CAP 6105
Pen-Based User Interfaces
Fall 2011

http://www.eecs.ucf.edu/courses/cap6105/fall2011/

Instructor: Joseph J. LaViola Jr.
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Hours: Tues. 4:00pm-5:30pm
Wed. 6:00pm-7:00pm
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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

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 22, 2011 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, 2011 Talk about final projects
Papers discussion

Week 2

August 29, 2011 Lecture - Visual Studio, C#, Tablet PC SDK
August 31, 2011 Lecture - Windows Presentation Foundation

Readings


Week 3

September 5, 2011 Holiday – No Class

Assignment 1 Out

September 7, 2011 Lecture - Ink Preprocessing & Simple Features
-- data representation
-- filtering
-- transformation invariance
-- dehooking, cusps, and self intersections
Readings


Week 4

September 12, 2011  Papers discussion

September 14, 2011  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, 2011  Papers discussion

September 21, 2011  Lecture - Ink Segmentation
    -- spatial segmentation
    -- temporal segmentation

Readings


Peterson, E., Stahovich, T., Doi, E., and Alvarado, C. Grouping Strokes into Shapes in Hand-Drawn Diagrams Proc. of the 24th AAAI Conference on Artificial Intelligence (AAAI-10), 2010, pp. 974-979


Week 6

September 26, 2011  Papers discussion

    -- Feature Extraction

Assignment 2 due
Assignment 3 out

Week 7

    -- Classifiers
      - procedural
      - template matching
      - linear classifiers
    - SVMs
    - K-nearest neighbor
    - AdaBoost
Readings


October 5, 2011 Papers discussion

Week 8

October 10, 2011 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, 2011 Papers discussion

Week 9

October 17, 2011 Lecture - Sketch-based Interfaces and Understanding
-- multi-domain sketch understanding frameworks

Readings


October 19, 2011 Papers discussion

Week 10

October 24, 2011 Lecture - Evaluation Methodologies
-- user studies
-- qualitative vs. quantitative
-- summative vs. formative

Assignment 4 due

Readings


October 26, 2011 Papers discussion
Project proposals due

Week 11

October 31, 2011 Student paper presentations
Project proposal decisions made

November 2, 2011 Student paper presentations

Week 12

November 7, 2011 Student paper presentations

November 9, 2011 Project status updates

Week 13

November 14, 2011 Student paper presentations

November 16, 2011 Project status updates

Week 14

November 21, 2011 Student paper presentations

November 23, 2011 No class

Week 15

November 28, 2011 Student paper presentations

November 30, 2011 Project Status updates

Week 16

December 5, 2011 DEMO DAY and Final Reports Due!!!
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 implement Anthony and Wobock’s $N symbol recognizer and try to improve its accuracy.

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:**

- Assignment 1 10%
- Assignment 2 10%
- Assignment 3 10%
- Assignment 4 10%
- Paper discussions 5%
- Paper presentations 5%
- Final Project 50%

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