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**

Seminar "Topics of Social Robotics"

- **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)**
  - heavily **overlap** with those of **social robotics**
  - 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"

Seminar "Topics of Social Robotics"

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**

Seminar "Topics of Social Robotics"

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**

Seminar "Topics of Social Robotics"

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!

Seminar "Topics of Social Robotics"

Organization:

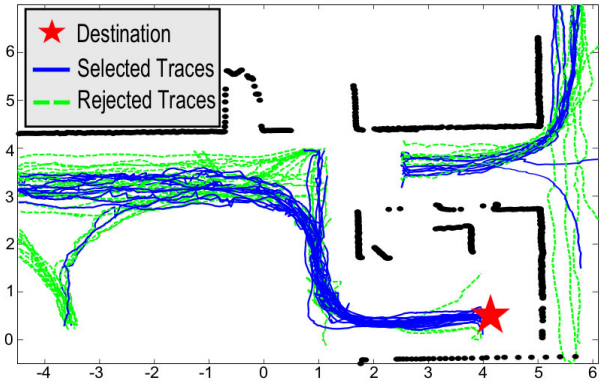
- **Today:** The first meeting will be held in room SR 01-016, Geb. 101. We will give an introduction, present the topics and assign the papers to the students.
- **Wednesday, Dec. 7, 2011:** A first version of the slides for the presentation must be sent to the supervisor.
- **Wednesday, Dec. 14, 2011, 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

