Linguistic Summarization using Fuzzy Set Qualitative Comparative Analysis

Mohammad M. Korjani, Advisor: Prof. Jerry Mendel
Signal and Image Processing Institute

Objective
- Develop a new Computing With Words (CVW) technique to generate rules/patterns from data and to summarize the data so that data can be transformed into knowledge.
- A methodology called Fuzzy Set Qualitative Comparative Analysis (fsQCA) is used for obtaining linguistic summarizations from data that are associated with cases.

fsQCA
- FsQCA seeks to establish logical connections between combinations of causal conditions and an outcome.
- It can also be viewed as a methodology for establishing causality, not of a single causal condition but of combinations of such causal conditions.
- FsQCA explains information in words; therefore, aids people in making subjective judgments.

Procedure
- Preparatory Steps: Choose a desired outcome, causal conditions, and determine MFs.
- Processing Steps: Find surviving causal combinations, simplify them by including substantive knowledge using counterfactual analysis.
- Summarization Steps: Connect cases to the solutions, compute coverage and consistency of solutions.

Granular Description of a Function

If \( X \) is \textit{MODOERATE} and \( Y \) is \textit{HIGH}

Then \( Z \) is \textit{HIGH}.

Democracy
Summarize \textbf{Breakdown of Democracy} of 18 European countries between World Wars 1 and 2

- IF a country is \textit{NOT DEVELOPED} and \textit{NOT URBAN} and \textit{NOT INDUSTRIAL} THEN \textbf{BREAKDOWN OF DEMOCRACY}.
- OR
- IF a country is \textit{UNSTABLE} THEN \textbf{BREAKDOWN OF DEMOCRACY}.

Auto MPG
Summarize causal combinations that explain \textit{LOW MPG} cars (195 cars with model years from 1970 to 1982)

- IF Horsepower is \textit{HIGH} and Wight is \textit{NOT LIGHT} and Acceleration is \textit{NOT HIGH} THEN MPG IS LOW.
- OR
- IF Horsepower is \textit{NOT HIGH} and Wight is \textit{HEAVY} and Acceleration is \textit{NOT LOW} THEN MPG IS LOW.