CAP 6105 Pen-Based User Interfaces

Fall 2013

http://www.cs.ucf.edu/courses/cap6105/fall2013/

Instructor: Joseph J. LaViola Jr.

Office: Engineering III Room 321
Hours: Tues. 4:00pm-5:30pm
       Wed. 6:00pm-7:00pm

Pen Computing Lab: Engineering III 208

Email: jjl@eecs.ucf.edu

If you want to email me, MAKE SURE to enter in the subject line “cap6105” followed by your name.

Course Objective and Topics

Topic in Pen-Based User Interfaces is a course designed to give students a thorough understanding of the latest techniques, algorithms, and evaluation methodologies used in designing and developing pen-, sketch-, touch-, and gesturally-based user interfaces. In addition to reading and presenting research papers, students will write several programs to reinforce concepts discussed in class and will produce a final project of their choice.

General Topics include:

1. Introduction and History of Pen- and Sketch-computing
2. C#, Visual Studio, and Windows Presentation Foundation
3. Ink Preprocessing
4. Gestural User Interfaces
5. Ink Segmentation
6. Classification Algorithms for Recognizing Ink
7. 2D Parsing
8. Sketch and Multi-touch based Interfaces
9. Evaluation Methodologies
**Syllabus**

**Week 1**

August 19, 2013 – Lecture - Introduction to Pen-based UIs
--- go over course mechanics
--- discuss the history pen computing
--- present some challenges with pen computing
--- present various applications

*Readings*


August 21, 2013 – Talk about final projects Papers discussion

**Week 2**

August 26, 2013 – Lecture - Visual Studio, C#, Tablet PC SDK

August 28, 2013 – Lecture - Windows Presentation Foundation

*Readings*


**Week 3**

September 2, 2013 – Holiday – No Class

**Assignment 1 Out**

September 4, 2013 – Lecture - Ink Preprocessing & Simple Features
--- data representation
--- filtering
--- transformation invariance
--- dehooking, cusps, and self intersections
Readings


Week 4

September 9, 2013 – Papers discussion

September 11, 2013 – Lecture - Gestural User Interfaces
-- in computer graphics/modeling
-- gesture structure - 1 or multi-stroke
-- gesture invocation - buttons & button placement
-- gesture learning - existing notations, tutorial, embedding in GUIs
  visual (pre & post) feedback
-- FSAs
-- punctuated gestures

Assignment 1 due Assignment 2 out

Readings


**Week 5**

September 16, 2013 – Papers discussion

September 18, 2013 – Lecture - Ink Segmentation
  -- spatial segmentation
  -- temporal segmentation

**Readings**


**Week 6**

September 23, 2013 – Papers discussion

  -- Feature Extraction

**Assignment 2 due Assignment 3 out**

**Week 7**

  -procedural, template matching
  -linear classifiers
  -SVMs
  -K-nearest neighbor
  -AdaBoost

**Readings**


October 2, 2013 – Papers discussion

Week 8

October 7, 2013 – Lecture - Parsing Ink

- parsing mathematics
- multi-stage
- parsing drawings
- parsing diagrams
  - 2D grammars
  - graph rewriting
  - procedurally coded syntax rules
  - stochastic grammars

Assignment 3 due Assignment 4 out

Readings


October 9, 2013 – Papers discussion

Week 9

October 14, 2013 – Lecture - Sketch-based Interfaces and Understanding

- multi-domain sketch understanding frameworks

Readings


October 16, 2013 – Papers discussion

**Week 10**

October 21, 2013 – Lecture - Evaluation Methodologies
-- user studies
-- qualitative vs. quantitative
-- summative vs. formative

**Assignment 4 due**

*Readings*


October 23, 2013 – Papers discussion

**Project proposals due**

**Week 11**

October 28, 2013 – Student paper presentations

**Project proposal decisions made**

October 30, 2013 – Student paper presentations

**Week 12**

November 4, 2013 – Project status updates

November 6, 2013 – Student paper presentations

**Week 13**

November 11, 2013 – Veteran’s Day, No class

November 13, 2013 – Project status updates

**Week 14**

November 18, 2013 – Student paper presentations

November 20, 2013 – Project status updates
**Week 15**

November 25, 2013 – Student paper presentations

November 27, 2013 – No Class

**Week 16**

December 2, 2013 – Project status updates

December 9, 2013 – **DEMO DAY!!!**
Collaboration Policy

Students must do their own work but are encouraged to collaborate with others in the form of discussion of concepts and implementation details pertaining to Visual Studio, C#, and Windows Presentation Foundation. For final projects, teams of up to two students are encouraged.

Assignments

Paper Presentations – Students will have to present 1-2 papers of their choice, outside of the assigned readings and give a 25 minute presentation on it.

Guided Discussion – During the paper discussion sections, students will lead the discussion on a particular paper that was assigned in class.

Programming Assignments

1. Intro – Students will replicate Windows Journal to get them acclimated to Visual Studio, C#, Windows Presentation Foundation, and pen and multi-touch input. This application will also be a test bed for the other assignments in the course.

2. 2D SKETCH – Students will develop a 2D shape recognition program to create and manipulate circles, rectangles, squares, and triangles. Students will explore how to best combine pen and multi-touch input for the various operations needed. The focus of the assignment will be on heuristic gesture recognition.

3. Math Symbol Recognizer (Research Contest) – Students will compare Anthony and Wobbock’s SN symbol recognizer against Li’s Protractor algorithm and try to improve overall recognition accuracy for both pen and touch data.

4. Pen Calculator – Using the math symbol recognizer created in assignment 3, students develop a pen-based calculator that will recognize and evaluate mathematical expressions. Students will use both pen and multi-touch input for different parts of this assignment.

5. Final Project

Students will do a final project of their choice that explores a particular concept in pen-, sketch-, or multi-touch-based user interfaces. They must first write a short proposal and get it approved by the professor.

Tentative Grading Scheme:

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<thead>
<tr>
<th>Assignment</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Assignment 1</td>
<td>10%</td>
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<tr>
<td>Assignment 2</td>
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<tr>
<td>Assignment 3</td>
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<tr>
<td>Assignment 4</td>
<td>10%</td>
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<tr>
<td>Paper discussions</td>
<td>5%</td>
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<tr>
<td>Paper presentations</td>
<td>5%</td>
</tr>
<tr>
<td>Final Project</td>
<td>50%</td>
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</tbody>
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The instructor reserves the right to use plus/minus grading in this course.