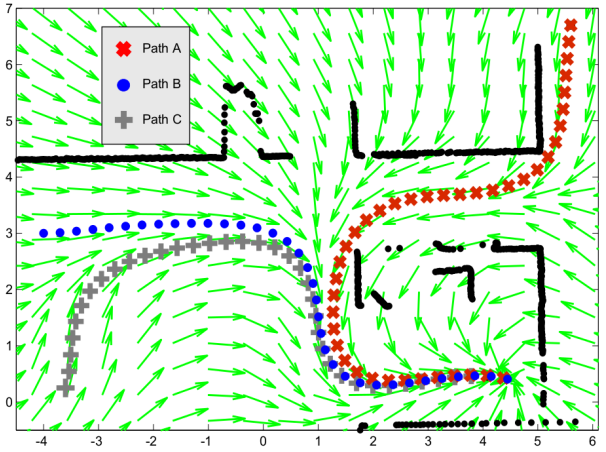
Note your preferences now…

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



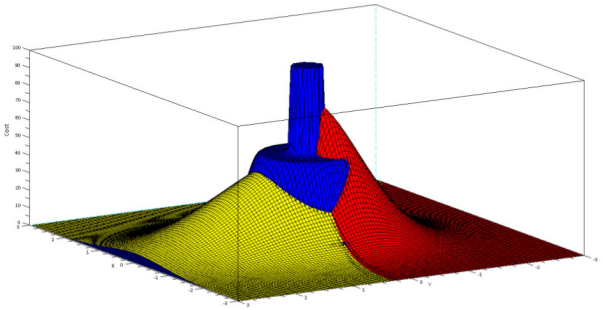
- traces of pedestrians



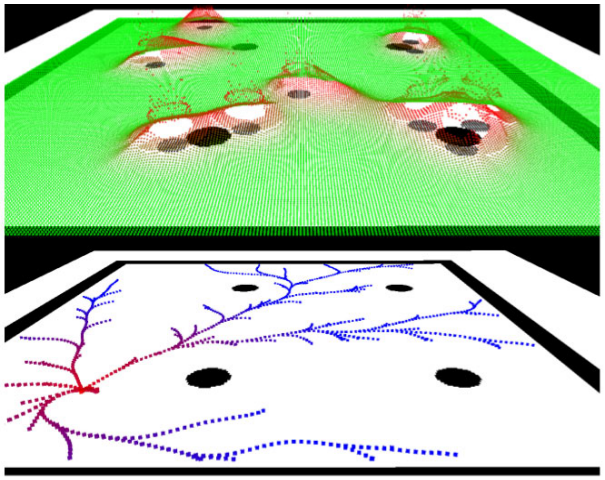
- posterior navigational map

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



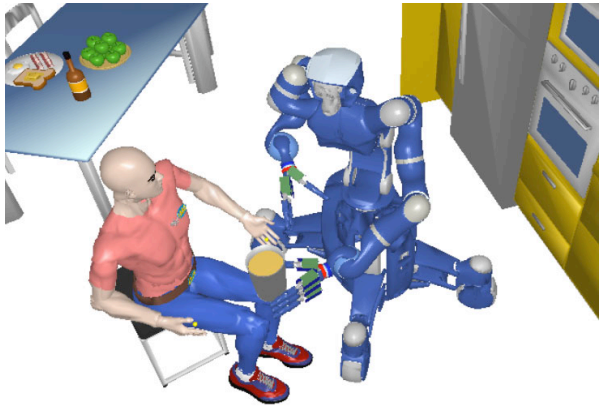
- Dynamic personal space

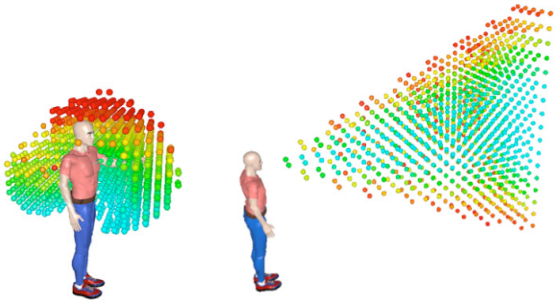


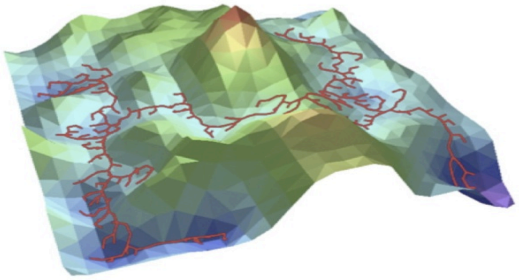
- Social cost map and RRT

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 constrainted 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 ID 4:

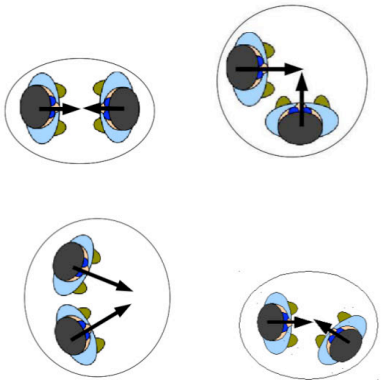
- **Paper:** *"Tracking-based semi-supervised learning"* by A. Teichman and S. Thrun, RSS 2011

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

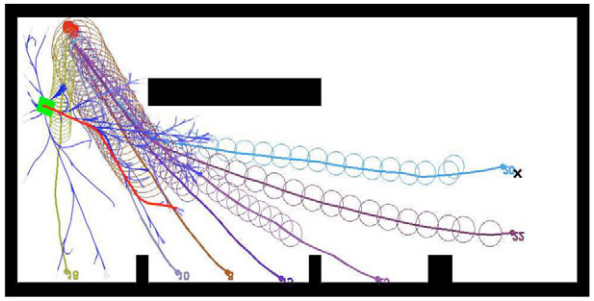
- **Methods used:** EM algorithm, supervised, semi-supervised, and incremental learning (boosting)
- **Comment:**
  - Uses Velodyne 3D laser scanner
  - Research for the Google autonomous car project

Paper ID 5:

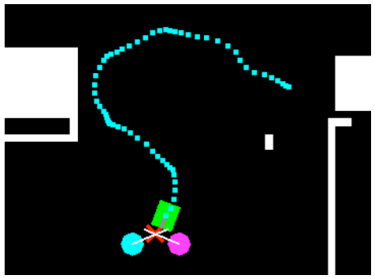
- **Paper:** *"Understanding human interaction for probabilistic autonomous navigation using Risk-RRT approach"* by J. Rios-Martinez, A. Spalanzani, C. Laugier, IROS 2011



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

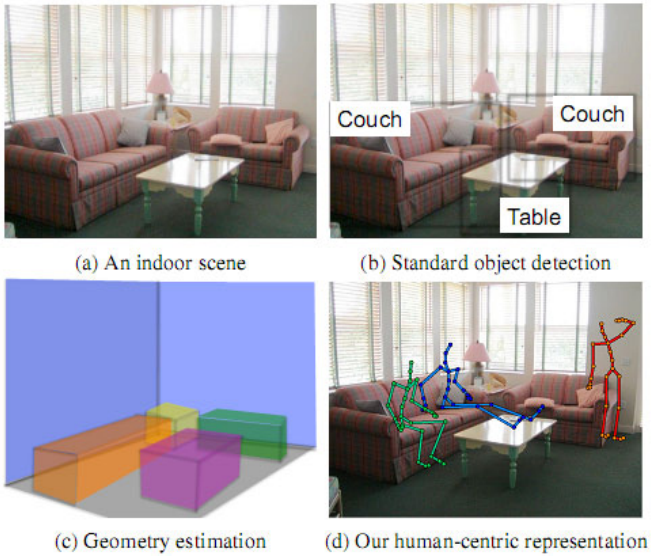


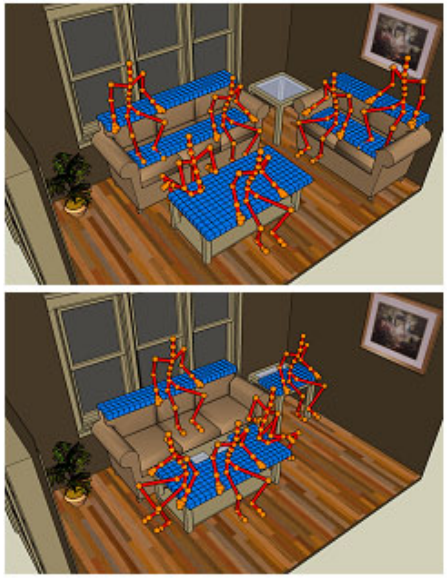
- **Methods used:** Psychological models, RRT (Rapidly Exploring Random Trees)
- **Comment:**
  - Combines Proxemics, F-formations, O-space
  - Integrated RRT-based motion planning that accounts for obstacles and social conventions



