Identifying Citation Classics in Fuzzy Decision Making Field using the Concept of H-Classics

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Introduction

Citation classics are used to designate those highly cited papers of a scientific discipline.

Citation classics help to discover potentially important information for the development of a discipline and also to understand the past, present and future of its scientific structure.

An analysis of the citation classics of a research field:

1. Allows to recognize the major advances in the discipline.
2. Gives a historical perspective on the scientific progress of the speciality.
3. Identifies also the main intellectual markers of the research field.

Introduction

Aim

To identify the papers considered as classic in the Fuzzy Decision Making research field.

Analyzed aspects

1. **Affiliations**: universities or institutions, authors, countries.
2. **Journals**.
3. **Concepts and thematics**.

Method

Classic methods

The traditional methods to identify citation classics consist on to set a specific threshold: **number of documents** or **citations count**.

There is no rigorous scientific argument to select this threshold and it will depend on the research field to analyze.

H-Classics

To overcome this drawback we use the H-Classics approach based on the H-index:

"*H-Classics of a research area A could be defined as the H-core of A that is composed of the H highly cited papers with more than H citations received.*"

Method

Process

The identification of the H-Classics consists on the following steps:

1. Selection of the bibliographic database.
2. Define a query to retrieve the articles and reviews of whole research field.
3. Calculate the H-index of the research field.
4. Recover the H highly cited papers that are included in the H-Core.

Method

Software tools

- **SciMAT** was used to build a knowledge base and perform a preprocessing step:
  - Authors.
  - Affiliations.
  - Keywords.

- **Wordle** was used to build the cloud tags.

Data

1 – Database

ISI Web of Science.

2 – Query

Journals AND Set_Of_TermsA AND NOT Set_Of_TermsB.

3 – H highly cited papers

70 highly cited papers in Fuzzy Sets research field

Query

(SO=("FUZZY SETS AND SYSTEMS" OR "IEEE TRANSACTIONS ON FUZZY SYSTEMS" OR
"INTERNATIONAL JOURNAL OF UNCERTAINTY FUZZINESS AND KNOWLEDGE BASED SYSTEMS" OR
"JOURNAL OF INTELLIGENT FUZZY SYSTEMS" OR "INTERNATIONAL JOURNAL OF FUZZY SYSTEMS" OR
"IRANIAN JOURNAL OF FUZZY SYSTEMS" OR "FUZZY OPTIMIZATION AND DECISION MAKING" OR
"FUZZY LOGIC AND APPLICATIONS" OR "ROUGH SETS FUZZY SETS DATA MINING AND GRANULAR COMPUTING" OR
"INFORMATION FUSION" OR "INFORMATION SCIENCE" OR
"INTERNATIONAL JOURNAL OF INFORMATION TECHNOLOGY \& DECISION MAKING" OR
"IEEE TRANSACTIONS ON SYSTEMS MAN AND CYBERNETICS PART A-SYSTEMS AND HUMANS" OR
"IEEE TRANSACTIONS ON SYSTEMS MAN AND CYBERNETICS PART B-CYBERNETICS" OR
"INTERNATIONAL JOURNAL OF GENERAL SYSTEMS" OR "APPLIED SOFT COMPUTING" OR
"SOFT COMPUTING" OR "KNOWLEDGE-BASED SYSTEMS" OR "CONTROL AND CYBERNETICS" OR
"COMPUTERS \& MATHEMATICS WITH APPLICATIONS" OR "EUROPEAN JOURNAL OF OPERATIONAL RESEARCH" OR
"EXPERT SYSTEMS WITH APPLICATIONS" OR "INTERNATIONAL JOURNAL OF APPROXIMATE REASONING" OR
"INTERNATIONAL JOURNAL OF INTELLIGENT SYSTEMS") AND
TS=("fuzzy decision making" OR "fuzzy group decision making" OR "fuzzy preference*" OR "aggregation operator*" OR
"fuzzy AHP*" OR "fuzzy analytic hierarchy process" OR "fuzzy majority" OR "fuzzy quantifier*") NOT
TS="FUZZY QUERYING") AND Tipos de documento: (Article OR Review)

Figure: Advanced query.

