FUZZY SUMMARISATION SYSTEM RESEARCH

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ABSTRACT: *This paper describes the implementation of fuzzy set theory and Fuz-zy Inference System (FIS) for prediction of electric load. The proposed technique utilizes fuzzy rules to incorporate historical weather and load data. The use of fuzzy logic effectively handles the load variations due to special events. The fuzzy logic has been extensively tested on actu-al data obtained from the Czech Electric Power Company (˘CEZ) for 24-hour ahead prediction. Test results indicate that the fuzzy rule base can produce results better in accuracy than artificial neural networks (ANNs) method.*

Keywords: *fuzzy sets, fuzzification, fuzzy logic, fuzzy inference system, prediction implementation, employees.*

Fuzzy logic model has been selected as an alternative method for the load forecasting problem in this paper. It is a suitable technique in case when the historical data are not real numbers, but linguistic values. This paper presents the results of a preliminary investigation of the feasibility of use of a fuzzy logic model for short-term load forecasting. In this research, historical load and weather data are converted into fuzzy set theory to produce fuzzy forecasts and defuzzification is performed to generate a point estimate for system load.

DESCRIPTION OF FUZZY INFERENCE SYSTEM. Fuzzy set A is defined in terms (U, μA), where U is relevant universal set and $\mu_A U < 0, 1 >$ is a membership function, which assigns each elements from U to fuzzy set A. The membership of the element x € U of a fuzzy set A is indicated $\mu_A(x)$. We call F (U) the set of all fuzzy set. Then „classical" set A is fuzzy set where: $\mu_A : U \rightarrow \{0, 1\}$. Thus x € A , $\mu_A(x) = 0$ and x € A , $\mu_A(x) = 1$. Let U_i, i = 1, 2, ..., n, be universals. Then fuzzy relation R on $U = U_1 \times U_2 \times ... \times U_n$ is a fuzzy set R on universal U.

Fuzzy Inference System: One of the possible applications is a fuzzy inference system (FIS) (fuzzy regulator). There are a few types of regulators. We use the regulator of type P : u = R(e) for our purposes, where the action values depend only on a regulation deviation:

Input variables: $E_i = (E_i, T (E_i), E_i, G, M)$, i = 1, ..., n.

Output variables: U = (U, T (U), U, G, M).

We consider the fuzzy regulator as the statement of the type: $R = R_1$

We do not require the output of fuzzy regulator to be a set in many cases, but we require the concrete value z_0 € Z, e.i. we want to make a defuzzification. The centroid method is the most frequently used method of defuzzification. The FIS defined in such a way is called Mamdami.

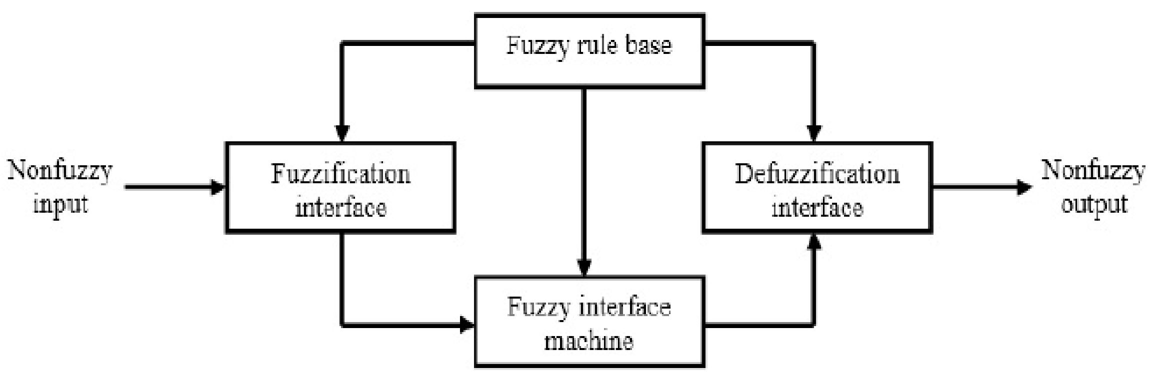

Fig. 1. Block diagram of a fuzzy inference system

DESCRIPTION FIS FOR PREDICTION OF LOAD

The four principal components of a fuzzy system is shown in Figure

The fuzzification interface performs a scale mapping that changes the range of values of input variables into corresponding universe of disco-urse. It also performs fuzzification that converts nonfuzzy (crisp) input data into suitable linguistic values, which may be viewed as labels of fuzzy sets. Fuzzy rule base, which consists of a set of linguistic con-trol rules written in the form “If a set of conditions are satisfied, Then a set of consequences are inferred”. Fuzzy inference machine, which is a decision-making logic that employs rules from the fuzzy rule base to infer fuzzy control actions in response to fuzzified inputs. Defuzzification interface performs a scale mapping that converts the range of values of output variables into corresponding universe of discourse. It also per-forms defuzzification that yields a nonfuzzy (crisp) control action from an inferred fuzzy control action [2]. A commonly used defuzzification rule known as centroid method is used here, according to which the defuzzifi-cation interface produces a crisp output defined as the center of gravity of the distribution of possible actions. This centroid approach produces a numerical forecast sensitive to all the rules.

