International Journal of Software Innovation
Volume 8 • Issue 1 • January-March 2020

Automatic Correction of Free Format MCQ Tests

Muaaz Habeek, University of Abdelhamid Mehri - Constantine 2, Constantine, Algeria
Charaf Eddine Dridi, University of Abdelhamid Mehri - Constantine 2, Constantine, Algeria
Mohamed Badeche, University of Abdelhamid Mehri -Constantine 2, Constantine, Algeria

ABSTRACT

Although the technology for the automatic grading of multiple-choice exams exists, it is neither efficient nor as automatic as it claims to be. All proposed methods have a predefined answer sheet format that looks like a crosswords table or a chessboard. Because of this format, all questions must have the same number of choices. Such an answer sheet is not clear, and candidates taking the exam can and will accidentally mark the wrong cell in the table. Most of them assume that there is only one possible answer for every question. This article proposes an algorithm that does not require any special format, works with all scanning resolutions and is actually fast.

KEYWORDS

Exams, Grading, Multiple Choice Questions (MCQS), Optical Character Recognition (OCR), Seven-Segment Number Method

1. INTRODUCTION

Nowadays, nearly everything is computerized, especially dumb, dull or dangerous things, like grading Multiple Choice Questions (MCQ) exam. Automatic MCQ grading is a relatively young research topic. The first system had been developed using Optical Mark Recognition (OMR) forms coupled with OMR software and dedicated scanners (Soumitra et al., 2016), these systems are oriented to big organizations and universities, but small institutes and individual teachers cannot afford these costly systems (Rakesh et al., 2013; Shubham et al., 2015; Remco, 2012).

Automatic MCQ grading systems are based on the extraction of response marks from scanned exam answer sheets. Many methods impose a special sheet format and do not support all types of MCQ such as: conventional MCQ, alternative MCQ and complex MCQ (Fisteus et al., 2013; Abuzar et al., 2016; Bouyy & Leticia, 2016).

Some systems have test generators (Francisco et al., 2016; Nithin et al., 2018) i.e. they provide the ability to generate the forms. This kind of system is often the worst because of its limitations and its strict specifications and conditions (ex: the same special form format for all exams and the candidate identification (id) is not interpreted automatically (Mahmoud & Khaled, 2018) or is written in a complex grid by checking boxes).

DOI: 10.4018/IJSI.2020010103

Many articles were published in this domain, yet the existing software fails to deliver an easy and practical solution because of their poor image processing techniques (Gokhan, 2017).

In this paper, we present a method that aims to fix all these issues and imposes as few restrictions as possible on the users (candidate / examiner). This method does not require a special sheet format, although it may require certain additions to the answer sheet, such as a rectangular box to contain the candidate id. The candidate id would be written in a more natural way by writing seven-segment digits. This method allows different number of options for questions, for example, the first question may have two options while the second may have twenty. These options do not have to have squares, they can have any type of enumeration (Karandiakr, 2010; Ammar, 2009).

2. PROPOSED SYSTEM

To develop an automatic QCM correction application, the solutions are found in the scientific results of the field of image processing. Research efforts since the 1950s have led to the collection of an impressive amount of algorithms quite diverse to realize such a system. The objective therefore, is to realize an application based on the proposed method for automatic correction, reliable, effective for a large number of answer sheets within a reasonable time, and supports many types of MCQ using only a standard computer and scanner. The application must also guarantee a very low margin of error, a high performance and an optimization in terms of time and effort. Unlike other programs (Francisco et al., n.d.), the paper layout is unknown, so the user has to input a sample sheet answer and specify its layout. The paper layout is an array of question layouts and a question layout is a set of squares. These squares are the small areas the candidate is supposed to color. The paper layout also contains a reference to a rectangle that indicates where this candidate id should be. The user can input more than one sample sheet, for example page one and page two of the same exam or two variations of the same exam. Then, these samples are put through the preparation phase and their layouts are modified accordingly.

Next, the user must choose a grading system. The data structure containing this information must be such that for every question the user can choose any combination of square states (check – not checked) and set a negative or positive grade for it.

Finally, the users inputs the set of sheets to be graded, this is when the main algorithm runs. It is divided into two phases:

- Preparation phase
- Parsing and grading phase

2.1. Preparation Phase

Scanned images must be standardized to provide the correct form for the correction. The preparation of these images is a crucial step used in image processing applications. This phase will aim at preparing the image of the scanned copies at the next phase of Parsing & grading phase.

This is where most of the image processing takes place. It takes the scanned image as input and returns as output a processed version of the input. This image has a predefined size called the uniform size. The algorithm that generates it is as follows:

- **Convert the input image to gray scale then re-size it to the uniform size using bi-linear interpolation:** As a first pretreatment step, the images are usually grayed out which reduces their size, optimizes processing, and allows the application of a number of algorithms that operate only on gray scale images;