Short Paper

Towards an Educational Tool for Arabic Handwriting Learning

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ABSTRACT: *Today many students produce a wrong and illegible handwriting. The traditional approach for handwriting teaching needs a long hour of handwriting practice, and teacher needs a lot of time to check the handwriting errors. Unfortunately, this is not feasible in many cases.*

In this paper we introduce an automated educational tool for Arabic Handwriting detection errors, such as the stroke production errors, stroke sequence errors, stroke relationship errors and stroke interline errors, to help students to generate clear and readable handwriting. Firstly, we used an attributed relational graph to locate the handwriting errors. Secondly, an immediate feedback is provided to the students to correct them.

Keywords: Arabic Handwriting Teaching, Handwriting Errors, Attibuted Relational Graph, Intelligent System

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1. Introduction

In a traditional handwriting teaching system, the teacher must write an Arabic character on the blackboard. Then, the students should rewrite the character on their exercise book. After that, the teacher checked the handwriting error in student's handwriting and provides a feedback in the next time. This system can be successfully acquired only though practice regularly and for long periods. So these techniques have many drawbacks. In this context, Z. H. Hu and al., define three drawbacks of the traditional education, such as Time -consumption, Faultiness, Teacher-oriented) [7].

These drawbacks have motivated researchers to work in this field.

Some researchers focus on the view-only handwriting system so students cannot do practice through the system [2]. In this context, Tang and al., have developed an educational software tool for teaching handwriting. This tool displays some animation for the writing models on the computer screen to help the students to rewrite the displayed handwriting model. However, this tool is not interactive because the correction errors are made by the students to compare the handwriting on paper with the model displayed on the computer screen [3].

Other researchers allow students to do practice and give a feedback to indicate the handwriting errors. [2, 5, 6, 7]

In Chinese handwriting education system, Tang and al., proposed an approach for checking the stroke sequence errors. Others

researchers have been focused on the stroke production error [6]. The work proposed in [7] tries both types of errors e.g. The stroke production errors, stroke sequence errors and stroke relationship errors.

In Arabic handwriting Education systems, S. Abdou and al., proposed a tool for teaching Arabic handwriting for children using tablet PCs and on-line handwriting recognition technology. This tool recognizes the student handwriting, and detects the segments to produce a feedback to help the students to improve their handwriting. However, handwriting recognition is focused on classifying the input characters into one of the candidate character with the highest similarity [1]. But handwriting education tools require a detailed matching between the input and the template characters to locate the exact differences.

In this paper, we introduce an automated tool for Arabic handwriting education system, using tablet PC and attributed relational graph matching technology. In the First, some animation is displayed for the handwriting template, and then the student can follow it to rewrite the handwriting input characters. After that, the system requires a detailed matching between the input and the template characters to check the handwriting error. Finally, an immediate feedback is provided to the student about the location of the handwriting errors are and how to correct them.

The remainder of the paper is organized as follows: In Section II, our proposed system is described. Then, section III, is devoted to the conclusions and future works.

