User interface technology
Announcements

Articulating Research Contributions **due this Friday at 9am**
Project Ideas Brainstorm due next Friday Apr 15 at 9am
Find a team!

- Slack #team-formation channel
- Monday at the end of class: team mixer, location this classroom
## Course Overview

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Recall: ubiquitous computing

“The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.”

— Mark Weiser

In contrast to visions of machines everywhere, Weiser advocated a vision of calm computing where computing receded into the background.
How to achieve this vision?

Interaction

UI Technology ("UIST")
Input, output, and interaction modalities

Ubiquitous computing ("Ubicomp")
Integration into life and into the lived environment
User interface technology

How can the user interact fluidly with the world around them?

- New input modalities: e.g., radar, acoustics
- New output modalities: e.g., fabrication, swarm robots
- New user vocabulary: e.g., voice, gestures

This research is often driven by, or involves the creation of, new hardware
Graspable User Interfaces
[Fitzmaurice, Ishii, Buxton 1995]
Tangible computing
[Ishii and Ullmer 1997]
What makes an interface tangible?

Ubicomp: integrated into the environment

Tangible: stronger claim — input and output are both in the physical world and are manipulable in the physical world, not purely on a screen

Activity sensing watch: ubiquitous but not tangible

IoT fridge: neither (likely)

[Follmer et al. 2013]
Input: sensor-driven interaction
Goals

How might people provide more fluent and effective input to interactive systems?

Typical approaches

- Come up with new signals
- Find new ways to recombine known signals

**Always:** demonstrate the technique in compelling scenarios
Bolt. “Put-that-there”: voice and gesture at the graphics interface. SIGGRAPH ’80.
Put That There

Contribution: combined gesture and voice input

In a closed world
With a toy goal
Using simple manipulation operations
Using a laser attached to the wrist

In many ways, our goal since 1980 has been to relax those assumptions
looks a bit like harry potter...

DigitalDesk

Contribution: fluid boundaries between digital and physical objects

- In a constrained space
- On a small set of tasks
- With predefined behaviors

Again, we work to relax these assumptions
General operating principle

Derived from [Saponas et al. 2009]

Features, e.g.:
- Root Mean Square (RMS) ratios between channels
- Frequency band z-score
- Derivatives, FFTs, etc.

Machine learning model

Classification

User specific fine-tuning (optional)

Derived from [Laput et al. 2015] [Laput et al. 2016] [Saponas et al. 2009]
Output: changing the world

No, the other changing the world.
How can we make the environment reactive?

We can make pixels dance — how do we make atoms dance too? What is a minimal instrumentation of the environment that we can perform to produce feedback that is as expressive as possible?
LaserOrigami produces physical 3D objects with a laser cutter.

Output: changing the virtual world
Virtual experiences with IRL constraints

Physics, and our own perceptual systems, impose constraints on what can be believably conveyed.

Research in AR, VR, and mixed reality often seek to push the boundaries of the realism of that experience.
Traxtion: perceived forces

[Rekimoto 2013]

Creates a haptic sensation without mechanical links to the ground

Traxion is a new tactile feedback device that creates force sensation based on human illusion.
Haptic Retargeting

[Azmandian et al. 2016]

Use “perceptual hacks” to make a single cube appear multiplied
TurkDeck

Skill sets for UIST research

Learn “enough to get by” in...

- Electrical engineering
- Mechanical engineering
- Computer graphics

Known techniques for research in these domains often have direct mappings onto open questions in interaction.