A Significant Milestones of Fuzzy Logic

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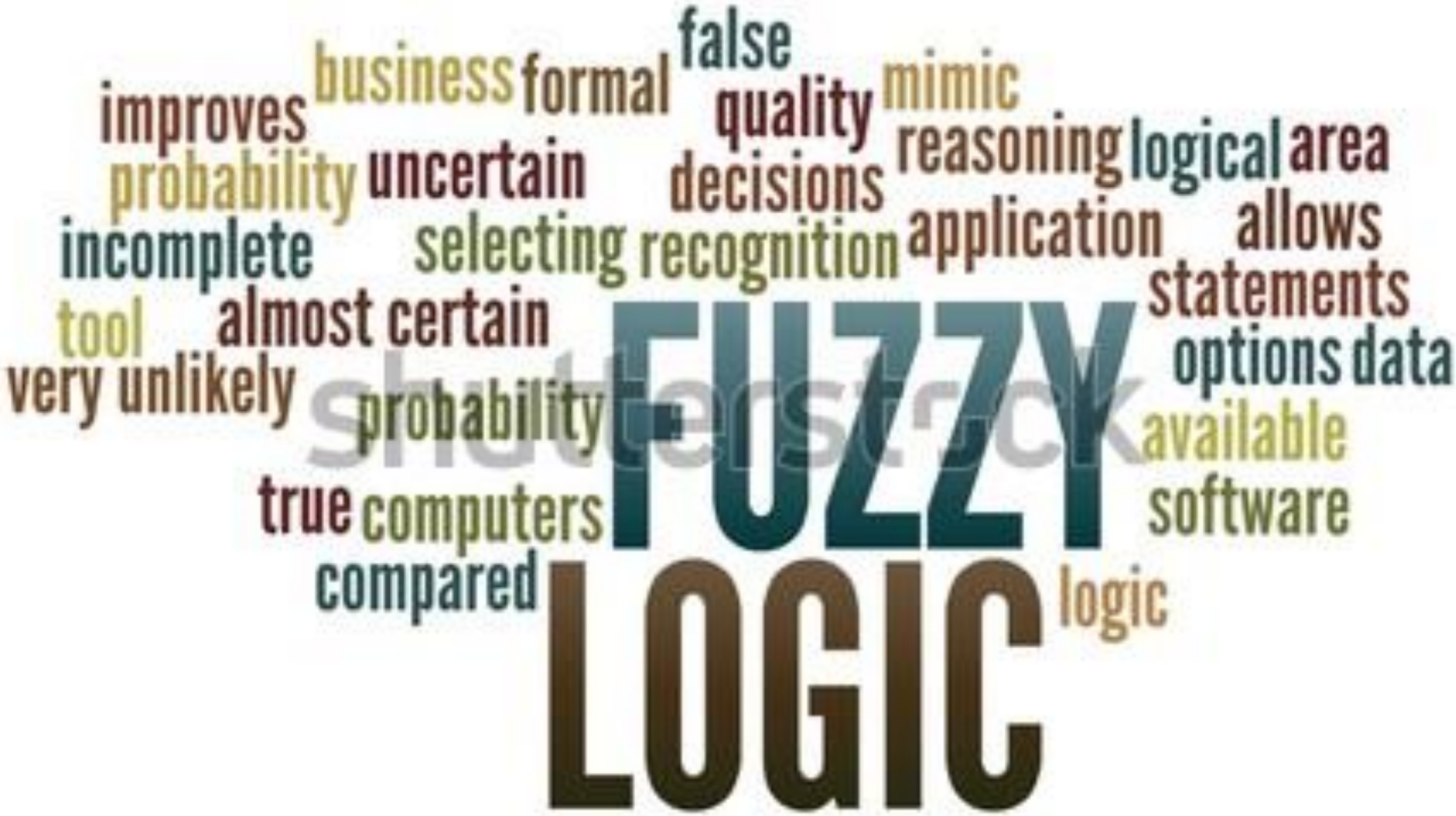
Example of Fuzzy Systém

