

Chapter 9

Predictable Scenarios of Fuzzy Logic Analysis for Sprinkler Irrigation Control

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ABSTRACT

MATLAB will be utilized to validate the various irrigation systems and report it; the air temperature, wind, and humidity will be member functions to improve the efficiency of irrigation performance before the irrigation process, and the fuzzy information system consists of fuzzy rules, which are derived from information of experts or from input-output learning of the system. Rules mimic human reasoning. Mamdani method is mostly applied in the fuzzy inference technique, and the generalized bell function is used for both of temperature and wind where the triangular function used for humidity. The principles were based on the last experiments and personal experiences, and the output will change into a crisp value from this procedure of defuzzification. There are many different methods to do defuzzification, but the most common technique is centroid method. The resultant surface graphic is enough to monitor, validate, and report the irrigation system efficiency to execute and schedule the irrigation practice management.

INTRODUCTION

Soft computing technology is an interdisciplinary research field in computational sciences. At present, various techniques of soft computing, such as statistics, machine learning, neural network, and fuzzy data analysis, are being used for exploratory data analysis.

DOI: 10.4018/978-1-7998-5000-7.ch009

Proposed a fuzzy set theory in which the set boundaries were not precisely defined; but, boundaries were in fact gradational. Such a set was characterized by the continuum of grades of membership (characteristic) function which assigned a grade of membership ranging between zero and one to each object. The central concept of fuzzy set theory is a membership function, which numerically represents the degree to which an element belongs to a set. In fuzzy set theory, an element can be a member of a particular set and, at the same time, a member of a different set to a certain degree. In fuzzy rule-based systems, knowledge are represented by an if–then rules (Zadeh, 1965).

Fuzzy rules consist of two parts: an antecedent part, which states conditions on the input variable (s), and a consequent part, which describes the corresponding values of the output variable (Allahverdi, 2002; Carman & Seflek, 2004). Fuzzy application areas include estimation, prediction, control, approximate reasoning, intelligent system design, machine learning, image processing, machine vision, pattern recognition, in medical computing, robotics, optimization, civil, chemical and industrial engineering, but fuzzy applications in hydrology and meteorology, are relatively less common (Kindler, 1992).

An automated irrigation system not only allows a better water use efficiency, but it also provides all the necessary information to generate detailed water usage reports which are critical to assess and improve irrigation performance. An automated irrigation system resolves one of the most difficult irrigation problems: when and how much water to apply to ensure thorough wetting of the root zone without loss of water past the roots. The flow front of the irrigation water can easily be detected with soil, water sensors buried in the ground at the required depth (Castilla, 1997).

Agriculture plays a vital role in economy of countries throughout the globe providing raw material to industries and fulfilling the increasing needs of immensely growing population pressure. However, in spite of great agricultural importance, productivity is not up to the mark and farmer's gains are substantial. Several issues are anticipated responsible like high cost of production, inflation, poverty, agricultural risks, inadequate access to finance, inadequate availability of inputs and the most noteworthy climate change; putting huge threat to the water availability, which is prime source of irrigation in agriculture sector (Shabbir & Tahir, 2014).

Once the soil has reached desired moisture content, the sensors send a signal to a controller to turns off the power to a solenoid valve or a pump which controls irrigation. As a result, the automated irrigation system prevents water escaping past the root zone and therefore, improves the efficiency of water use (Sigrimis et al., 2001). The main goal of this investigation is produce a intelligence model using MATALB and Fuzzy logic system to monitoring, validate and reported the irrigation systems efficiency to correct the irrigation practices managements.

Table 1. List of acronyms and nomenclature

TEMP	= Temperature membership function,
WIND	= Wind membership function,
HUM	= Humidity membership function,
RAIN	= Rain fall membership function,
IE	= efficiency of irrigation performance membership outputs,
MF	= Membership function, and
FIS	= Fuzzy information system.
IF	= Irrigation efficiency

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