Paper ID 6:

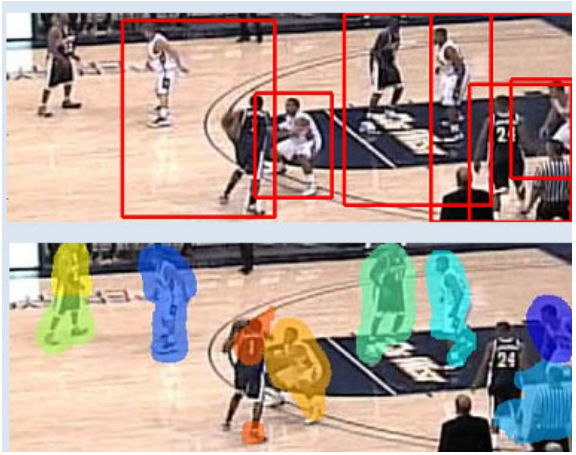
- **Paper:** *"From 3D Scene Geometry to Human Workspace"* by A. Gupta, S. Satkin, A. Efros and M. Hebert, CVPR 2011 (best paper)
- **Summary:** Human-centric understanding of an image: Where can I sit? Where can I lay down?
- **Methods used:** 3D from single image estimation, voxelized cost maps, morphological operators
- **Comment:** It takles a core computer vision problem: understanding the world the way a human does.

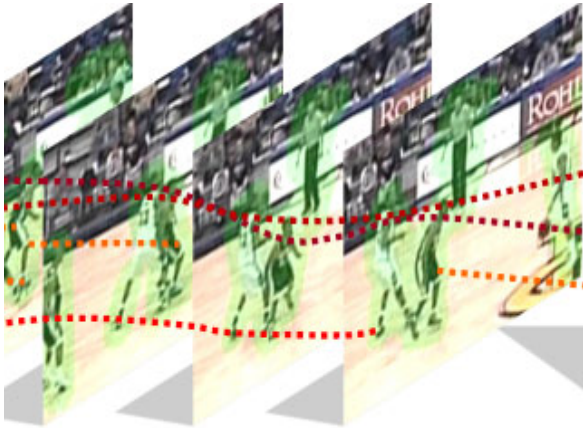




Paper ID 7:

- **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.

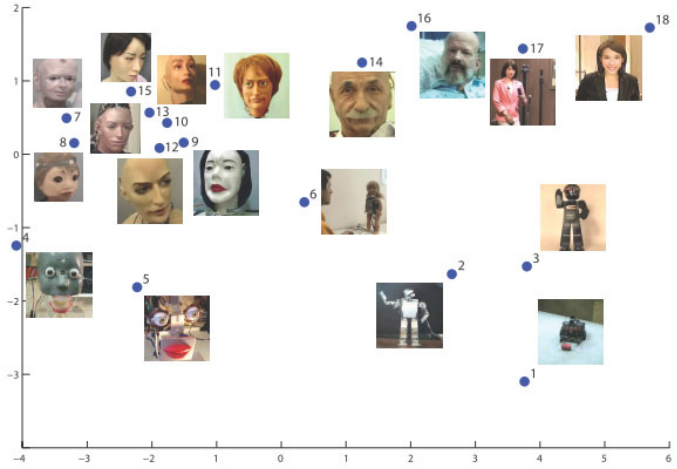
Paper ID 9:

- **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.

?

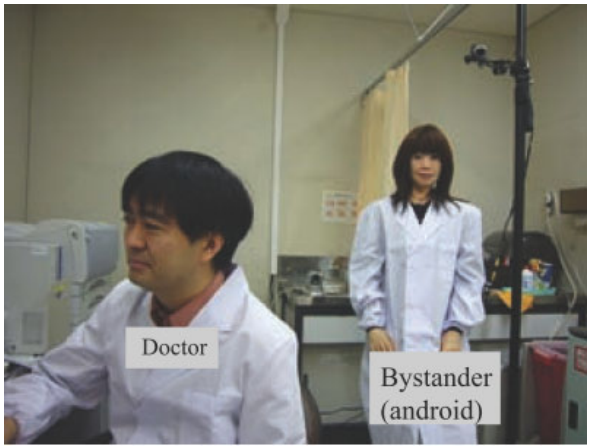
- **Methods used:** Multiple Linear Regression, General Linear Model, Factor Analysis, Multidimensional Scaling, Kernel Isometric Feature Mapping



- **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 mimiking 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 ID 11:

- **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.