A Cat and Temperature

Questions

We analyze some questions connected with imprecision, uncertainty, vagueness and the ability of traditional Boolean logic to cope with concepts and perceptions that are vague or imprecise in this contribution.


false
business
formal
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improves
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reasoning
logical
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probability
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decisions
application
allows
incomplete
selecting
recognition
statements
tool
almost certain
FUZZY
options
data
very unlikely
probability
available
true
computers
software
compared
LOGIC
logic

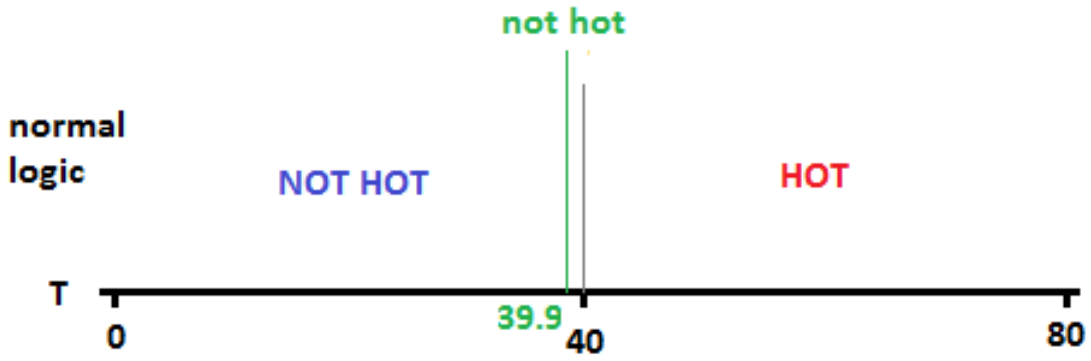
Fuzzy Logic as Multi-Valued Logic

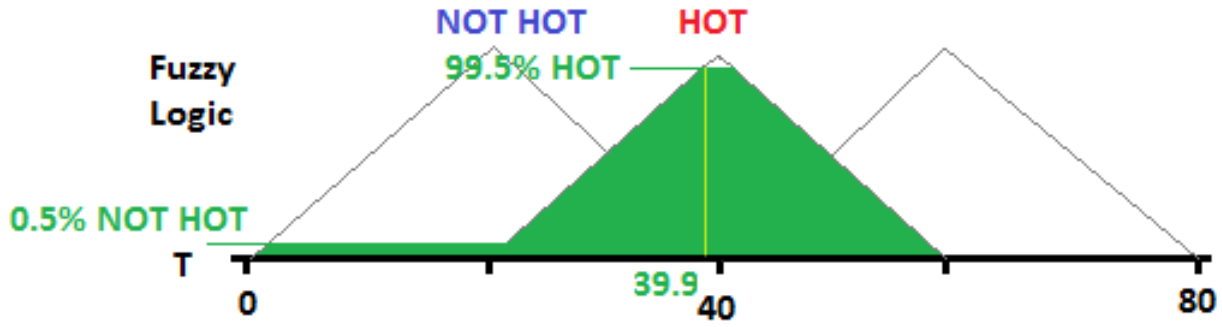
- The Fuzzy Logic
  (which was translated sometimes
  into Czech language by **„mlhavá logika“** or **„rozmazaná logika“**)
  can be considered as **Multi-Valued Logic.**

  It is founded on, and closely related to to **Fuzzy Sets Theory,** and
  successfully applied on **Fuzzy Systems.**

