**Paper-writing Plan**

**The following is my paper-writing plan for next two years. The proposed plan is based the software development work I have already done, instead of work starting from scratch.**

**This plan is optional depending on the availability of time released from teaching duty.**

**1:**

**Title**: Generic and Special Quadrilateral Fitting

**Abstract**: While the line fitting, hyperbolic fitting and circular fitting are very useful statistical modeling problems and used in data analytics, quadrilateral fitting is not popular. Nevertheless, It is a practical problem. The problem is stated as this: given a set of points on a plain, to find a general quadrilateral, or special quadrilateral such as rectangle, parallelogram, square, rhombus such that a certain measurement of distance between the quadrilateral and the points reaches the minimum. It is a problem of optimization and we can find a number of applications. We want to study the solvability, uniqueness and optimal algorithms.

The representation and a generic algorithms have been developed and several numeric experiments have been done using Octave.

**2:**

**Title**: An Improved Digit Recognition Based on Topologic Feature Extraction and its Application in Automatic Grading of Student’s Handwritten Quizzes

**Abstract**: Digit-recognition is one of the most useful AI routines. A problem has risen from a teaching practice in K-12 education: the students in a large class of K-12 submitted handwritten answers to a class quiz. The answer sheet is in a tabular format and most text are numbers. How do we develop a solution based on exiting or new AI to recognize the answers and grade them automatically? A straightforward solution might be to catch an image of hand-written answer sheet and recognize the digits. It turns out that we need an enhanced digit recognition algorithm. In this paper, we present such an algorithm to extract the topologic features of trajectory of the digit pictures.

Reference: **https://play.google.com/store/apps/details?id=com.systemsonweb.grading**

This system allows instructor to collect real big data for course assessment and student’s evaluations and generates reports for the course assessment and program assessment.

**Status**: The system has been developed and is already working.

**Time Frame**: It will take two weeks to write the paper

**Difficult Part**: integration of references

**Target Journal for Publication**: ACM Communication, or ACUE related the publication oppornities <https://acue.org/media-kit/publication-opportunities/>

**3:**

**Title**: A Design of Teaching and Learning Management System to Facilitate ACUE’s Effective Practice Framework

**Abstract**: ACUE’s sequence of course modules on Effective Practice Framework does not use modern educational technologies. Without using technologies, it is difficult to engage all students to participate in discussion sessions and grade manually all student’s work. This paper presents a web system that facilitates most teaching methods included in ACUE Effective Practice Framework. As a framework of web application system in general, it has the following components specifically for teaching and learning management: assignment management, classroom discussion assistant, and AI type of automatic grading engine. The assignment can be reading questions, homework, tests or project with grading rubrics. Assignment managing routines include editing, previewing, answering, grading and reviewing. Classroom discussion assistant component enables all students, instead of the dominant talkers,to contribute to the discussion topics, and monitors, records, analyzes and displays details of student’s participation and performance.

This system allows instructor to collect real big data for course assessment and student’s evaluations and generates reports for the course assessment and program assessment.

**Status**: The system has been developed and is already working.

**Time Frame**: It will take two weeks to write the paper

**Difficult Part**: integration of references

**Target Journal for Publication**: ACM Communication, or ACUE related the publication oppornities <https://acue.org/media-kit/publication-opportunities/>

**4:**

**Title:** A Course Scheduling Management System that Supports Instructor’s Teaching Preferences.

**Abstract:** Course Scheduling is a very important task of administration and management for an educational institution. Manual scheduling turns out to be very time-consuming, but on the other hand, automatic scheduling is a NP-hard problem in computer science. Any progress in this problem is of significance as it potentially saves a tremendous amount of resources for institutions. Furthermore, the current scheduling method does not support instructor’s preferences or does that inefficiently. Instructor’s preferences include subject preference and time preferences, that is, instructors desire to be able to input their preferred course and preferred time slots to teach, and let a “smart scheduler” work out the schedule that satisfies their preferences as many as possible.

This paper presents a design of such a system, including a web user interface, a database and a back-end scheduler. The key component of the system is the back-end scheduler that deals with the NP hard scheduling problem. The strategy for developing the algorithm is “hardest task first”. So-called hard task is to schedule a course session that has many requirements but has few number of choices of time slot and instructor. Essentially, user wants the smart scheduler to tell as early as possible the existence of valid schedule. An opposite scenario is that after three days of intensive computing, an inefficient scheduler reports to user non-existence of valid schedule.

