WS 2012/2013

Seminar: **Topics of Social Robotics**

Welcome!

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Seminar "Topics of Social Robotics"

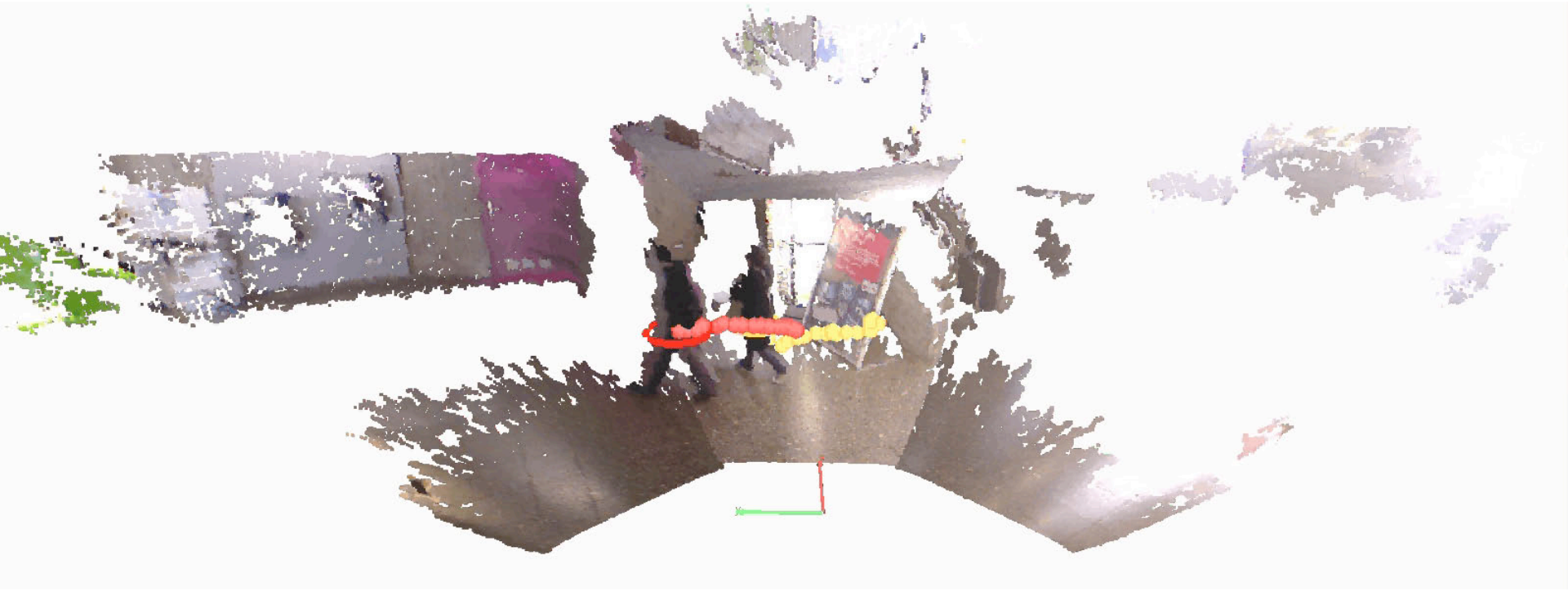
- **Social robotics** is a growing field concerned with how humans and robots can better **live** together, **work** together, and **interact** together
- Social robotics involves problems of:
  - **Perception** of humans
  - Human **behavior modeling**
  - **Task and action planning** in the presence 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"