Differences between Logic and Fuzzy Logic

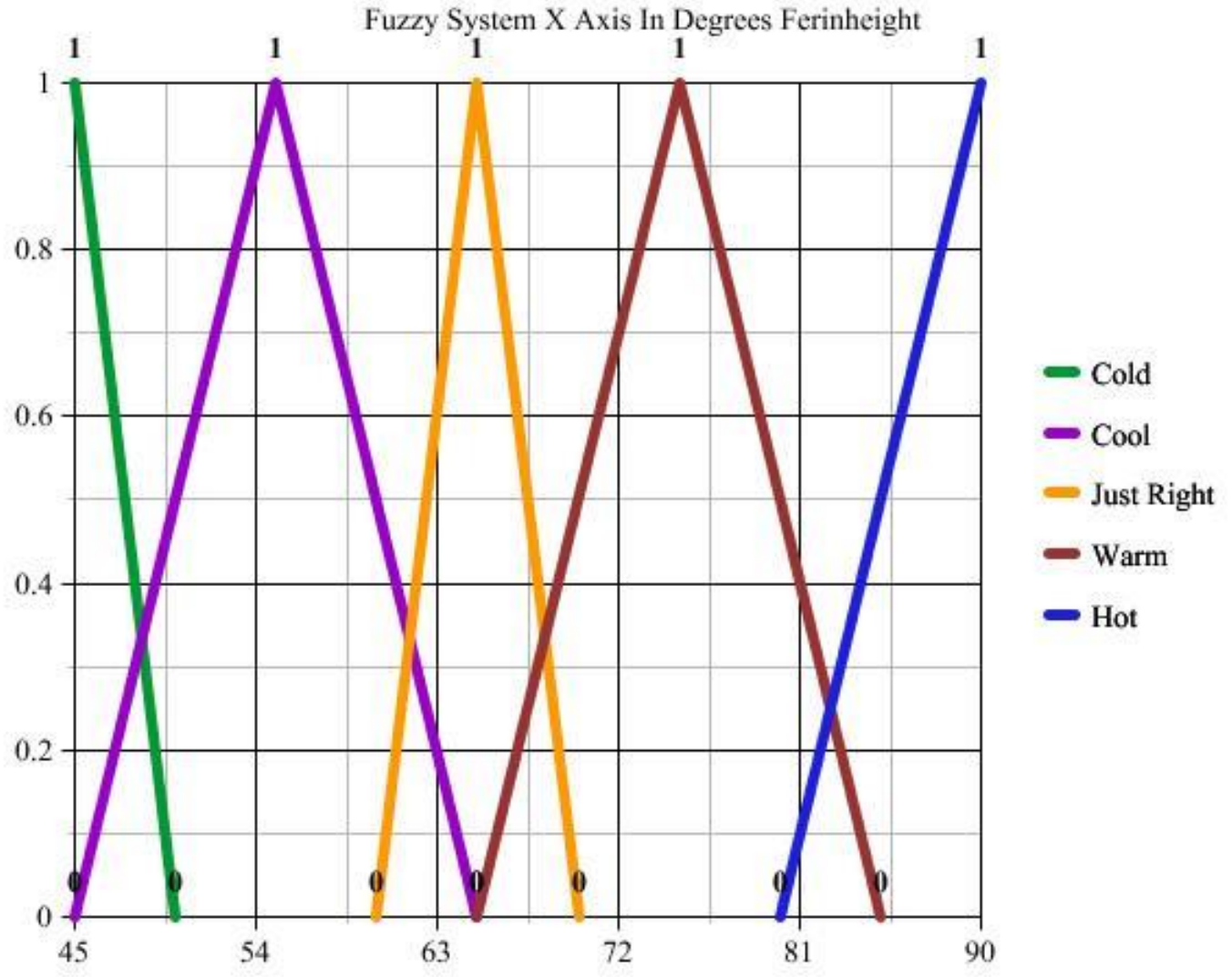
- Values: non hot or hot





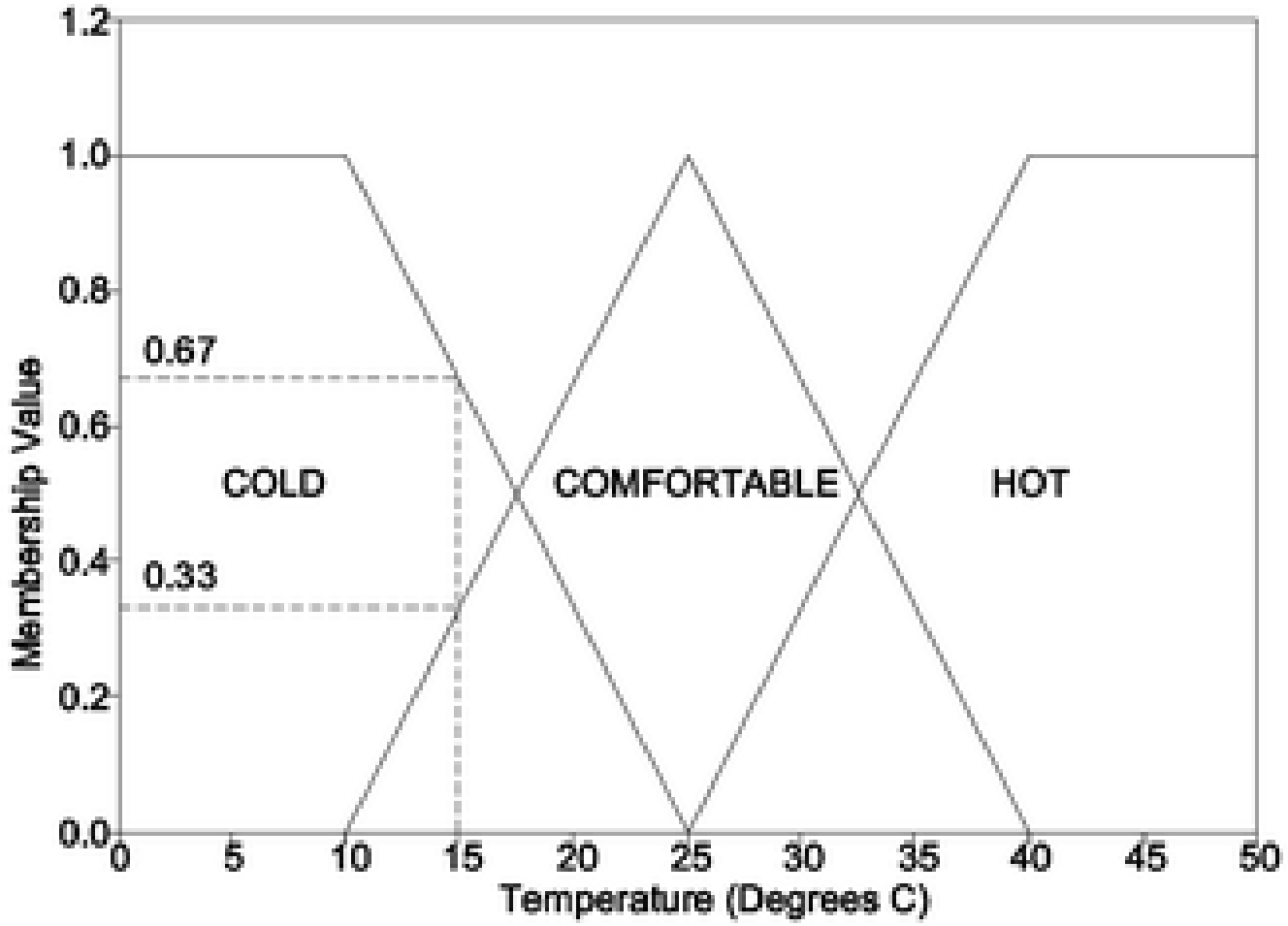
Values:

- Cold
- Cool
- Just Right
- Warm
- Hot



Value:

Cold
Comfortable
Hot



Tradition

- Usually is thought that fuzzy logic is quite recent,
- but its origins date back at least to the Greek philosophers
  and especially **Plato (428 – 347 B.C.).**
  It even be plausible to trace their origins in China and India.
  The pioneers considered about variing degrees of truth and falsehood.

  For example: In the case of colours between white and black there is a whole infinite he shade of gray. Some recent theorems show that in principle fuzzy logic can be used to model any continuous system , be it based in AI, or physics, or biology, or economics, etc.
  Scientists in many fields may find that fuzzy commonsense models are more useful, and many more accurate than are standard mathematical models (Russel, B. etc.).