**Status**: The algorithm and system have been developed and are already working.

**Time Frame**: two weeks

**Difficult part**: reference integration.

**5:**

**Title:**A Thick-Client-Thin-server Distributed System for Course Registration

**Abstract**: There are two types of architectural-level designs of web application systems, that is, thin-client-thick-server and thick-client-thin-server. A thin-client-thick-server system has a light-weight client and heavy server. A banking system is a typical thin-client-thick-server system as banks are not confident about their customer’s computers for mission critical tasks while they are confident on their own system as they can put plenty of resources to develop such a system. Many universities also use thin-client-thick-server system for student’s course enrollment. In this paper, we analyze such a design and conclude that such a design for course enrollment is inefficient. On the other hand, a thick-client-thin-server is a better choice, which tremendously reduces work load for server by utilizing client’s computing power, this means that only inexpensive hardware for system needs to be deployed to support university’s operation. In this paper we will present the thick-client-thin-server design for course enrollment, which takes a list of courses to be taken by student user and optional restrictions, and reports all valid schedules for further selection. We also present performance comparisons of two types of designs.

**Status**: The algorithm and program have been developed. A User interface is needed to be developed.

**Time Frame**: 10 days

**6**

**Title**: Enhancing the Images of Handwritten Assignment Submissions by Removing the Positioning Lines Inside

**Abstract**: It is a general requirement for students to submit typed papers to answer assignments on a Learning Management System. However, if a student’s solutions contains complicated scientific notations or hand-drawn illustrations, or school policy prohibits students from using computers, photos of answering paper may be taken by using cell phone and submitted to the Learning Management System. Unfortunately, such images have many problems, for example, they contain unwanted ruled lines that originally come from the homework book or composition book, and they are stretched or skewed, because when students take the photos in rush, cell phones are not aligned with paper perfectly. In this paper, we list some of the issues associated with the image submissions of assignment, design and implement algorithms for processing such images to improve readability for instructors to do grading. In particular, we want to straighten the images and remove the ruled lines inside.

Our algorithm is based on Hough transform , affine transform and Newton method for finding maxima.

Nowadays many online administrative services offered from government agencies also accept customer’s image submissions of application materials.

**Status**: Algorithms have been developed and implementation are half-way done.

**Time frame**: 20 days.

**Targeted Journal**: SIAM Journal for Image Processing

**7:**

**Title**: A Sequence of Processing Routines that Converts Paper Forms to Web Forms

**Abstract**: Almost any task of administration and management is executed through one or more forms. A form is a guideline for the form owner to collect information input from his/her serving customers. There are still a lot of paper forms used in administration and management in educational institutions and governments for the following reasons. (1) The cost of developing, running and maintaining web information systems is still big, (2) the form owners are unwilling to make transitions from paper form to web form because of their fear of new technologies, and (3)being used to the paper forms, customers are unwilling to transit to web forms such as the google forms because the form layout is completely different from the old forms and it takes time to train themselves to adapt new forms. However, because there are numerous advantages of web forms over paper forms, the sooner or later, agencies have to change the paper forms to web forms.

There are three primary advantages to convert existing paper forms to web forms with preserving user interface: (1) the cost of developing and maintaining the web forms is tremendously reduced (2) the form owner’s transition from paper form to web form is willing and easy because their previous efforts put in the form design get preserved and (3) the customer’s transition from paper form to web form is willing and easy because of the same form layout and other convenience of electronic forms.

In this paper, we present a design of a web application system that converts existing paper forms to web forms to preserve form layout and visual design effects. Our design is based on the analysis of the images of existing paper forms to recognize various form components and detect their locations. From the properties of form components and location information, we can construct web form components that resemble original components.

The key issue turns out to be pattern recognition in image analysis. Possible patterns are lines, boxes and checkboxes. Artificial intelligence is used to optimize the pattern recognition as the engine will accumulate the knowledge of pattern recognitions and make itself “smarter and smarter” automatically so that fewer and fewer manual corrections are needed.

The system has all necessary management routines for creating, renaming, modifying forms, and managing form data and user permissions.

**Status**: The whole system has been developed and fully tested.

**Time frame**: two weeks.

**8:**

**Title**: A Web-based Presentation Tool that is more suitable for Teaching than PPT

**Abstract**: Microsoft Power Presentation Tool (PPT) is a dominate presentation tool in business world. However, it is not very good for teaching lectures in classroom, in particular in STEM field where scientific notations and animations are required for instructional presentations. In this paper we present a design of a web-based presentation tool (WPT) that facilitates the teaching on the computer-projector setting in classroom. In addition to the basic features such as indexing, page sorter, slide show, transition, integration of multimedia contents and remote navigation that are available in PPT, WPT has these features:

(1) Instant LaTex displaying without compilation

(2) Unified Model Language (UML) supporting

(3) Making tables only using the Tab key

(4) Variety of animation methods

(5) Scheduling object appearing and disappearing, emerging and vanishing

(6) Context menu for rapidly formatting and decorating content blocks

(7) Online tools as cloud-computing web services for creating content blocks

(8) QRcode-enabled remote controlling by mobile device

(9) Freely dragging and zooming content blocks during presentation

This web-based presentation tool is particularly good for teaching mathematics, computer science, physics, engineering and business.

Reference: https://zhongyanlin.github.io/site/showcase/

**Target Journal**: Instructional Technology

**Time frame**: two weeks.