

A Fuzzy Cognitive Map Approach for Analyzing Impact of Social Aspects Contributing to Homelessness

Introduction: There is a lack of consensus among researchers about the exact definition of homelessness [1] but in a broader context and in this research, a person is considered homeless who "lacks a fixed, regular, and adequate night-time residence [2]". Homelessness in Vancouver is a challenge to the social development of the community. A recent survey of homeless count [3] revealed that Vancouver has witnessed 106% increase in homelessness during 2002-2005. Homelessness Partnership Initiative [4], a federal government program, is designed to reduce homeless communities in several areas including Vancouver.

There is multitude of social reasons contributing to homelessness; for instance, lack of income, addiction, cost of housing, abuse, family breakdown (single parent), conflict, eviction, etc. [4,5]. Similarly, there are many possible solutions to curb this social evil; for instance, income assistance, job training, rent supplements, motivational counselling, infant and childcare subsidy, collaboration with non-profit organizations, etc. [6-8].

It is difficult to understand the impact of social factors, on the mental state of a person, which prompt him to quit his house or remain homeless (may be due to addiction to drugs). Following are a few sample questions which would be answered by our proposed system:

- a) How much impact does family breakdown has on homelessness?
- b) Can we curb homelessness by providing motivational counselling?

Methodology: Understanding the interplay between various social factors is the main motivation behind this research project. We plan to apply Fuzzy Cognitive Map (FCM) to model this scenario. FCMs are fuzzy logic based graph structures for the representation of causal reasoning [9]. FCMs are applicable to soft knowledge domains as their structures help systematic causal propagation. These graph structures describe the behaviour of an intelligent system using concepts, representing entities, states, variables or characteristics of the system, here the social factors. Each node in FCM represents a concept $C_i \in C = \{C_1, C_2, \dots, C_n\}$, where C is the set of concepts. Similarly, each arc (C_i, C_j) is directed as well as weighted, and represents causal link between concepts, showing how concept C_i causes concept C_j . The arc weights are associated with a weight value matrix E_n , which is $n \times n$ square matrix with each $E_{i,j}$ having values in $[-1, \dots, 1]$. Weights can be one of three possible types:

$$E_{i,j} \begin{cases} < 0 \text{ implies casual decrease, i.e., } C_j \text{ increases (decreases) as } C_i \text{ decreases (increases)} \\ = 0 \text{ implies no causality} \\ > 0 \text{ implies casual increase, i.e., } C_j \text{ increases (decreases) as } C_i \text{ increases (decreases)} \end{cases}$$

If $E_{i,j}$ takes on discrete values $\{-1, 0, 1\}$, then the FCM is called simple or crisp FCM. Fig 1 shows one such sample FCM structure.

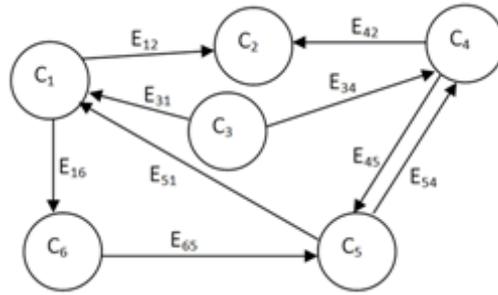


Figure 1: Sample Fuzzy Cognitive Map Structure.

FCM offers a more flexible and powerful framework for representing human knowledge and for reasoning, unlike traditional expert system that explicitly implement “IF/THEN” rules [9], it emphasizes the connections of concepts as basic units for storing knowledge, and the structure represents the significance of system. It is an advantageous tool for the design of knowledge base and the modelling of complex social systems.

Expected result: This research project aims to design a fuzzy logic based cognitive map to model the impacts of various social factors on homelessness. There are some positive factors that help in controlling this problem; and some negative factors that promote the magnitude of this problem. Both types of factors co-exist, so it will be interesting to analyze their interactions and to see how they influence homelessness.

References

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