A New Radial Basis Function Artificial Neural Network based Recognition for Kurdish Manuscript

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ABSTRACT

During recent decades, recognizing letters was a considerable discussion for artificial intelligence researchers and recognize letters due to the variety of languages and different approaches have many challenges. The Artificial Neural Networks (ANNs) are framed based on particular application such as recognition pattern and data classification through learning process is configured. So, it is a proper approach to recognize letters. Kurdish language has two popular handwritings based on Arabic and Latin. In this paper, Radial Basis Function (RBF) of ANNs is used to recognize Kurdish-Latin manuscripts. Although, the authors’ proposed method is also used to recognize the letters of all Latin languages which include English, Turkish and etc. are used. The authors implement RBF of ANNs in MATLAB environment. In this paper, the efficiency criteria is supposed to minimize the Mean Square Error (MSE) to recognize Kurdish letters and maximize recognition accuracy of Kurdish letters in training and testing stage of RBF of ANNs. The recognition accuracy in training and testing stages are 100% and 96.7742%, respectively.

Keywords: Artificial Neural Networks (ANNs), Kurdish Letters Recognition, Mean Square Error (MSE), Radial Basis Function (RBF), Recognition Accuracy

1. INTRODUCTION

Nowadays, machines have many applications in different contexts with the ability to recognize pattern. The examples of these machines are those which capable of reading alphabetical symbols. In fact, these provide economical alternatives to user directory method. These programs save time and cost and cause less errors. One of these machines which capable of learning is ANNs (Demuth & Beale, 2002). The ANNs play an important role in pattern recognition applications. The recognition systems are used in many contexts which had different natures. One of these contexts is letters recognition. During last decades, considerable
developments are achieved in this feature such as automatic reading of postal address, bank checks and so on. Letters recognition is one of the issues which don’t have any particular rule or algorithm and it can be used different methods to design its systems and each one has its own special advantages and disadvantages. Letters recognition is a process which must be performed several repetitions in it. This repetition process must be occurred to get desirable results (Rashnodi, Sajedi, & Abadeh, 2011; Meisels, Kandel, & Gecht, 1989).

Letters recognition is one of the fields of pattern recognition, which has been the subject of considerable research (Ahangar & Ahangar, 2009). Many reports are published about word recognition in different languages such as Chinese (Yeung, 1994), Japanese (Yamada, Kami, Temma, & Tsukumo, 1989), English (Morasso, 1989; Smith, Barogoin, Sims, & Voorhees, 1994), Arabic (Almualim & Yamaguchi, 1987; Abuhaiba, Mahmoud, & Green, 1994; Gharehchopogh & Ahmadzadeh, 2012) and Farsi (Ahangar & Ahangar, 2009; Gharehchopogh & Ahmadzadeh, 2012). But yet, recognizing Kurdish letters due to the some occurred issues are in recognizing these letters aren’t performed. It is a very complicated problem which includes many changes in writing styles, size and different sides of different languages’ characters. Because, writing characters as matrix in different sizes and make them into the particular form is a difficult task. These changes can be repeated infinitely (Gharehchopogh & Ahmadzadeh, 2012; Gharehchopogh, 2011) and ANNs had proper efficiency to solve this problem. The ANNs is adopted as a new technology in computer science which supposed to simulate human brain neurons behavior. It is mostly used in many cases in the recent years such as ANNs capabilities in recognition, estimation and prediction (Gharehchopogh, 2011).

The most important advantages of ANNs are that it is used to solve problems of too complicated regular technologies which there are no algorithm solution or there are many complicated solutions for them (Sibanda & Pretorius, 2011). These features are mostly used in recognizing letters. As the people, material and others information and data are saved digitally in computers, the raw data are kept as databases in most places which are easily available. It can be used ANNs to analyze these saved statistical data (Gharehchopogh, 2011). These are generally used to simulate and solve issues which don’t follow any particular formula or regulation (Gharehchopogh & Ahmadzadeh, 2012; Gharehchopogh, 2011) and letters recognition is one of these issues. There are many relations among saved data in computers which initially must be thought and used these planned ANNs to learn patterns and the relations between data and extraction of the hidden data (Sathasivam, 2011; Gao, 2005). These networks can be used in any position in which a relation is considered among some of the variables that are as input and as output variables (recognize) are (Gharehchopogh & Ahmadzadeh, 2012). In general, the structures of the ANNs are divided in two groups which include Feed-Forward and Recurrent (Prochazka & Pavelka, 2007). The feed-Forward networks include several ANNs that one of the most important of them it is RBF of ANNs, which in this paper used of RBF for Kurdish letters Recognition. Because RBF in comparison to other ANNs reaches to the desired result in shorter time and can be get to the best results by increasing repetition in training (Demuth & Beale, 2002). The efficiency criterion in this method is to reach the minimum error which its indicator is MSE and also maximum accuracy in Kurdish letters recognition. This proposed method is also applied in recognition all the letters of other Latin languages. In this paper, RBF of ANNs are implemented in MATLAB environment.

The authors have organized the general structure of this paper as follow: In the Section 2, the authors discuss about the previously performed researches to recognize letters; in the Section 3, Latin-Kurdish letters manuscripts and how to recognize these letters are discussed; in the Section 4, RBF of ANNs and the proposed method for this network is provided. And,
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