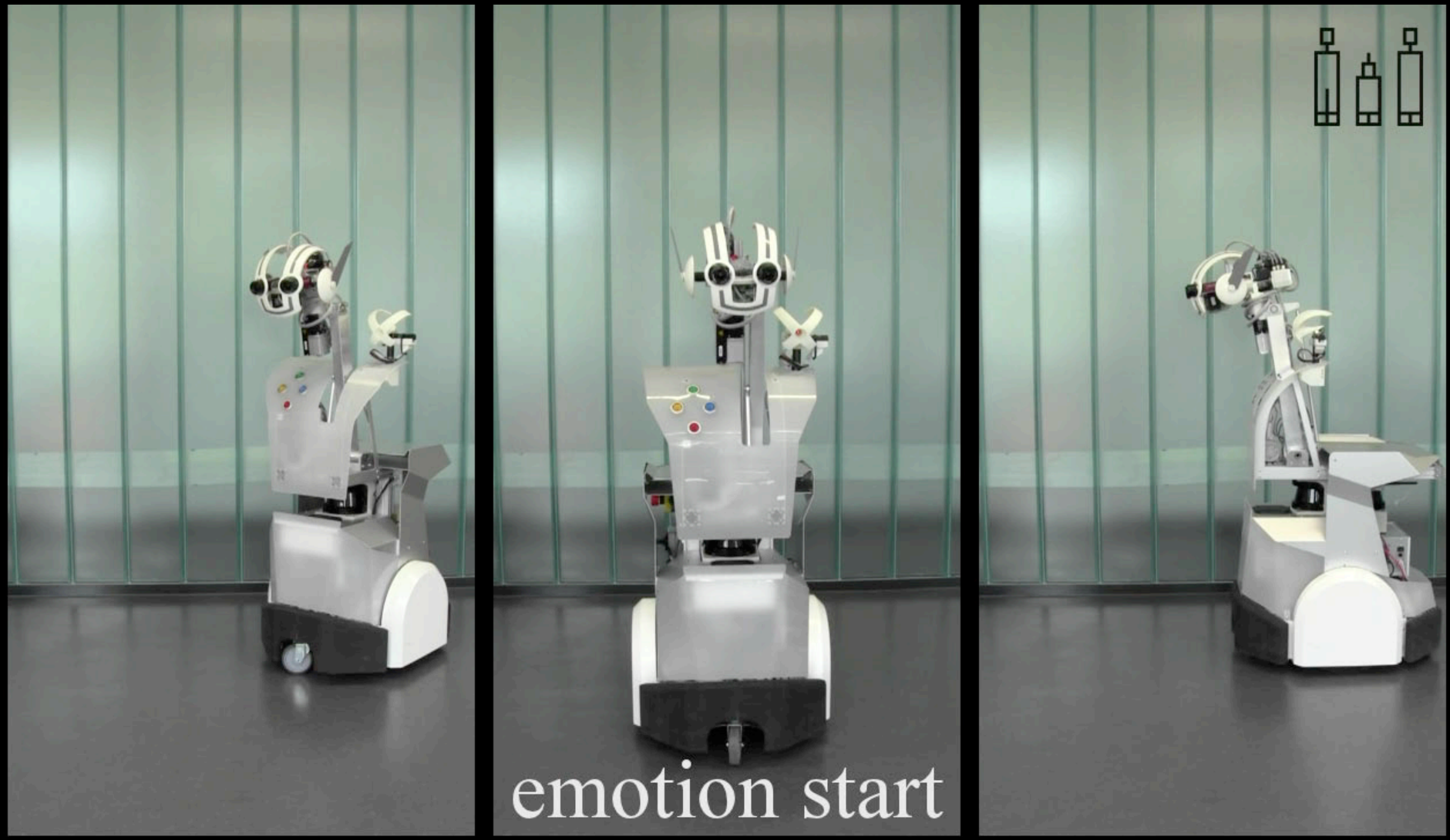
- **Human-robot interaction (HRI)** explicitly deals with the direct interaction between (humanoid) robots and humans
- HRI research topics
  - **relate to** those of **human-computer interaction (HCI)**
  - heavily **overlap** with those of **social robotics**
  - include, e.g.:
    - A robot's multimodal behavior planning in interaction with humans
    - Psychological & sociological effects of robots in the society
    - Application & evaluation of new interaction paradigms

- 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“

SRL Research: People Detection and Tracking



SRL Research: Emotional Body Language for HRI



SRL Research: Socially-Aware Coverage Planning

Learn how to cover an inhabited environment with minimal interference

- Spatio-temporal Poisson process model for human activities
- Approach: **asymmetric TSP with time-dependent costs**
- Applications: noisy vacuum robot, all coverage applications in human environments

Robot is in kids bedroom since at this time and place, encountering a human is improbable

It's around 8 pm, human agents are engaged into a dinner activity

Simulator of Human Activities, home environment

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 more 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%)

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**. 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** such as self-made animations
  - Explain a method very well, as a **mini-tutorial**
  - Reading **related papers** (e.g. earlier work from the same authors, important papers for the problem addressed)
- 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 01-018, Geb. 101. We will give an introduction, present the topics and assign the papers to the students.
- **Monday, Jan. 28, 2013:** A first version of the slides for the presentation must be sent to the supervisor.
- **Monday, Feb. 4, 2013:** A first version of the report for the presentation must be sent to the supervisor.
- **Monday, Feb. 11, 2013, the whole day:** Blockseminar in which all students give their talks, room SR 00-031, Geb. 051.
- **Friday, Feb. 15, 2013:** The final version of the summary report has to be submitted to the supervisor.