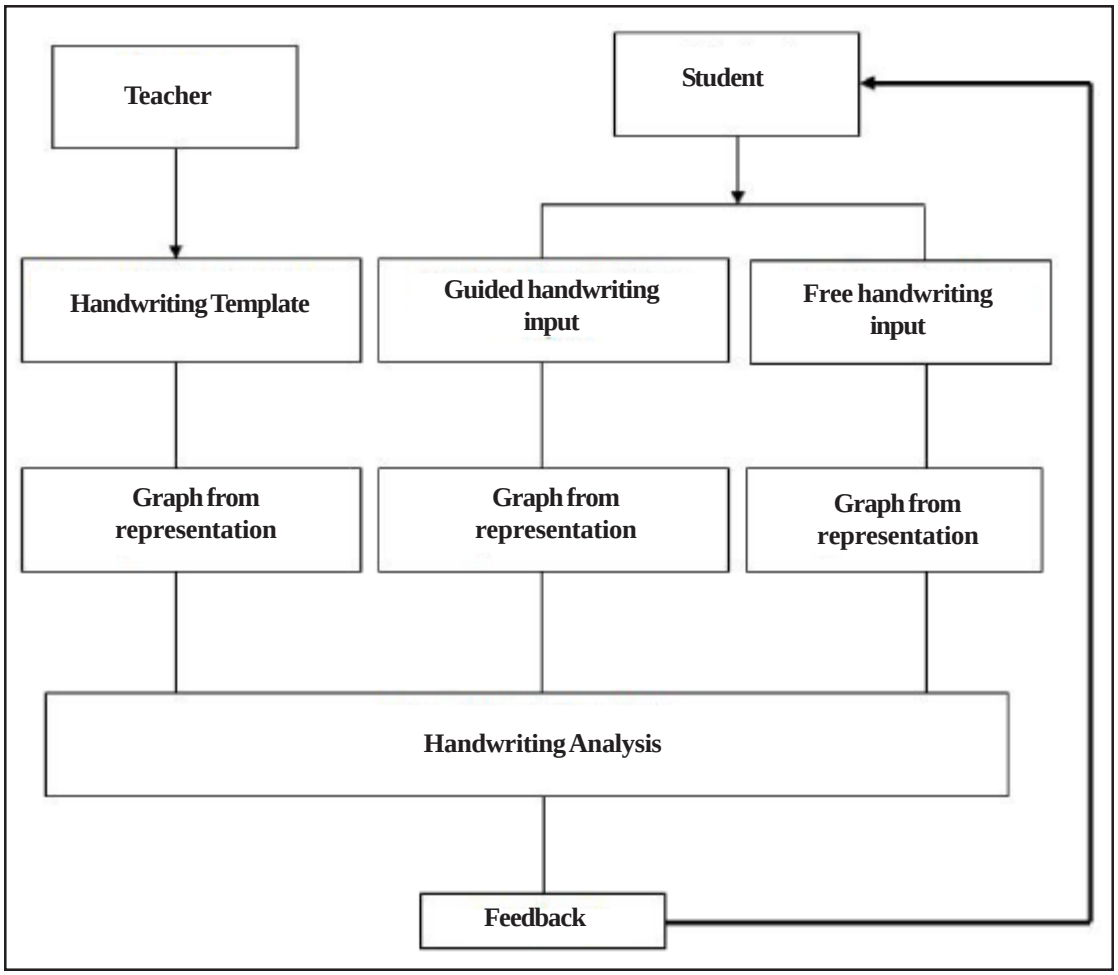

Figure 1. The Arabic handwriting education system

2. The Proposed Approach

The flaw of the proposed handwriting education system is illustrated in "*Figure* 1".

