WS 2011/2012

Seminar: **Topics of Social Robotics**

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Seminar "Topics of Social Robotics"

• **Social robotics** is a growing field concerned with how humans and robots can better **live** together, **work** together, and **interact** together.

• Social robotics involves problems of:
  
  • Human **perception**
  
  • Human **behavior modeling**
  
  • **Task and action planning** in the presence of humans
  
  • **Design** of socially acceptable **human-robot-interfaces**

• In other words: „**the human is in the loop“**

• Methods from robotics may be combined with models and insights from **social psychology** and **cognitive science**.
Human-robot interaction (HRI) explicitly deals with the direct interaction between (humanoid) robots and humans.

Its research topics relate to those of human-computer interaction (HCI) and heavily overlap with those of social robotics. They include, e.g.:

- A robot’s multimodal behavior planning in interaction with humans
- Psychological & sociological effects of robots in the society
- Application & evaluation of new interaction paradigms

Do (normally or most often) not include, e.g.:

- GUI interface design & programming
- Questions of computational complexity and related theoretical stuff

In other words: What happens if they are out there one day? Involves lots of empirical studies and statistical methods for analysis. One of many related subfields is „Affective Computing“.
Overview:

• In this seminar, the students will choose, read, present and summarize a recent publication in the field of social robotics.

• In this way, the students
  • learn about state-of-the-art methods in this field
  • learn to understand and critically read a paper
  • learn to present and summarize a paper thereby improving their presentation and scientific writing skills

• Language: English

• The seminar is restricted to 9 students. First come, first serve.

• There are several students on the waiting list. Make up your mind.
Seminar "Topics of Social Robotics"

Requirements:

• You have to prepare a talk of 30 minutes and to write a summary report
• Talk and summary can either be in German or English
• The summaries should not exceed 7 pages (latex, a4wide, 11pt). Longer summaries will not be accepted
• The final grade is a combination of three factors:
  • Presentation (50%)
  • Summary report (40%)
  • Active participation during the Blockseminar (10%)
• Last date to sign up for the exam is February 18, 2012
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Please note:

- Reading and understanding a scientific paper is **not easy**; in 90% of the cases you **do not have all the background knowledge** required to understand a paper.

- Understanding a paper is not a **yes/no condition**: you must decide when you have a reasonably good understanding of the content.

- Apply a **top-down approach** when reading the paper. Try to get an overview and then focus on the details.

- Papers might also contain **mistakes**.
Hints for a good grade:

• Some papers are easier, some are more difficult to understand. For the sake of fairness, additional work and a particular deep understanding is expected for easy papers

• Additional work may include
  • Implementing a method
  • Submitting additional material from an implementation (e.g. animations)
  • Reading related papers (e.g. earlier work from the same authors, important papers for the problem addressed)

• Explain a method very well, as a mini-tutorial

• The challenge of a good talk is to present complex ideas in a simple way

Finally:

• Plan accordingly!
Organization:

- **Today**: The first meeting will be held in room SR 01-016, Geb. 101. We will give an introduction, present the topics and assign the papers to the students.

- **Wednesday, Dec. 7, 2011**: A first version of the slides for the presentation must be sent to the supervisor.

- **Wednesday, Dec. 14, 2011, the whole day**: Blockseminar in which all students give their talks, room SR 04-007, Geb. 106. Reserve also the morning of Dec. 15 for the case of additional presentations (date?)

- **Wednesday, Jan. 25, 2012**: A first version of the summary must be sent to the supervisor.

- **Wednesday, Feb. 1, 2012, 14-16 h**: Towards to end of the semester, we will have another 2 hour class in room SR 04-007, Geb. 106. This is additional opportunity for the students to interact with their supervisors when they finish up the summary reports.

- **Friday, Feb. 17, 2012**: The final version of the summary report has to be submitted to the supervisor.
Papers

Note your preferences now…
Paper ID 1:

- **Paper:** "Learning Navigational Maps by Observing Human Motion Patterns" by S.T. O’Callaghan, S. P. N. Singh, A. Alempijevic, F. T. Ramos, ICRA 2011

- **Summary:** Learning a continuous probabilistic function to model walking directions by observing human motion.

- **Methods used:** Gaussian Processes

- **Comment:**
  - Leads to paths that are similar to the expected human behavior
  - No a priori knowledge of the environment needed
  - Online adaptation to new data

- traces of pedestrians

- posterior navigational map
Paper ID 2:

- **Paper:** "An Anthropomorphic Navigation Scheme for Dynamic Scenarios" by L. Scandolo, T. Fraichard, ICRA 2011

- **Summary:** Modeling a social cost map that captures social rules and planning of socially acceptable trajectories.