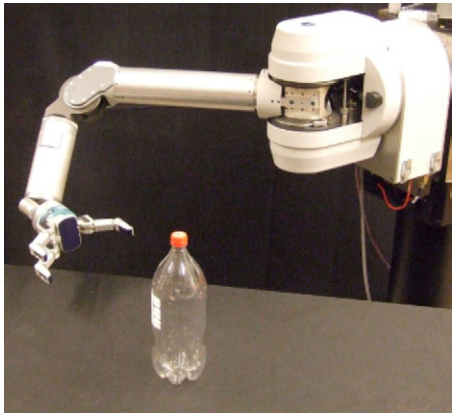
Papers

Note your preferences now…

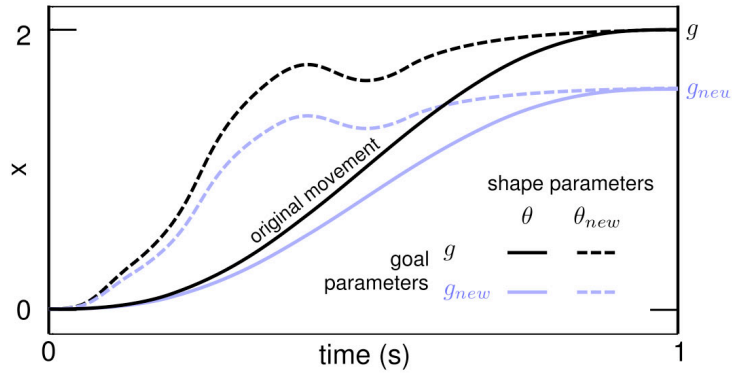
Paper ID 1:

”Learning Motion Primitive Goals for Robust Manipulation“
by F. Stulp *et al.*, IROS 2011

- **Summary:** Learning to move towards and grasp objects robust against uncertainty of the goal, obstacles in the way, and object pose



- **Methods used:** Dynamic Motion Primitives (DMP) represent motion as a solution of a set of nonlinear dynamic system equations. Learning DMPs involves locally weighted regression and reinforcement learning.

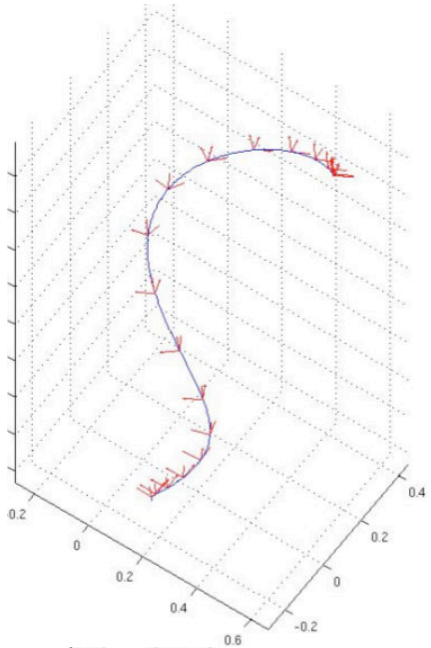


1-dim. DMP

- **Comments:**
  - Used in our own research for the emotional body language of DARYL
  - Possibility to choose another paper in the same line of work

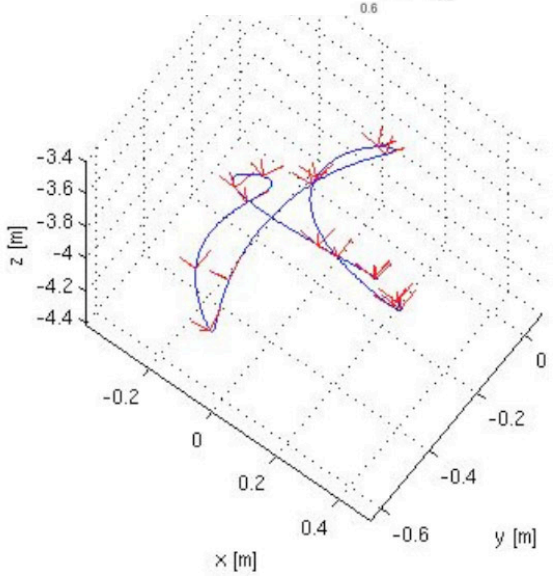
Paper ID 2:

”Recognition of 6 DOF Rigid Body Motion Trajectories using a Coordinate-Free Representation“
by J. De Schutter *et al.*, ICRA 2011



