Intelligent User Interfaces
Design and Implementation

http://www.dfki.de/~sonntag/courses/WS15/IUI.html
Specific Objectives of the Course
Upon completion of the IUI course, students are expected to have:

• Interdisciplinary knowledge and understanding of IUI topics

• Skills to engage as active participants in critical reflection and debate

• The intellectual capabilities inherent in reading and interpretation, written argument, qualitative/quantitative critique, and creative thinking required for further IUI scholarship

• ... which means:
Upon completion of the IUI course, students are expected to have:

• **Understanding of:**
  - importance of IUI design and implementation issues
  - limitations of presented algorithmic solutions (and in general undecidable/untractable)

• **Ability to:**
  - participate in large-scale IUI programming/implementation projects.
  - communicate effectively in a professional environment & work in IUI group projects
  - review and evaluate IUIs (to a certain extend)
  - recognise the need to keep up to date with developments in IUI
  - participate professionally in industrial research and development (after taking related information science courses).
Grading

• Credit points: 4 ECTS-CP (2C+1R)

• Grading will be based on the assignments, the recitations (required prerequisite for final examination), and the oral or written examination.

  • **Readings Critiques** (*4 assignments*); Readings critiques must be submitted in hardcopy at due date, don’t worry: Critiques will be graded as "check", "check minus", or "check plus" (extra credit).

  • **Recitations** (up to three students, but: 50% of points required prerequisite for final examination)

  • Software project

  • 100% the written examination

• Regular class attendance (and active participation) is expected.
Recitations

• exercise sheets / Übungsblätter

• you will like it: it includes video projects: for each HCI video, explain what the IUI aspect is, and if there is none, describe how the HCI application presented in the video “product” could have been designed to include IUI.
Interdisciplinary Field and Transcommunity
Some IUI Objectives

- Increase productivity
- Decrease expenditures
- Improve efficiency, effectiveness, and naturalness of interaction

How?
- for example, use knowledge representation, reasoning, ML, adaptation, adaptivity

Example Email Filter / Email Response System / Dialogue System
Who was world champion in 1990?

Deutschland (1990)

zeige mir mehr Informationen zu diesem Film

Casino Royale
Antworten

Casino Royale
Regisseur: Martin Campbell
Schauspieler:
Jeffrey Wright, Daniel Craig, Mads Mikkelsen, Dame Judi Dench, Eva Green
Genre: Action
FSK: 12
Beschreibung: Nachdem James Bond

2006 WM Demonstrator
Hat Kansas City gewonnen?
Sport

Wie komme ich nach Hause?
Karten

Poste auf Twitter
Twitter

Neuer Facebook-Status
Facebook

Finde eine gute Pizzeria
Restaurants

Zeige mir witzige Filme
Filme

Spiele Norah Jones
Musik

OK, I found four theaters not far from Anchorage:

CENTURY 16 ANCHORAGE
3451 Boniface Pkwy, Anchorage, AK
Released August 15

REGAL DIMOND CENTER 9 CINEMAS
5050 6th Ave, Anchorage, AK
Released August 15

REGAL TOTEM 8 THEATRES
3331 Tudor Rd, Anchorage, AK
Released August 15

REGAL TIKHITNO STADIUM 16 &
1102 N. Mckinnon Rd, Anchorage, AK
Released August 15

I found quite a number of movies:

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2001: A Space Odyssey was directed by Stanley Kubrick.

A pair of astronauts heads to Jupiter to investigate a radio signal sent from a mysterious moon on the moon, but their tranquil trip is endangered when their on-board computer begins acting oddly. The simple plot of director Stanley Kubrick's inspired space adventure (co-scripted with noted science fiction author Arthur C. Clarke) belies the profound philosophical implications of this classic film, which...

'The Big Lebowski' stars Jeff Bridges, John Goodman and Julianne Moore.

Here's 'The King's Speech' which won the Oscar for Best Picture in 2011:

The hilariously twisted comedy-thriller stars Jeff Bridges, John Goodman, Steve Buscemi and Julianne Moore. Join the 'Dude' and his bowling buddies on their journey that blends unforgettable characters, hilarious, a case of mistaken identity and White Russians. Enter the visually unique and entertaining world from...

I found a few movies coming out last Monday to Sunday:

The Perks of Being a Wallflower
1h 58m
After the death of his father, the titular Wallflower (Emma Stone) begins a gradual transition from a deteriorating speech impediment at his high school to a confident and powerful young woman.

Hotel Transylvania
1h 39m
A young vampire (Adam Sandler) looks for the perfect human bride for his wedding.