Theory of fuzzy sets - Zadeh, 1965

- Fuzzy logic in the context of the theory of fuzzy sets was introduced by Zadeh (1965).

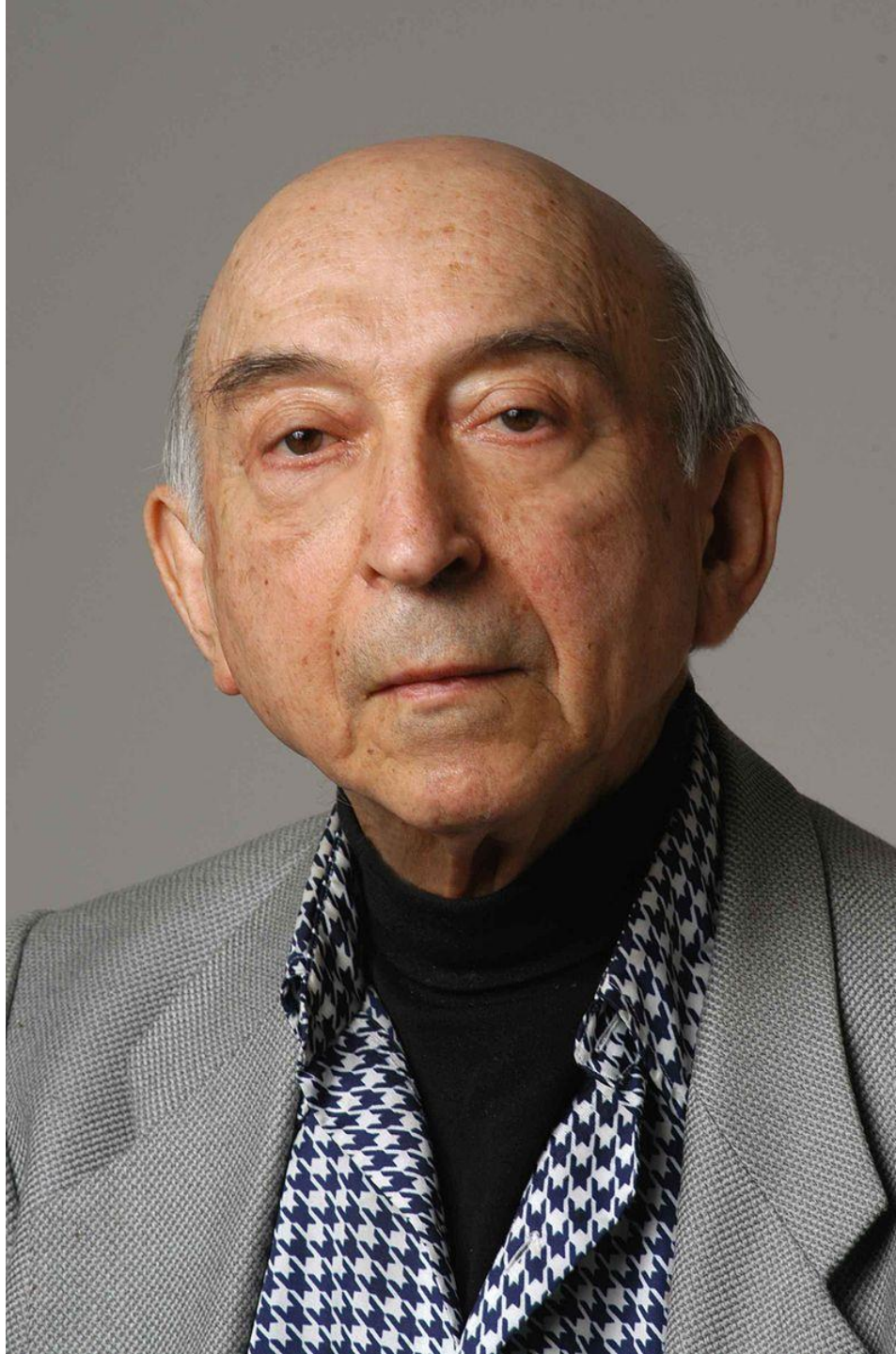
A fuzzy set assigns a degree of membership, typically a real number from the interval [0,1][0,1], to elements of a universe.