- **Summary:** Represent 6-dof motion in a way that makes trajectories easy to cluster/classify/predict. Representation of motion that encodes the instrinsic geometric properties of trajectories invariant to coordinate frames or velocity profiles

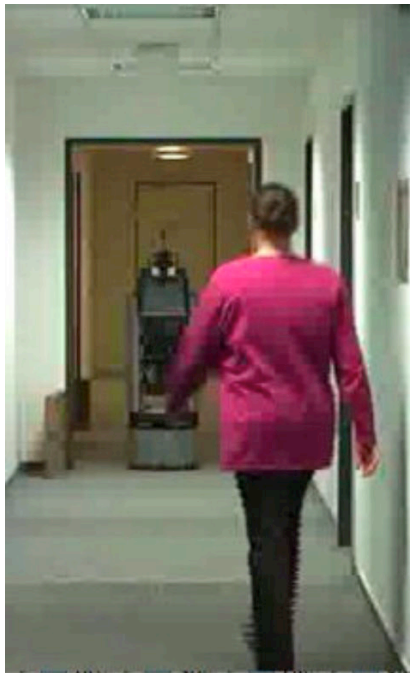
- **Methods used:** Classification techniques using Dynamic Time Warping (DTW) and Hidden Markov Models (HMM)



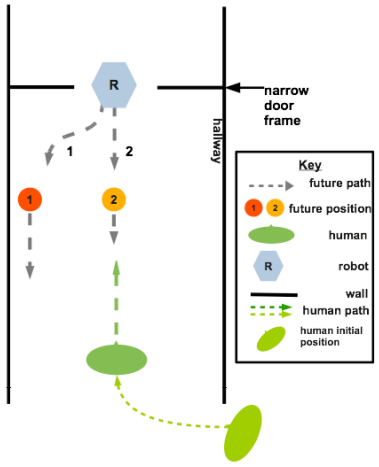
- **Comments:**
  - Possibility to make a survey and comparison of different trajectory presentation techniques or to limit the consideration to 2D poses (full 6 dof is complex)

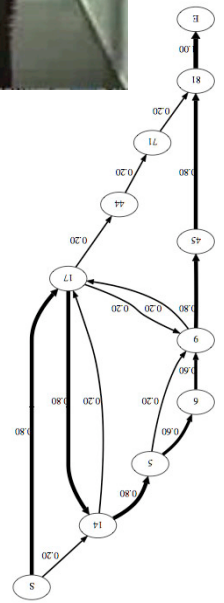
Paper ID 3:

"Analysis of Human-Robot Spatial Behaviour applying a Qualitative Trajectory Calculus"
by M. Hanheide *et al.*, RO-MAN 2012



- **Summary:** Qualitative trajectory calculus (QTC) as a coding scheme of joint spatial behavior. Develops a probabilistic model for such behavior to better understand, predict, and recognize human motion.
- **Methods used:** QTC, Markov chains
- **Comments:**
  - QTC describes relative motion of two agents (towards, away, left, right, none, etc.) and has $3^4 = 81$ states
  - Experiment in a passing-by scenario





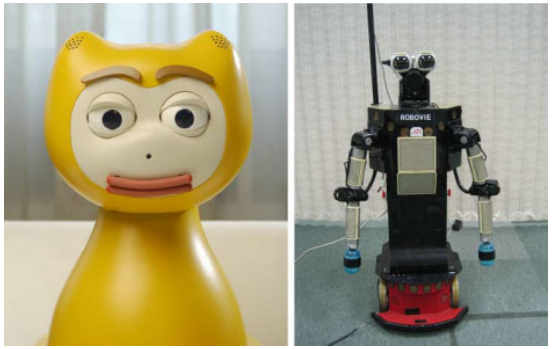
Paper ID 4:

“Keepon: A Playful Robot for Research, Therapy and Entertainment“ by H. Kozima, M.P. Michalowski, C. Nakagawa, Int. Journal Social Robotics, 2009