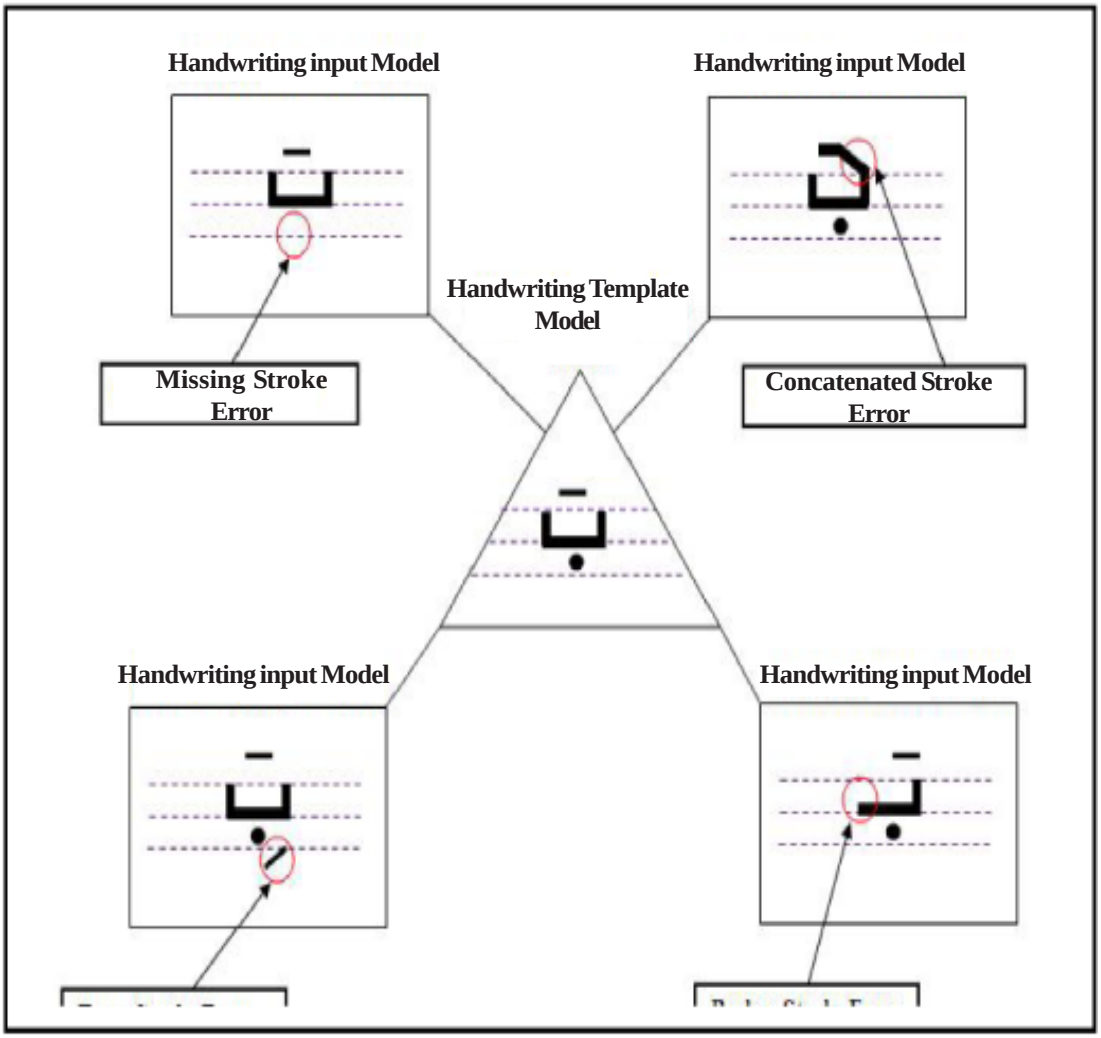

Figure 2. Stroke procduction errors

First, the input handwriting which the student has taken and the template handwriting which the student has in input to follow are both represent as attributed relational graphs(A.R.G) [6] [7], the ARGs was applied to locate the stroke production errors and stroke sequence errors. Secondly and referring to the "*Figure* 1", the nodes in the graph are used to represent the strokes in characters. The edges denote the relationship between two consecutive of strokes. In the handwriting analysis block, the error-tolerant graph matching is used to find the correspondence between handwriting template and handwriting input, through the node and edge to locate the stroke production errors "*Figure* 2", stroke sequence and stroke interline errors "*Figure* 3", In addition, the relationship difference between the edge in the handwriting template and the handwriting input are used to locate the stroke relationship errors.

Finally, a useful feedback is provided to the student about the cheeked handwriting errors and haw to correct them.

3. Conclusion and Future Work

In this paper, we have proposed an Arabic handwriting education system with automatic errors detection. We have used the attributed relation graph to represent the Arabic handwriting characters incorporating the spatial relationship information between strokes, and the spatial relationship information between the strokes and interlines.

Our system can automatically check whether there are one or multiple stroke sequence, production, relationship and interline errors in the student's handwriting.

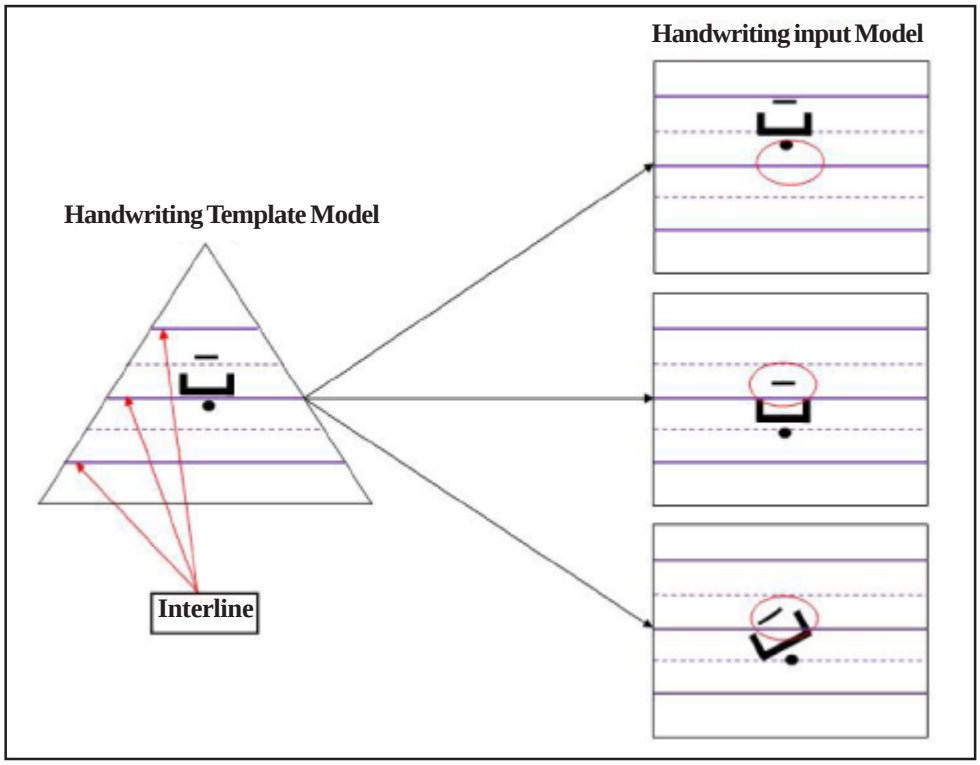

Figure 3. Stroke interline errors

In our future work, we will continue to improve the accuracy in errors detection. Extended application capability to be used on mobile phones enabled with handwriting inputs.

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