Looper
1h 50m
In a lawless future, a time-traveling cop finds himself in the past, where his only hope of survival is to stop himself from killing his younger self.

Wont Back Down
1h 48m
A teacher and a single mother sue the local school district for inadequate education funding.

Battleship
1h 24m
A battleship is set up to battle an alien invasion in this action-packed adventure.

The Ledge
1h 34m
A jilted woman (Naomi Watts) plots revenge on her cheating fiancé (Sam Rockwell) and his mistress (Embeth Davis) in this psychological thriller.

The Watcher
1h 30m
After being viciously attacked in her home, a single mother sets out to track down the man who tried to kill her in this spine-tingling thriller.
Augmented and mixed reality examples

http://www.dfki.de/~sonntag/siemens-talk.pdf
Introducing aspects of IUIs
Classification Example: IP Continuum for Adaptive Interface Design

- Interface-proactivity (IP) continuum between the user and the system (Isbell and Pierce) from HCI perspective (2005)
- Vocabulary for discussing and comparing adaptive interfaces

http://www.cc.gatech.edu/~isbell/papers/IPContinuum-IsbellPierce.pdf
IUI Design Opportunities

Risks (examples):
- Don’t do what the user wants
- Sometimes this is okay
- Interrupt the user at a bad time
- Frustrate user
- Loose user trust

How should the system decide?
- Design opportunities: needs and technique driven
IUI Design Opportunities

What are some specific UI components that you/others interact with?
- Desktop/Web apps
- Ubiquitous and pervasive apps
- Mobile apps
- Very large displays

In the future?
- Speech based multimodal dialogue systems
- Cyber-physical Systems, e.g., MedicalCPS
- Towards user-environment interaction and collaboration

OLD SCHOOL
Towards automation and mixed initiative

- Roughly, input processing requires system to “understand” input
- Likewise, output display requires system to “generate” output
  - Historically, canned output is used (parse tree not required)
  - **Reaction on the fly**
  - Generation on the fly
  - Requires common representation of knowledge
  - Towards model-based solutions
ELIZA’s Canned Text

- Psychotherapist who repeats your thoughts
  - “Yes, tell me more about _______”
  - “Do you think it is ________ to ________”
  - “I understand. I am listening.”

- Simple “parsing” and substitution of key words into canned phrases.

- Try it out at: http://nlp-addiction.com/eliza/
Some Major IUI Challenges

- Mixed-initiative dialogue (will be discussed)
- Modeling what users want
- Eliciting what users want
- Not knowing the “true” world state (partial observability) and acting
- Planning and reasoning ahead
- Continually learning model parameters or whole models (never ending learning)
- Speech understanding and activity recognition
Medium and Modality

**Medium**
- Material object used for presenting, saving, or handling information, e.g., paper, CD, microphone, mouse

**Modality**
- Human senses used to process information, e.g., vision, audition, olfaction, touch, taste
- Also called mode
Intelligent Help Agent

- “What do you want to do?”
- “Copy a videotape to a DVD”
- “First, insert a blank DVD in the recorder”
- “OK, what next?”
- “Push the button marked IN/REC on the DVD recorder.”
Some Examples of IUIs

- Radspeech (Video)
- ERmed (later ...)
- DigitalPen (Demo)
- Smartweb Design (later ...)

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Student Projects

- The tutors will meet with each project team individually a couple times during the semester to provide advice, answer questions, etc.
• Count as 3 recitation!

• Phase 1: Topic Selection & Task Analysis
  Identify a type of technology to investigate and begin thinking about tasks and (possibly hypothetical) set of users that you will support with your intelligent user interface. Determine what is difficult (and easy) about the current task and how it can be supported.

• Phase 2: Initial Design and Implementation
  Specify system design goals and create an initial conceptual design and implement it together.

• Phase 3: Final Report and Presentation
  Write a report describing the users, their tasks, your technological solution to supporting them (including design and prototype implementation), and how the system is expected to be used. Also include an empirical or observational study of how you would evaluate your system's success in meeting its goals of supporting users.
Student Projects

• What you turn in: 6 page final report

  • Two to three page description of the task being supported, how users currently perform this task, and the type of technology.

  • This should include some indication of how the new system might augment current work practices -- remember to respect current tradition while looking for ways to transcend current practice.

  • Description of the system goals and conceptual design. This should include diagrams/drawings of the interface or interactions between system components and users in order to provide a sense of what the system might look like.

