
بسم الله الرحمن الرحيم

A Study of TOPSIS in Classical, Fuzzy, Intuitionistic Fuzzy and Neutrosophic Environments

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Dedicated

To

My loving parents, especially to my father, May ALLAH ALMIGHTY bless him with healthy life.

My beloved wife

Without whose support it was very difficult for me to complete this thesis.

My esteemed supervisor

Dr. Muhammad Saeed

Without whose encouragement and humbleness, I cannot even start my thesis.

DECLARATION

I **Muzammil Ali** S/O **Ali Muhammad** ID: ***12002109003***. Session **2012-2014** hereby declare that the matter printed in the thesis titled "**A Study of TOPSIS in Classical, Fuzzy, Intuitionistic Fuzzy and Neutrosophic Environments**" is my own work and has not been printed, published and submitted as research work, thesis or publication in any form in any University, Research institution etc. in Pakistan or Abroad.

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ABSTRACT

Multi Criteria Decision Making uses different techniques to find a best alternative from multi-alternative and multi-criteria conditions. TOPSIS is an important practical technique for ranking and selection of different alternatives by using distance measures. Classical TOPSIS uses *crisp* techniques for the *linguistic assessments*, but due to imprecise and fuzziness nature of the linguistic assessments, there must be some tools to deal with the vague information. Therefore, it is necessary to involve fuzzy techniques (FS, IFS and NS). In this thesis, the algorithms of crisp TOSIS, Fuzzy TOPSIS, Intuitionistic Fuzzy TOPSIS and Neutrosophic TOPSIS are discussed. Examples related to each type of TOPSIS are solved. Finally, it is tried to compare all the discussed techniques.

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Muzammil Ali

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LIST OF ABBREVIATIONS AND ACRONYMS

AFDM	Aggregated Fuzzy Decision Matrix
AHP	Analytic Hierarchy Process
ANDM	Aggregated Neutrosophic Decision Matrix
ASVNDM	Aggregated Single Valued Neutrosophic Decision Matrix
AWIFDM	Aggregated Weighted Intuitionistic Fuzzy Decision Matrix
AWM	Aggregated Weight Matrix
AWNDM	Aggregated Weighted Neutrosophic Decision Matrix
CC	Closeness Coefficient
DEA	Data Envelopment Analysis
DM	Decision Maker
FDM	Fuzzy Decision Matrix
FNIS	Fuzzy Negative Ideal Solution
FPIS	Fuzzy Positive Ideal Solution
FS	Fuzzy Sets
FST	Fuzzy Set Theory
F-TOPSIS	Fuzzy TOPSIS
FTST	Fuzzy TOPSIS-Based Software Tool
IFS	Intuitionistic Fuzzy Sets
IFWA	Intuitionistic Fuzzy Weighted Averaging Operator
IF-TOPSIS	Intuitionistic Fuzzy TOPSIS
IVF	Interval Valued Fuzzy
IVIFS	Interval Valued Intuitionistic Fuzzy Sets

LV	Linguistic Variable
MADM	Multi Attribute Decision Making
MCDM	Multi Criteria Decision Making
MODM	Multi Objective Decision Making
NAFDM	Normalized Aggregated Fuzzy Decision Matrix
NIS	Negative Ideal Solution
NL	Neutrosophic Logic
NS	Neutrosophic Sets
PIS	Positive Ideal Solution
SMART	Strategic Measurement Analysis and Reporting Technique System
SVNN	Single Valued Neutrosophic Numbers
SVNWAO	Single Valued Neutrosophic Weighted Averaging Operator
SVN-TOPSIS	Single Valued Neutrosophic TOPSIS
TFN	Triangular Fuzzy Number
TOPSIS	Technique for Order Preference by Similarity to Ideal Solutions
WAO	Weighted Averaging Operator
WNDM	Weighted Normalized Decision Matrix

1 INTRODUCTION

1.1 Decision making and its importance

Due to the competition in all trades of life the roll of decision making in all disciplines is becoming so much vital than ever before. Timely and a correct decision in multi-alternative and multi-criteria environment are not so simple. Multi Criteria Decision Making (MCDM) deals with real life scenarios where one has to deal with such decision-making problems and hence, the reason that MCDM is one of the most flourishing branch of Operation Research.