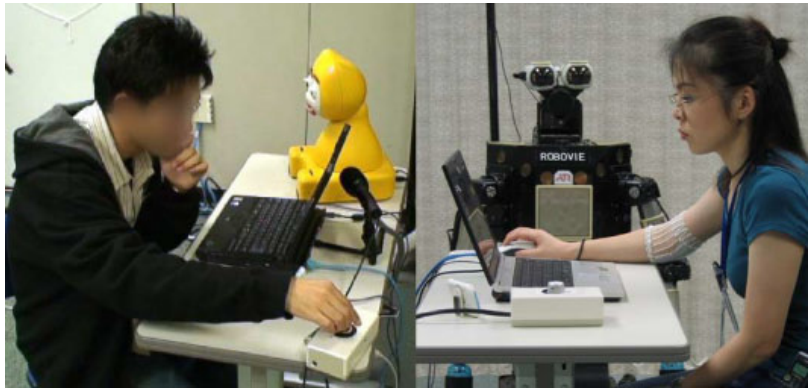
- **Summary:** Overview of the small creature-like robot „Keepon“ and its application to child therapy over the past years
- **Methods used:** A number of observational studies based on methods from social psychology
- **Comment:** Interesting results concerning the applicability of robots for child development studies and therapy (autism)

Paper ID 5:

"Does the Design of a Robot Influence its Animacy and Perceived Intelligence" by C. Bartneck, T. Kanda, O. Mubin, A. Al Mahmud, Int. Journal Social Robotics, 2009



- **Summary:** Comparison of iCat and Robovie II concerning how their animate behavior (animacy) lets people judge their intelligence
- **Methods used:** Questionnaires; statistical methods (Kronbach's alpha; ANOVA; …)
- **Comment:** How quickly could you turn a robot off, if it begged you to stay 'alive'?



Paper ID 6:

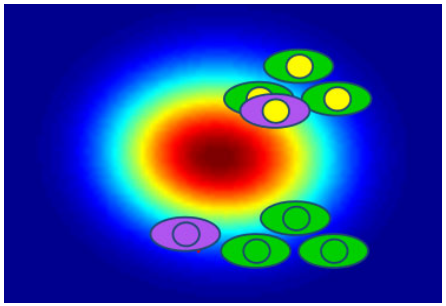
"Where Robot and Virutal Agents Meet" by T. Holz, M. Dragone, G.M.P. O'Hare, Int. Journal Social Robotics, 2009

- **Summary:** Comprehensive review of social interaction with agents embodied as robots, virtual agents and across domains
- **Methods used:** Classification according to Milgram's Reality-Virtuality Continuum: real ↔ mixed ↔ virtual
- **Comment:** Shows how computer science researchers of different application fields can (and should) learn from each other

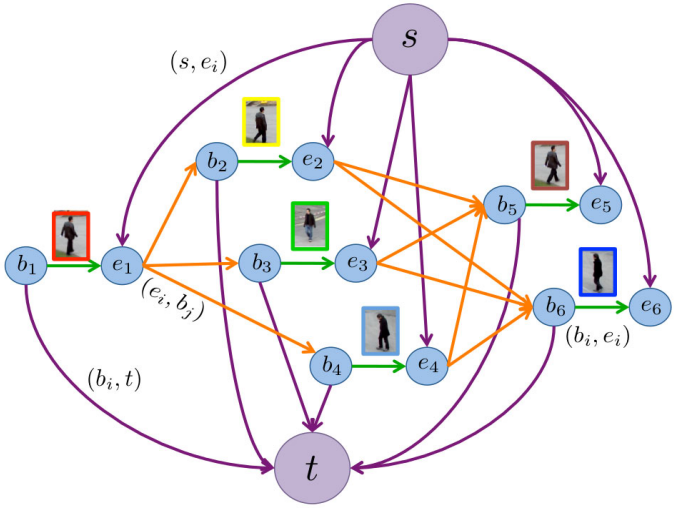
Paper ID 7:

"Everybody needs somebody: Modeling social and grouping behavior on a linear programming multiple people tracker" by L. Leal-Taixe *et al.,* ICCV Workshop 2011

- **Summary:**. Improved tracking by social and grouping behavior models using a minimum-cost network flow. Motion prediction using social forces.
- **Methods used:** Minimum-cost flow network and Linear programming
- **Comment:**
  - Social force model
  - Learnd group behaviour (distance, speed distributions)