  • This year, we will focus on 3D (video) sensor data + Myo + annotating daily life activities in the IOT (internet of things) paradigm.
IUI moves on ...
IUI Group
Endorsement

• the design, realisation, and evaluation of interactive systems that exhibit some form of intelligence

• create a transcommunity

• bring to mind the “binocular view” of interaction and intelligence that is central to IUI
The term intelligent UI

• techniques used to realize intelligent systems have their origins in AI—though in many cases a subfield has formed around a given type of technique (no longer primarily associated with AI)

• The canonical intelligent system includes a wide variety of capabilities, including sensing and perception, knowledge representation and reasoning, learning, creativity, planning, autonomous motion and manipulation, natural language processing, and social interaction.
Relationships between the intelligence in a system and the user interaction

• The intelligent processing is found in the user interface(s) of the system, and its purpose is to enable an effective, natural, or otherwise appropriate interaction of users with the system. For example, the system may support human-like communication methods such as speech or gesture; or it may adapt its style of interaction to individual users.
Relationships between the intelligence in a system and the user interaction

• The intelligent processing is found in the “backend” of the system, and its primary purpose is to serve some beneficial function such as performing actions partly autonomously on behalf of the users. The relevance of the system’s intelligence to interaction with users.
Relationships between the intelligence in a system and the user interaction

• The intelligent processing is used not directly in the system itself but in the process of designing, implementing, and/or testing the system. Hence, the system that the users interact with may not itself be an intelligent system.
Systems where the intelligence lies mainly in the user interfaces

- Systems with adaptive user interfaces that are automatically adapted to the inferred capabilities or needs of the user.

- Multimodal systems that aim to enable more natural, human-like forms of input and output.

- Systems with human-like virtual characters that enable the user to interact with a system in a way that is partly similar to human-human interaction.

- Smart environments in which embedded objects interact intelligently with their users.

- Personalised websites, in which the displayed content is adapted to the inferred interests of the user.
Systems where the intelligence lies mainly behind the user interfaces

- Recommender systems, which present products, documents, or other items that are expected to be of interest to the current user.
- Systems that employ intelligent technology to support information retrieval.
- Learning environments that offer learning assistance on the basis of assessments of each learner’s capabilities and needs.
- Interface agents that perform complex or repetitive tasks with some guidance from the user.
- Situated assistance systems that monitor and support a user’s daily activities.
- Systems for capturing knowledge from domain experts who are not knowledge engineers.
- Games that make use of AI technology to create the opponents against which the human players play.
Different perspectives on IUIs

Focus on Intelligent Technology

Better intelligent algorithms
Technical evaluation

Existing interaction designs
Knowledge and assumptions about users and interaction

Focus on User Interaction

Better interaction designs and principles
Studies involving users

Existing intelligent systems
Knowledge and assumptions about possible system intelligence

Binocular View

Design of combinations of intelligent algorithms and interaction
Studies examining algorithm performance and users’ behavior

(c) Riedl and Jameson
Relevant Research Areas

• In some research areas, such as recommender systems, information retrieval, or intelligent learning environments, the system’s intelligence typically consists in learning, reasoning, or decision making which supports the system’s primary function (e.g., suggesting appropriate products or documents; monitoring and supporting a learner’s progress).
Relevant Research Areas

• In some other areas, the main contribution of the intelligence is to enhance communication between the system and users, in a way which may or may not be closely related to the system’s main function. This is the contribution most commonly found in the areas of multimodal interaction, natural language processing, embodied conversational agents, computer graphics, and accessible computing.
In what ways can artificial and human intelligence work together effectively

• Where does intelligent processing yield the greatest benefits for interaction, relative to other forms of computation?

• What patterns of division of processing between the human and the intelligent system tend to be successful, and which less so?
Challenges to usability and acceptance
the incorporation of intelligence raises

• The performance of an intelligent component may be fallible, leading to inappropriate interpretations or actions.

• Intelligent processing is often—though not inevitably—relatively difficult for users to predict, understand, and control.

• If they rely on relatively extensive information about the users, intelligent systems may raise certain types of privacy and security risks.

• An increased ability of a system to take over tasks that normally require thought and judgment can limit the breadth of experience and the responsibility of users.
Methodology for research, design and evaluation of IUIs

• How can we understand users’ requirements for intelligent support in a particular context when the potential users have little idea of what sort of intelligent support is currently feasible?

• How can we design an evaluation of a system that comprises measures of the performance of the intelligent algorithms, observations of users’ behavior, and the interpretation of users’ subjective reactions.
Notes on IUI evaluation

• With a focus on technology, it is often possible to demonstrate a small but statistically reliable improvement to an algorithm, especially when benchmark datasets are used.
  • Benchmark datasets are often not available.

• By contrast, improvements and differences with regard to interaction design usually have to be more substantial to be measurable, and the effort required to achieve and document them (e.g., with user studies) is often greater.
  • User studies are often biased.