Lecture 1 - Introduction to IUI (1)

Ubiquitous Computing

- **Definition:** Ubiquitous computing refers to technologies that become so well integrated into daily life that they are virtually invisible to users.

> **Ubiquitous Computing Quote – Mark Weiser (1991)**
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> "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it."
> "…Hundreds of computers in a room could seem intimidating at first […] these hundreds of computers will come to be invisible to common awareness. People will simply use them unconsciously to accomplish everyday tasks."

The best technologies are those that operate in the background. Users interact with the services without needing to be aware of the technical details behind them.

> **Context on Ubiquitous Computing**
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> Ubiquitous computing envisions a world where computing devices are embedded everywhere — in homes, workplaces, and public spaces — thus enabling seamless interactions without overwhelming the user with technical complexity.

Goals of Human-Machine Systems

Design Objectives:

- **Primary Goal:**
  - Design systems in which human-machine cooperation leads to performance that outperforms both humans and machines acting independently.
- **Key Challenge:**
  - Achieving intuitive cooperation between humans and computers.
- **Human-Human Communication as a Model:**
  - Techniques such as mid-air pointing and using natural gestures are highlighted as inspirations for current interface design.

Properties of Interactive Human-Centered AI

> **Definition of iHCAI**

An interactive human-centered artificial intelligence is an artificial intelligence that enables interactive exploration and manipulation in real time and is designed with a clear purpose for human benefit, while being transparent about who has control over data and algorithms.

Core Characteristics:

1. **Real-Time Interaction:**: Users can interact in real time with algorithms, models, and data, with immediate control over parameters.
2. **Instant Feedback:** Any changes made by the user can be observed immediately.
3. **Adjustable Processing Speed:** Systems may slow down fast processes to allow for user intervention.
4. **Interactive Exploration:** Users can explore the decision-making process, understanding how adjustments affect outcomes.
5. **Human Benefit:** The design should clearly state how humans benefit from the AI.
6. **Risk Awareness:** It should explain potential risks posed by the AI to both individuals and society.
7. **Control Transparency:** It must be clear who controls the AI—specifically, who has power over data, models, and algorithms.
8. **Data Transparency:** The sources of data, knowledge bases, and information used to inform the AI should be visible.

How can interfaces be designed to maximize the complementary strengths of humans and AI?

- **Human-AI Collaboration:** Interfaces should leverage AI's efficiency for data processing while allowing human oversight in decision-making.
- **Adaptive Interaction:** Implementing context-aware and explainable AI models ensures users can understand, guide, and correct AI-driven processes.

What ethical and societal challenges arise from increasingly autonomous AI systems?

- **Bias & Fairness:** AI decisions may reinforce biases present in training data, impacting fairness in areas like hiring, law enforcement, and healthcare.
- **Loss of Human Control:** Highly autonomous AI systems may reduce human oversight, raising concerns about accountability, decision justification, and unintended consequences.

How can transparency and accountability be ensured in complex, interactive AI systems?

- **Explainability:** AI models should provide human-readable justifications for decisions, allowing users to understand and challenge outcomes.
- **Regulatory Oversight:** Clear policies, audits, and human-in-the-loop frameworks are necessary to maintain control over AI-driven decision-making.

Designing principles for intervention user interfaces

- Ensure expectability and predictability
- Communicate options for intervention

- Allow easy exploration of interventions
- Easy reversal of automated intervention actions
- Minimize required attention
- Communicate how control is shared.
