numeric values, the least value for each definite attribute of each substitute that needs to be computed. Attributes plane value for the given alternative can be calculated using equation (9) as shown in Table 13.

After attaining the plane values, the features banished for every attribute is confirmed by using formula (10).

Finally, the probability weight for each attribute is computed by using equation (11). The aggregated probability weight of all the attributes of substitute gives its effectiveness.

4.4 Discussion

In the era of modern science, the uses of computers are being increased day by day almost everywhere involving developing countries and there should be needed a perfect planning. For this reason, GFEA has a high appreciation. Such as private universities ranking using GFEA is significant for us. The result of preprocessed data is demeanor to generate the quest properly and easily. It is very significant to make each and every data be changed in accordance with the requirement of the algorithm in order to accomplish this technology.

CHAPTER 05

Conclusion & Future Work

5.1 Conclusion

In this process, we have made a decision support framework, which will rank the private universities and it makes easy to take decision appropriately. We have discussed the approach of this project here. We have built a decision support system by using Weight Allocation (WA) & Generic Features Extraction Approach (GFEA).

5.2 Future Work

The process we have used to build our project the Weight Allocation (WA) & Generic Features Extraction Approach (GFEA), which is a structured technique for organizing and analyzing complex decisions. This technique is based on mathematics and psychology. Our project on choosing the more proper and better private university for students is related to mathematics and psychology.

In the future, if anyone does study or research on this project then, he or she might research those topics such as –

- In In this paper we work with four universities but in future we shall try to work with all the private universities even public universities all over the country.

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A-DECISION-MAKING-APPROACH-FOR-RANKING-PRIVATE-UNIVERSITIES

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