Various membership functions have been discussed, and for the particular application data sets, their effects on model performance have been demonstrated. The proposed model has been able to generate fore-casts with a MAPE frequently below 2.8 % for working days, 3.6 % for weekends and 3.4 % for special days. The simulation results demonstrate the effectiveness of the fuzzy model for 24-hour ahead prediction.

LITERATURA

1. Mamdani, E.H.: Applications of fuzzy logic to approximate reasoning using linguistic synthesis, IEEE Transactions on Computers, Vol. 26, No. 12, pp.1182-1191 (1977)

2. Sugeno, M.: Industrial applications of fuzzy control, Elsevier Science Pub. Co. (1985)

3. Zadeh, L.A.: The concept of a linguistic variable and its application to approximate reasoning, Parts 1, 2, and 3, Information Sciences, Academic Press, New York (1975)

4. Zˇ ´AK, L. Fuzzy Objects and Fuzzy Clustering. Proc. 8th Zittau Fuzzy Colloquium, Zittau, 2000, pp 293 – 302, ISBN 3-00-006723-X.

5. Muhammad Riaz Khan, Libor ˇZ´ak and ˇCestm´ır Ondru°ˇsek, Fuzzy Logic Based Short Term Electric Load Forecasting, ELEKTRO 2001, 4th Inter- national Scientific Conference, ˇZilina, 2001, pp 19-25, ISBN 80-7100-836-2

6. Zak, L. Application Of Fuzzy Logic To Time Series. In Aplimat 2005, 4nd International Conference. Bratislava: FME STU Bratislava, 2005. p. 549-555. ISBN: 80-969264-1- 1.

7. D. Valiˇs, L. ˇZ´ak and O. Pokora, "Contribution to system failure occurrence prediction and to system remaining useful life estimation based on oil field data," Proceedings of the Institution of Mechanical Engineers, Part O: Journal of Risk and Reliability, vol. 229, no. 1, pp. 36-45, 2015.

8. D. Mazurkiewicz, "Computer-aided maintenance and reliability management systems for conveyor belts," Eksploatacja i Niezawodnosc - Maintenance and Reliability, vol. 16, no.3, pp. 377-382, 2014.

9. D. Mazurkiewicz, "Tests of extendability and strength of adhesive-sealed joints in the context of developing a computer system for monitoring the condition of belt joints during conveyor operation," Eksploatacja i Niezawodnosc - Maintenance and Reliability, vol. 3, pp. 34-39, 2010.

10. A. Glowacz, "Diagnostics of direct current machine based on analysis of acoustic signals with the use of symlet wavelet transform and modified classifier based on words," Eksploatacja i Niezawodnosc – Maintenance and Reliability, vol. 16, no. 4, pp. 554-558, 2014.

11. A. Glowacz, “Diagnostics of synchronous motor based on analysis of acoustic signals with the use of line spectral frequencies and k-nearest neighbor classifier,” Archives of Acoustics, vol. 39, no. 2, pp. 189-194, 2014.

12. S. Cornak et al. (2011, November). Lifetime extension of engine oil using additives. Presented at MendelNet. [online]. Avaiable: https://mnet.mendelu.cz/mendelnet2011/mendelnet 2011 fulltext.pdf

13. Yuldashev, A. V. (2024). PRINCIPLE OF FORMING AN INTELLECTUAL MODEL OF DIAGNOSING OBJECT STATES. Economy and Society, (3-2 (118)), 436-440.

14. Valijon o'g, Y. L. A., Saydulla o'g, N. Y., Shavkat o'g, N. S., & Ubaydulla o'g'li, X. S. (2023). CONSTRUCTION OF NUMERIC CONTROL SYSTEMS USING FUZZY MODULE. RESEARCH. UZ, 28(5), 31-37.

15. Valijon o‘g, Y. L. A., Shavkat o‘g, J. E., Hakimjon o‘g, S. H., & Farkhod o‘g, M. F. (2023). KNOWLEDGE REPRESENTATION MODELS IN ARTIFICIAL INTELLIGENCE. RESEARCH. UZ, 28(5), 22-30.

16. Valijon o‘g, Y. L. A., Davlat o‘g, X. R., & Tirkash o‘g, I. G. A. (2023). DESIGNING A SUGENO-TYPE SYSTEM USING FUZZY LOGIC. Journal of new century innovations, 43(2), 97-106.