

Optimization of Terminal Aerodrome Forecast

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Abstract— Weather forecasting is a critical application in meteorology and has been a standout amongst the most scientifically and technologically difficult issues extreme and broad. Climate determining is an capricious procedure that includes various particular fields of mastery. A fuzzy logic based methodology can be implemented with the Case based Reasoning (CBR) system. CBR and fuzzy set theory both have their own capabilities so that we combine both of them then we can get a strong solution to solve a problem. Case Based Reasoning is method of solving a new problem with the help of old solutions.

According to fuzzy k-nn based prediction algorithm we can get the predictable parameters such as visibilities, cloud ceilings. This paper emphasis on the comparative study of case based reasoning and fuzzy logic. In this paper we discuss about the Mamdani's method implementation upon the twelve factors required in TAF (Terminal Aerodrome Forecast).

Keywords— Weather forecasting, Fuzzy Logic, Mamdani Method, Fuzzy k-nn based algorithm, Case based Algorithm

I. INTRODUCTION

A. TERMINAL AERODROME FORECASTING

The climate is in condition of consistent change driven comprehensively by sunlight based vitality and by vitality got from the pivot of the Earth. Latitude, land masses and sea streams focus climate includes on a globe scale. In this we predict the wind speed, temperature, etc. factors around the airport. Importance of TAF is to tell whether the landing and take-off of aircrafts are safe or risky. The factors such as wind direction, pressure, wind speed, cloud ceiling height, etc. are very serious issues for flight safety.

B. CASE BASED REASONING

A case based reasoning is the retrieval methodology in which old solutions are taken into consideration and put into pool of case base then all the solutions are taken into account to produce a predictable best result. This methodology is used to get the twelve constraints used for weather forecast but we can say that the result is not accurate all the time, it just like experimental method. This methodology is not limited but can also be implemented in stock marketing (Rafiei 1999, and Xia 1997), plagiarism detection (Shivakumar and Garcia-Molina 1995), forest fire prediction (Rougegrez 1993), and protein and DNA sequencing (Pearson and Lipman 1988). CBR also utilize worse use of knowledge achievement.

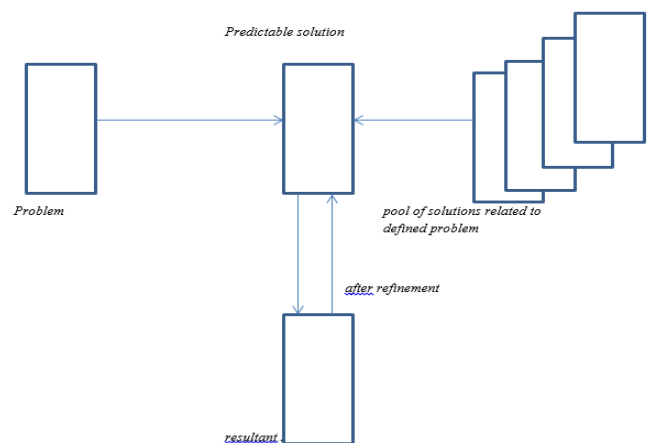


Fig 1: Basic flow of CBR

C. FUZZY K-nn Algorithm

The Fuzzy k-nn considers temporal cases. We outline a comparability measuring capacity, sim that is used to discover k-nn for a present climate case and rank them as indicated by their level of comparability to the present climate. Given two cases, each distinguished by one of a kind time records t1 and t2, sim gives back a genuine number relative to the level of likeness of the two cases such that:

$$0.0 < \text{sim}(t1, t2) \leq 1$$

All weather case are unique, sim can be identified exactly k nearest neighbours.

The three steps to use the algorithm Fuzzy k-nn are:

1. Configure similarity-measuring function.
2. Traverse case base to find k-nn.
3. Make prediction based on weighted median of k-nn.

D. COMPARISON BETWEEN CASE BASED REASONING AND FUZZY LOGIC

Case based reasoning emphasizes upon old solutions whereas fuzzy k-nn algorithm uses formula $0.0 < \text{sim}(t1, t2) \leq 1$. Case -based reasoning can be classified by two types interpretive and problem solving whereas Fuzzy logic does not such bifurcation. Fuzzy logic uses AI (Artificial Intelligence) whereas Case Based Reasoning uses solutions of old problems. Fuzzy Logic can be used to provide characterization of imprecise and uncertain information; in case retrieval to evaluate partial matches by means of fuzzy matching techniques. Both fuzzy logic and Case based reasoning both have their strengths and can be used in Terminal aerodrome Forecast, to identify the value of attributes at airport for Take-off and Landing.

II. PROPOSED WORK

As case based reasoning is not applicable where optimum solution is required. In our System, we use Mamdani's method by using formula:

$$\text{MAMD}(x, y) \equiv n$$

\vee

$$i=1 (A_i(x) \& B_i(y)).$$

(where x is A1 and y is B1 or x is A2 and y is B2 or ...).

(2) as a conjunction of implications:

$$\text{RULES}(x, y) \equiv n$$

\wedge

$$i=1 (A_i(x) \rightarrow B_i(y)).$$

(if x is A1 then y is B1 and ...).

Here, both MAMD and RULES define a binary fuzzy relation (given the interpretation of A_i , B_i and truth functions of connectives). Now given a fuzzy input $A^*(x)$ one can consider the image B^* of $A^*(x)$ under this relation, i.e.,

$$B^*(y) \equiv \exists x(A(x) \& R(x, y)),$$

Where, $R(x, y)$ is $\text{MAMD}(x, y)$ (most frequent case) or $\text{RULES}(x, y)$.

Thus one gets an operator assigning to each fuzzy input set A^* a corresponding fuzzy output B^* . Usually this is combined with some fuzzifications converting a crisp input x_0 to some fuzzy $A^*(x)$ (saying something as "x is similar to x_0 ") and a defuzzification converting the fuzzy image B^* to a crisp output y_0 . Thus one gets a crisp function; its relation to the set of rules may be analysed. For detailed information on fuzzy control see Driankov et al. 1993. (But be sure not to call minimum "Mamdani implication" — minimum is not an implication at all! For logical analysis, see e.g., Hajek 2000).

To evaluate the predictable value of 12 attributes such as date, hour, cloud amount(s), cloud ceiling height, visibility, wind direction, wind speed, precipitation type, precipitation intensity, dew point temperature, dry bulb temperature, pressure trend we can use mamdani implementation. In this we can only predict the value of attributes but cannot be so much sure as weather is unpredictable.

CONCLUSION

This paper emphasizes on the difference between the fuzzy logic and case based reasoning methodology. Also it discuss about Mamdani's proposal for predicting all the 12 attributes.

The proposed fuzzy k-nn system analyzes over a wide span of time cases specifically and definitely regarding their various remarkable qualities. The fuzzy k-nn method is not attached to particular classes nor is it obliged to utilizing just a particular restricted arrangement of predictors. Although CBR and Fuzzy logic together form a TAF but implementing Mamdani method we can get better result. Also to have a better result larger database of many decades will be needed.

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