- **Methods used:** Psychological models, RRT (Rapidly Exploring Random Trees)

- **Comment:**
  - Navigation in populated environments
  - Emulation of human (social) behaviors
  - Generation of socially acceptable trajectories in dynamic environments

- Dynamic personal space

- Social cost map and RRT
Paper ID 3:

- **Paper:** "Planning Safe and Legible Hand-over Motions for Human-Robot Interaction" by J. Mainprice, E. A. Sisbot, T. Simeon, R. Alami, 2010 IARP Workshop

- **Summary:** Motion planning for mobile manipulation under constrained cost maps

- **Methods used:** RRT (Rapidly Exploring Random Trees)

- **Comment:**
  - Three constraints: distance, visibility, comfort
  - Stop considering humans as obstacles, instead model them with posture, field of view, preferences and conventions
• **Paper:** "Tracking-based semi-supervised learning" by A. Teichman and S. Thrun, RSS 2011

• **Summary:** Track classification in 3D point clouds based on a decomposition of the problem into segmentation, tracking, and semi-supervised classification.

• **Methods used:** EM algorithm, supervised, semi-supervised, and incremental learning (boosting)

• **Comment:**
  
  • Uses Velodyne 3D laser scanner
  
  • Research for the Google autonomous car project
Paper ID 5:

• **Paper:** "Understanding human interaction for probabilistic autonomous navigation using Risk-RRT approach" by J. Rios-Martinez, A. Spalanzani, C. Laugier, IROS 2011

• **Summary:** Socially acceptable motion planning accounting for social conventions of individuals and groups

• **Methods used:** Psychological models, RRT (Rapidly Exploring Random Trees)

• **Comment:**
  
  • Combines Proxemics, F-formations, O-space
  
  • Integrated RRT-based motion planning that accounts for obstacles and social conventions
• **Paper:** "From 3D Scene Geometry to Human Workspace" by A. Gupta, S. Satkin, A. Efros and M. Hebert, CVPR 2011 (best paper)

• **Summary:** Human-centric understanding of an image: Where can I sit? Where can I lay down?

• **Methods used:** 3D from single image estimation, voxelized cost maps, morphological operators

• **Comment:** It tackles a core computer vision problem: understanding the world the way a human does.
Paper ID 7:

- **Paper:** "Detection Free Tracking: Exploiting Motion and Topology for Segmenting and Tracking under Entanglement" by K. Fragkiadaki and J. Shi, CVPR 2011

- **Summary:** Detection-free system for segmenting multiple people in a very crowded video sequence.

- **Methods used:** figure/background segmentation, spectral clustering, trajectory estimation

- **Comment:** It tracks targets in very entangled video sequences (e.g. basketball players, people crowded scenes)
Paper ID 8:

- **Paper:** “Real Time Head Pose Estimation with Random Regression Forests” by G. Fanelli, J. Gall, L.V. Gool, CVPR 2011

- **Summary:** Head pose estimation in dense depth data. Face is approximated by local surfaces.

- **Methods used:** random forest regression, depth-based features

- **Comment:** It does not use nose/ears detectors. It works with a wide variety of face expressions.
• **Paper:** "Human Emotion and the Uncanny Valley: A GLM, MDS, and Isomap Analysis of Robot Video Ratings" by C. Ho, K. F. MacDorman, Z. Dwi Pramono, HRI’08

• **Summary:** 18 videos of robots (and one human) were rated and the results analyzed wrt. emotions.

• **Methods used:** Multiple Linear Regression, General Linear Model, Factor Analysis, Multidimensional Scaling, Kernel Isometric Feature Mapping

• **Comment:** Interesting results tackling an open question of HRI
Paper ID 10:

- **Paper:** "Psychological Effects on Interpersonal Communication by Bystander Android using Motions Based on Human-like Needs" by Takano E., Chikaraishi T., Matsumoto Y., Nakamura Y., Ishiguro H., Sugamoto K., IROS’09

- **Summary:** An android mimicking a nurse in the back of a medical doctor

- **Methods used:** Questionnaires, ANOVA

- **Comment:** Rather simple, but interesting; will be complemented by a review of one or two other statistical methods for analyzing empirical data
• **Paper:** "How to approach humans? Strategies for social robots to initiate interaction" by S. Satake, T. Kanda, D.F. Glas, M. Imai, H. Ishiguro, N. Hagita, HRI’09

• **Summary:** A robot in a shopping mall first decides which humans to approach and then how to do so

• **Methods used:** Support Vector Machine (SVM), Chi-square test, Residual analysis

• **Comment:** An interesting application of a humanoid robot in the wild.