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Fuzzy Logic: An Introduction

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This tutorial is intended to give an overview of the concepts Fuzzy Logic and illustrate them with several examples using fuzzy logic. This tutorial is also intended to serve as an introduction into the study of Fuzzy Logic. Below is an outline of the tutorial and a brief annotated bibliography of books and articles to be used a as starting point for research into this area.

Fuzzy Logic Tutorial

I. Definition and Brief History of Fuzzy Logic

II. Fuzziness and Natural Language

III. Fuzziness and Certainty

IV. Need for Fuzzy Set Theory
Fuzzy Set vs Crisp Sets
Set Operations
On Crisp Sets
On Fuzzy Sets
V. Linguistic Variables

VI. Fuzzy Logic and Fuzzy Rules

VII. Fuzzy Reasoning using Fuzzy Rules
Problem Solving Using Fuzzy Reasoning
Examples of Fuzzy Reasoning

Annotated Bibliography

Cox, Earl The Fuzzy Systems Handbook: A Practitioner's Guide to Building, Using, and Maintaining Fuzzy Systems. Cambridge, MA: AP Professional, 1994. This handbook examines the architecture, function, and operation of rule-based fuzzy systems in a business environment. It provides the reader with an understanding of the basics of fuzzy logic and fuzzy systems. Included with the handbook is a library of C++ sources code which will allow the user to implement a fuzzy system.

Giarrantano, J. and G. Riley. Expert Systems: Principles and Programming. Boston, MA: PWS-KENT Publishing Co., 1989. Chapters Four and Five of this text present an

overview of the techniques for handling uncertainty in expert systems. In particular Chapter Five presents information on the techniques of Certainty Factors, Dempster-Shafer Theory of Evidence and Fuzzy Logic. Chapters four and Five are self-contained enough that they may used to supplement a course on decision making in the face of uncertain information.

Klir, George J. and Folger, Tina A.. Fuzzy Sets, Uncertainty, and Information. Englewood Cliffs, N.J. Prentice Hall, 1988. This book is intended to be used as a text book either in an advanced undergraduate class or at the graduate level. Chapters one to three cover the fundamentals of fuzzy set theory and its connection to fuzzy logic.

Kandel, Abraham. Fuzzy Mathematical Techniques with Applications . Reading, MA. Addison-Wesley Publishing Co. 1986. This book presents an exhaustive research on the theories of fuzzy mathematics. Topics include: fuzzy functions, fuzzy events and fuzzy statistics. In addition it contains an extensive bibliography of approximately 1000 references on fuzzy set theory and its applications.

Kosko, B. Fuzzy Thinking: The New Science of Fuzzy Logic. New York NY. Hyperion. 1993. This book is a popularization of fuzzy logic and fuzzy systems. In addition to providing an overview of the technical details fuzzy logic and fuzzy systems the author provides an epistemological argument for the acceptance of fuzzy reasoning. The level of this text is intended for those with some mathematical background (i.e. set theory and college algebra).

Kosko, B. Neural Networks and Fuzzy Systems - A Dynamical Systems Approach to Machine Intelligence. Englewood Cliffs, N.J. Prentice Hall, 1992. One the most important recent works in the area of fuzzy logic and fuzzy systems. Dr. Kosko makes an argument that Aristotlean and Boolean logic are special cases of fuzzy logic. A less technical though similar argument is made in his book cited above.

McNeill, D. and Freiberger, P. Fuzzy Logic. New York NY. Simon &Schuster, 1993. This book is another popularization of fuzzy logic. It is intended for management types who need a general understanding of fuzzy logic and fuzzy systems and their applications. In addition the book provides a historical perspective of the development of these concepts in both industry and academia.

Negoita, C.V. Simulation, Knowledge-based Computing, and Fuzzy Statistics. New York, NY. Van Nostrand Reinhold Co. Inc., 1987. This text presents the conceptual foundations for the development of Fuzzy Statistics. Topics include: Fuzzy Random Variables, Fuzzy Limit Theorems, and Bayes Formula for Fuzzy Probabilities.

Terano, T., Asai, K., and Sugeno, M. (eds.) Applied Fuzzy Systems . Boston MA. AP Professional, 1989. This book is an explanation of various fuzzy applications developed in the areas of business, industry, expert systems, computers, and software. Familiarity with fuzzy logic and fuzzy set is assumed although a two chapter review is included..

Yager, R.R. and Filev, D.P. Essentials of Fuzzy Modeling and Control. New York, NY. John Wiley & Sons, Inc., 1994. The focus of this text are the essential ideas and tools necessary for the construction for the development of intelligent process controllers.

Zadeh, L.A. and Kacprzyk, J.(eds.) Fuzzy for the Management of Uncertainty. New York, NY. John Wiley & Sons Inc., 1992. This book is a collection of recent papers that focus on fuzzy knowledge based systems. In particular it presents a collection papers that survey approaches to approximate reasoning; a collection of papers addressing fuzzy inference; a collection of papers concerned with knowledge representation and elicitation: a collection of papers dealing with the implementation of fuzzy knowledge based systems; and finally a set of papers dedicated to fuzzy database systems. This book is recommended for those with a foundation in fuzzy logic and desire to get a feel for the current state of research in fuzzy knowledge based systems.