PERVASIVE PERSONALIZED INTELLIGENCE FOR IOT

CSCI 7000-025
MON/WED @4PM,

Danny Dig

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Today’s goals

• Discovery: learning about each other (Family Occupation Recreation Motivation)

• What is Pervasive Personalized Intelligence?
• Examples of Research themes on IoT

• How can I be successful in CSCI 7000-025?
Family
Occupation: Faculty in Software Engineering

Change is the heart of software development

Programming is program transformation

Q1: Analyze what software changes occur in practice?
Q2: How can we automate them?
Q3: Can we represent programs as transformations? Archive, retrieve, and visualize them?
Q4: Can we infer higher-level transformations?

Automated changes in (i) upgrading library APIs, (ii) convert sequential to parallel code, (iii) improve responsiveness in mobile...
Recreation
On Aug 5, 2015 …

From personal success to significance

From a ladder climber to a ladder holder
Quiz #1: About YOU

- Write down your name
- **FORM** (family, occupation, recreation, motivation)

- **Grad Program** (e.g., CS PhD, MS, etc.), year of study, who is your grad advisor

- Your **background** (e.g., industry experience, other CS background – such as strong ML, PL, etc.)

- What is the ONE Thing that you **expect** to take out of CSCI 7000-025?
- What are your plans **post graduation**?
What are your expectations from CSCI 7000-025?

A. How to communicate technical material to outsiders
B. How do we conduct industry-relevant research
C. Understand limitations and opportunities of IoT
D. Learn applications of IoT for human users
E. Whole picture vantage of IoT, how to process IoT data
F. Overview of IoT applications in healthcare, and the rest of the field
G. Common challenges across different applications and how we approach them with reuse
Theme: IoT

IoT revolution: digitization & connection of everything

In 15 years, smart Infrastructure estimated to become $59T market

Q: What do you envision as some Killer Feature for IoT?
Q: What are the Killer Features for IoT?

K1: Precision Ag: automate food production, and eliminate waste
K2: Transportation across the board
K3: Big data: data-driven decision making
K4: Climate control improvement
K5: Predict & improve human health
K6: Smart city
K7: Distributed, custom production and manufacturing
Q: What are the Killer Features for IoT?

Smart home:
- managing the home (monitoring energy and resources), scheduling family activities, housekeeping (auto-replenish consumables, cleaning, pet feeding), health monitoring (assistive care)

Smart City:
- transportation (find parking), environmental monitoring of pollution, manage resources (control street lighting), enhances perception of city activities

Smart Manufacturing:
- virtual chief foreman assisting managers
From IoT 1.0 to 2.0

V 1.0: sensors and actuators to collect data

V 2.0: augmenting our intelligence with knowledge to expedite decision-making, everyday activities, and processes
Center on Pervasive Personalized Intelligence

http://ppicenter.org
Listening to Industry during Discovery Visits
Pervasive Personalized Intelligence (PPI)

From Reactive to Predictive Analytics:
- City: resource utilization, new infrastructure
- Ag: predict diseases, harvest
- Industry 4.0: auto-diagnosis on device

Pervasive to the Edge

Personalized
Research Thrusts and Capabilities of PPI

- Smart City
- Smart Food
- Smart Home
- Smart Office
- Smart Manufacturing
- Smart Health & Fitness
- Precision Ag
- Smart Retail
- Shipping & Logistics

- Data Science
- Edge Computing

- Programmability
- Dev Maintain
- Security & Privacy
- Human Users
Course Administration

Check webpage:
   TBA through email

Work items due Wed:
- Familiarize with class webpage
- sign up on Piazza (all communications through Piazza, no email after Wed)

Prereqs are enforced: computing background (SE, systems, PL, ML)
CS 7000-025 is Different!!!

Research-based course:
- at times it would feel it is not ”organized”
- there are lots of choices, you need to select
- structure is fixed, but content is dynamic

Complete a research or industrial-novel project of your choice (teams of 2-3 students)
- follow the steps of open-ended/risky research (proposal, fit in literature, evaluate empirically)
- at the end of the term you would have produced a research paper that you can submit to conference
- WHY: equips you to conduct novel R&D
CS 7000-025 is Different!!!

Participate in class discussion and activities.

Read 1-2 research papers for every class meeting (11 pages each, double column => total of 500 research pages)
  - later on, you choose papers that match your project
  - 1 book chapter /week (Put Your Dream to the Test)

Paper Critiques: for each class meeting, for each research paper, submit before class (by 5pm previous day)
  - WHY: equips you with critical thinking

Research presentation: you prepare and deliver for the selected research papers
  - WHY: equips you to communicate your ideas
Projects Focus on IoT-related topics

For new grad student, project gives ideas for dissertation

For experienced PhD student, project advances your research

Technological shifts/opportunities for IoT:
- constraints on memory/CPU/bandwidth/battery usage
- connectivity with the cloud
- rapid evolution of the platform
- reliance on ML/AI solutions

Industrial-innovation: availability of rich data from sensors (e.g., dataset from City of Portland)

Research projects (not an app), teams of 2-3 people
Example Transformations for IoT

What are the new transformations we need to automate?
- inspiration from explorative studies
- empirical studies to find performance or energy anti-patterns

Examples of transformations:
- candidate programs with trade-offs between performance & power consumption
- adaptation to different display technologies
- split functionality between the device and cloud
CS 7000-025 is Different! Lots of Guests

Interviews with C-level executives from PPI Center:
- e.g., Jason Shepherd, CTO of Dell Technologies
- Lutz Beck, CIO of Daimler Trucks
- Bob Wold, VP of Trimble

Live from IoT World 2020 (April 6th, 8th)
- Broadcast of keynote speakers
- Interviews with people on the booths

Faculty:
- E.g., Tom Dietterich, father of the ML field, ACM Fellow
1-hour Group Discussion

Soft Skills: leadership, creating a vision and plan for accomplishing

WHY: Soft Skills make a greater Difference in life than “Hard Skills”

WHAT: Take your dream through 10-step process to see, own, reach it

HOW: learning environment in a roundtable format