

Morse Code Recognition System with Adaptive Fuzzy Algorithm for the Disabled

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Abstract

The Morse code is an efficient tool for the severe disabilities that is always used to represent various characters by a series of long-short sounds. To keep a fixed input speed that is difficult for the disabled people. In order to release the serious limitation of typing speed control, several algorithms were proposed to chase the typing pattern of a user, including adaptive unstable-speed prediction (AUSP), least mean square and matching (LMS&M), adaptive variable-ratio threshold prediction (AVRTP), and the back propagation neural network (BPN). It is successful to solve the problem of the irregular input speed, but the mathematic computation becomes more and more complex. In this study, we try to use fuzzy theory combining with the adaptive algorithm to recognize the Morse code, expecting to adapt all kinds of variation for users, and raising the recognition rate.

Keywords: Morse code, Disabilities, Fuzzy theory, Adaptive algorithm

Introduction

With the progress of information era, there are many assistive tools developed for the disabled to interact with their environment. The Morse code is an efficient tool for the severe disabilities that is always used to represent various characters by a series of long-short sounds. But a user must remember the miscellaneous Morse code and accept an exacting training on the stable typing speed with a fixed long-to-short ratio.

To keep a fixed input speed that is difficult for the disabled people. In order to release the serious limitation of typing speed control, several algorithms were proposed to chase the typing pattern of a user. After 1995, there are several algorithms proposed for unstable input speed by using adaptive and network signal processing techniques including adaptive unstable-speed prediction (AUSP)[1], least mean square and matching (LMS&M)[2], adaptive variable-ratio threshold prediction (AVRTP)[3, 4], the back propagation neural network (BPN)[5, 6]. The recognition rate of unstable typing pattern had significant improvement from AUSP algorithm (29.1%), LMS&M algorithm (81.6%) to AVRTP algorithm (94.0%)[4]. It's successful to solve the problem of the irregular input speed,

but the mathematic computation becomes more and more complex.

In this study, we try to use fuzzy theory combining with the adaptive algorithm [7-9] for the recognition of Morse code. The fuzzy process for its simple and fast-speed calculation is easily installed in the single-chip microprocessor as a real time recognition, and the adaptive algorithm can modify the parameters of membership functions for raising the recognition rate of Morse code. The recognition rate of the adaptive fuzzy algorithm is investigated in comparison to the previous ones.

Method

The fuzzy recognition method of Morse code is a single input single output system, and that has no standard rule to adjust the fuzzy membership functions for user's condition, so the result of Morse code recognition is not fair. This study uses an adaptive algorithm trying to adjust the parameters of the membership function and lets the system trace the user's typing pattern, expecting to adaptive all kinds of variation for user, and raising the recognition rate. The adaptive fuzzy recognition system structure is shown as the Figure 1.

The recognition procedure is described as follows:

1. To find the typing speed, the original input data I_k is normalized by function f_T ,

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