Fuzzy logic arises by assigning degrees of truth to propositions. The standard set of truth values (degrees) is [0,1][0,1],
where 00 represents “totally false”, 11 represents “totally true”,

and the other numbers refer to partial truth.

Lotfi Asker Zadeh (1921 – 2017)

- * February, 4th 1921, Baku, Azerbaijan
- Electrical Engineer of Iranian Descent
- + September, 4th, 2017, University of California, Berkeley



Different stages of fuzzying of world

Fuzzying of world is possible to divide into different stages:

- the early 1970's are the „theoretical study" stage,

- the period from the late 1970's to the early 1980's the stage of „developing application for control",
- and that from late 1980's to the present the stage of „expanding practical applications and next step in theoretical studies.

We remark some important events
in this historical development of fuzzy logic:

Fuzzy logic in a very wide sense

Fuzzy logic is often understood in a very wide sense
which includes all kinds of formalisms and techniques
referring to the systematic handling
of *degrees* of some kind.

In particular in engineering contexts
(fuzzy control, fuzzy classification, soft computing)
it is aimed at efficient computational methods
tolerant to suboptimality and imprecision.

First years in the late 19th century

- 1965 – Professor Lotfi Zadeh of the University of California at Berkeley introduces **„Fuzzy Sets Theory“.**
- 1968 – Zadeh presents „Fuzzy Algorithm“.
- 1972 – Japan Fuzzy Systems Research Foundation founded (later becoming Japan Office of the International Fuzzy Systems Association (IFSA)).
- 1973 – Zadeh introduces a methodology for describing systems using language that incorporates fuzziness.

