CAP 6105 Pen-Based User Interfaces

Fall 2016

http://www.cs.ucf.edu/courses/cap6105/fall2016/

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

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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 22, 2016 – 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 24, 2016 – Talk about final projects Papers discussion

Week 2
August 29, 2016 – Lecture - Visual Studio, C#, Tablet PC SDK
August 31, 2016 – Lecture - Windows Presentation Foundation

Readings

Week 3
September 5, 2016 – Holiday – No Class
Assignment 1 Out

September 7, 2016 – Lecture - Ink Preprocessing & Simple Features
  -- data representation
  -- filtering
  -- transformation invariance
  -- dehooking, cusps, and self intersections
Readings


**Week 4**

September 12, 2016 – Papers discussion

September 14, 2016 – 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 19, 2016 – Papers discussion

September 21, 2016 – Lecture - Ink Segmentation
  -- spatial segmentation
  -- temporal segmentation

**Readings**


**Week 6**

September 26, 2016 – Papers discussion

  -- Feature Extraction

**Assignment 2 due Assignment 3 out**

**Week 7**

October 3, 2016 – Lecture - Classification Algorithms for Recognizing Digital Ink (Part 2) -- Classifiers
  - procedural, template matching
  - linear classifiers
  - SVMs
  - K-nearest neighbor
  - AdaBoost

**Readings**


October 5, 2016 – Papers discussion

**Week 8**

October 10, 2016 – 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 12, 2016 – Papers discussion

**Week 9**

October 17, 2016 – Lecture - Sketch-based Interfaces and Understanding

-- multi-domain sketch understanding frameworks

Readings


October 19, 2016 – Papers discussion

**Week 10**

October 24, 2016 – Lecture - Evaluation Methodologies
-- user studies
-- qualitative vs. quantitative
-- summative vs. formative

Assignment 4 due

Readings


October 26, 2016 – Papers discussion

Project proposals due

**Week 11**

October 31, 2016 – Student paper presentations

Project proposal decisions made

November 2, 2016 – Project status updates

**Week 12**

November 7, 2016 – Student paper presentations

November 9, 2016 – Project status updates

**Week 13**

November 14, 2016 – Student paper presentations

November 16, 2016 – Project status updates

**Week 14**

November 21, 2016 – Student paper presentations

November 23, 2016 – No Class
Week 15

November 28, 2016 – Project status updates

November 30, 2016 – Student paper presentations

Week 16

December 5, 2016 – TBD

December 12, 2016 – 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 Wobock’s SN symbol recognizer with a modified version of Taranta et al.’s Penny Pincher algorithm coupled with stochastic resampling to increase the amount of usable training 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 1</th>
<th>10%</th>
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<tbody>
<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>
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<tr>
<td>Final Project</td>
<td>50%</td>
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The instructor reserves the right to use plus/minus grading in this course.