CAP 6105 Pen-Based User Interfaces

Fall 2015

http://www.cs.ucf.edu/courses/cap6105/fall2015/

Instructor: Joseph J. LaViola Jr.

Office: Engineering III Room 383
       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

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 24, 2015 – 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 26, 2015 – Talk about final projects Papers discussion

Week 2
August 31, 2015 – Lecture - Visual Studio, C#, Tablet PC SDK
September, 2, 2015 – Lecture - Windows Presentation Foundation

Readings

Week 3
September 7, 2015 – Holiday – No Class
Assignment 1 Out
September 9, 2015 – Lecture - Ink Preprocessing & Simple Features
   -- data representation
   -- filtering
   -- transformation invariance
   -- dehooking, cusps, and self intersections
Readings


**Week 4**

September 14, 2015 – Papers discussion

September 16, 2015 – 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 21, 2015 – Papers discussion

September 23, 2015 – Lecture - Ink Segmentation
  -- spatial segmentation
  -- temporal segmentation

Readings


Week 6

September 28, 2015 – Papers discussion

  -- Feature Extraction

Assignment 2 due Assignment 3 out

Week 7

October 5, 2015 – Lecture - Classification Algorithms for Recognizing Digital Ink (Part 2) -- Classifiers
  -procedural, template matching
  -linear classifiers
  -SVMs
  -K-nearest neighbor
  -AdaBoost

Readings


October 7, 2015 – Papers discussion

Week 8

October 12, 2015 – 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 14, 2015 – Papers discussion

Week 9

October 19, 2015 – Lecture - Sketch-based Interfaces and Understanding
-- multi-domain sketch understanding frameworks

Readings


October 21, 2015 – Papers discussion

**Week 10**

October 26, 2015 – Lecture - Evaluation Methodologies
-- user studies
-- qualitative vs. quantitative
-- summative vs. formative

**Assignment 4 due**

*Readings*


October 28, 2015 – Papers discussion

**Project proposals due**

**Week 11**

November 2, 2015 – Student paper presentations

**Project proposal decisions made**

November 4, 2015 – Student paper presentations

**Week 12**

November 9, 2015 – Project status updates

November 11, 2015 – Veteran’s Day, No class

**Week 13**

November 16, 2015 – Student paper presentations

November 18, 2015 – Project status updates

**Week 14**

November 23, 2015 – Student paper presentations

November 25, 2015 – No Class
Week 15

November 30, 2015 – Project status updates

December 2, 2015 – Student paper presentations

Week 16

December 7, 2015 – Project status updates

December 14, 2015 – 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 with a modified version of Taranta et al.’s Penny Pincher 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:**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment 1</td>
<td>10%</td>
</tr>
<tr>
<td>Assignment 2</td>
<td>10%</td>
</tr>
<tr>
<td>Assignment 3</td>
<td>10%</td>
</tr>
<tr>
<td>Assignment 4</td>
<td>10%</td>
</tr>
<tr>
<td>Paper discussions</td>
<td>5%</td>
</tr>
<tr>
<td>Paper presentations</td>
<td>5%</td>
</tr>
<tr>
<td>Final Project</td>
<td>50%</td>
</tr>
</tbody>
</table>

The instructor reserves the right to use plus/minus grading in this course.