From Fuzzy Control for Steam Engine – 1974 to IFSA - 1984

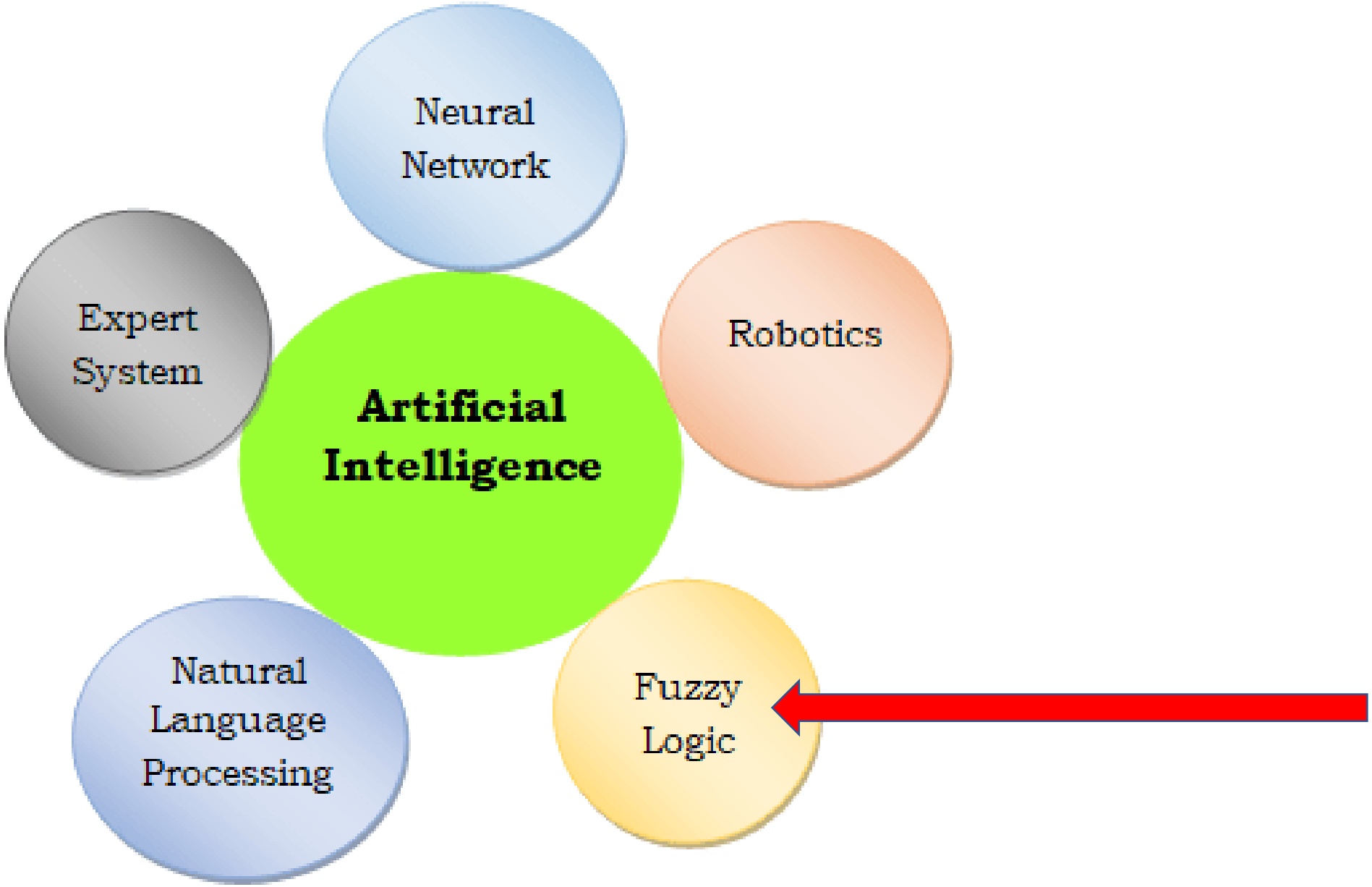
- 1974 – **Dr. Mamdani** of the University of London, UK, succeeds with an experimental Fuzzy control for steam engine.
- 1980 – F**. L. Smith & Co. A/S, Denmark,** implements fuzzy theory in cement kiln control
  (the world's first practical implementation of fuzzy theory).
- 1983 – **Fuji Electric Co., Ltd.,** implements fuzzy theory in the controll of chemical injection for water purification plants (Japan's first].
- 1984 – **International Fuzzy Systems Association** (IFSA) founded.

History of IFSA from 1984 (International Fuzzy Systém Association)

- 1985 – 1st IFSA International Conference.
- 1987 – 2nd IFSA International Conference.
  Fuzzy Logic-controlled subway systém starts operation in Sendai, Japan.
- 1988 - International Workshop on applications of Fuzzy Logic-based systems (with eight fuzzy models on display).
- 1989 – **The Laboratory for International Fuzzy Engineering Research** (LIFE) established as joint affair between the Japanese Government, academic institutes and private concerns.
  Japan Society for Fuzzy Theory and Systems founded , etc.,

Fuzzy Boom 1987
to Hájek Mathematical Fuzzy Logic

- **The year 1987 marked the start of Japan's so-called „Fuzzy boom", reaching peak in 1990.**
- 1998 - This entry focuses on fuzzy logic in a narrow sense, established **as a discipline of mathematical logic following the monograph by Petr Hájek (1998)**
  and nowadays usually referred to as **"mathematical fuzzy logic"**
  (see Cintula, Fermüller, Hájek, & Noguera 2011 and 2015).
  It focuses on logics based
  on a truth-functional account of partial truth
  and studies them in the spirit of classical mathematical logic - syntax, model theoretic semantics, proof systems, completeness, etc.;
  both, at propositional and the predicate level.


Neural Network
Expert System
Artificial Intelligence
Robotics
Natural Language Processing
Fuzzy Logic

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Precision and Significance in the Real World