Results
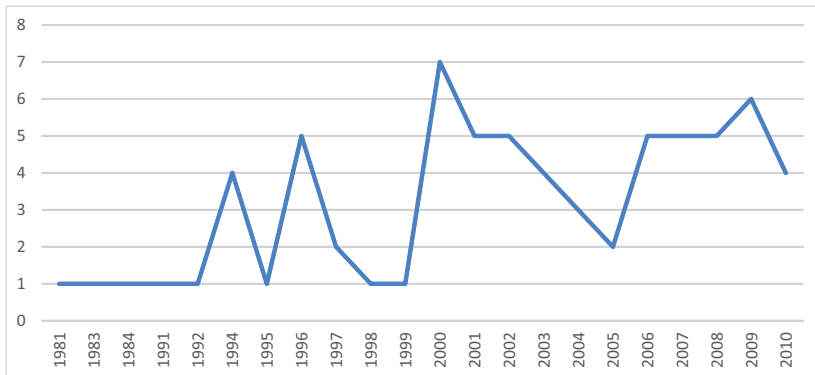
Figure: Distribution of classics per year

Results

Table: Authors with more than two classics.

Authors	#documents
Herrera-Viedma, E	16
Herrera, F	15
Chiclana, F	10
Xu, ZS	10
Yager, RR	6
Martínez, L	5
Alonso, S	4
Cheng, CH	3
Kacprzyk, J	3
Wei, GW	3
Chang, DY	2
Da, QL	2
Fedrizzi, M	2
Grabisch, M	2
Mata, F	2
Mikhailov, L	2
Nurmi, H	2
Szmidt, E	2

Results

Table: Universities or institutions with more than two classics.

Institution	#documents
University of Granada	17
Iona College	6
De Montfort University	5
Southeast University	5
University of Jaén	5
Chongqing University Arts & Science	3
Beijing Materials College	2
National Yunlin University Science & Technology	2
Polish Academy Science	2
Thomson-CSF, Central Research Laboratory	2
Tsing Hua University	2
University of Illes Balears	2
University of Trento	2
University of Turku	2

Results

Table: Countries with more than two classics.

Country	#documents
Spain	20
Peoples R China	18
USA	10
England	8
Taiwan	7
Belgium	2
Finland	2
France	2
India	2
Italy	2
Poland	2
Turkey	2

Results

Table: Documents published by each journal.

Journal	#documents
FUZZY SETS AND SYSTEMS	20
EUROPEAN JOURNAL OF OPERATIONAL RESEARCH	13
IEEE TRANSACTIONS ON FUZZY SYSTEMS	9
INTERNATIONAL JOURNAL OF INTELLIGENT SYSTEMS	8
APPLIED SOFT COMPUTING	3
EXPERT SYSTEMS WITH APPLICATIONS	3
IEEE TRANSACTIONS ON SYSTEMS MAN AND CYBERNETICS PART A-SYSTEMS AND HUMANS	3
INTERNATIONAL JOURNAL OF APPROXIMATE REASONING	3
INTERNATIONAL JOURNAL OF GENERAL SYSTEMS	2
COMPUTERS & MATHEMATICS WITH APPLICATIONS	1
CONTROL AND CYBERNETICS	1
IEEE TRANSACTIONS ON SYSTEMS MAN AND CYBERNETICS PART B-CYBERNETICS	1
INFORMATION FUSION	1
INTERNATIONAL JOURNAL OF UNCERTAINTY FUZZINESS AND KNOWLEDGE-BASED SYSTEMS	1
KNOWLEDGE-BASED SYSTEMS	1

Results

Figure: Cloud tags

Conclusion

A bibliometric analysis in order to identify the citation classics of the Fuzzy Decision Making area is performed through the concept of H-Classics.

An amount of 70 citation classics were identified. Affiliations, journals and topics covered have been analyzed.

Citation classics are composed by:

- **Techniques and tools**.
- **Decision making theory**.

Conclusion

Techniques and tools

- Computing with words: Linguistic modelling, Linguistic variables, Uncertain linguistic variables.
- Preference relations: Fuzzy preference relations, Multiplicative preference relations, Incomplete preference relations.
- Aggregations operators: OWA, IOWA, etc.
- Analytical Hierarchy Process.

Conclusion

Decision making theory

- Group decision making.
- Multicriteria decision making.
- Multiperson decision making.
- Decision support systems.
- Consensus and Majority.

Thanks for your attention.