- Social forces

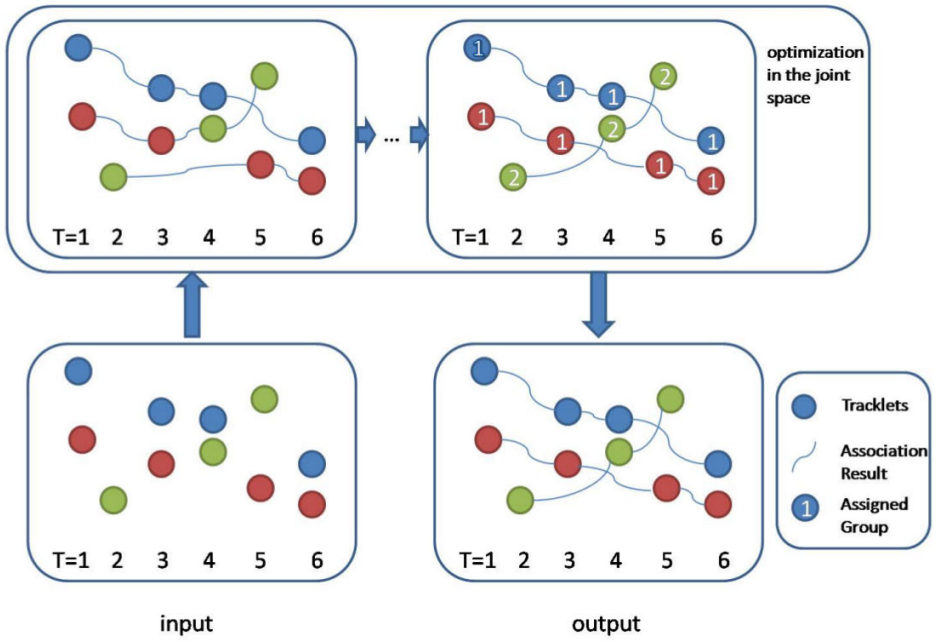


- flow network

Paper ID 8:

"Improving Multi-target Tracking via Social Grouping" by Z. Qin and C. R. Shelton, CVPR, 2012

- **Summary:**. Improved tracking by the analyse of social grouping behavior. Maximization of both visual and social grouping cues. Comparison of tracklets (people) and group trajectories.
- **Methods used:**
  Hungarian algorithm and
  K-means clustering
- **Comment:**
  - Tracklet based tracking
  - Nonlinear global optimization

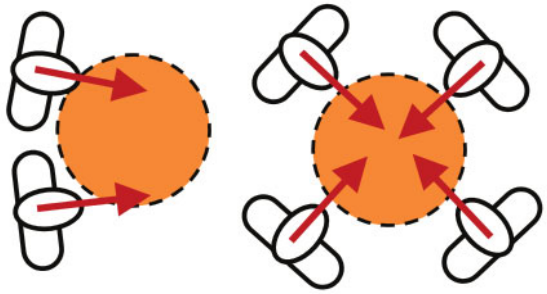


- overview

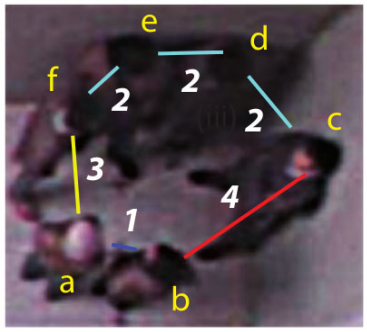
Paper ID 9:

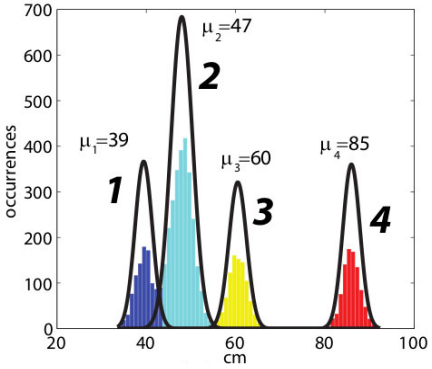
"Towards Computational Proxemics: Inferring Social Relations from Interpersonal Distances" by M. Cristani *et al.*,
Int. Conf. on Social Computing, 2011

- **Summary:**. Detection of social relations based on interpersonal distances. Social and physical distances tend to match one another.
- **Methods used:** Gaussian clustering by Expectation-Maximization (EM)
- **Comment:**
  - Proxemics theory
  - Detection of F-formations
  - Visual tracking



- F-formations





- clustering result

SRL seeks Master thesis students

WANTED: Master Thesis Students at the Social Robotics Laboratory

The SRL is looking for motivated Master thesis students that are interested to work in the following research topics. If successful, we can offer PhD positions for students interested in research starting next spring.

Topics:

- People Detection, Tracking, and Social Grouping from sensory data (2D-, 3D-range data, MS Kinect, Asus Xtion, …)
- Socially-aware Robot Motion Planning among Groups of Humans
- Human-Robot Interaction using our Robot Daryl
- We are open for your own ideas!

If you are interested contact us, visit our homepage (srl.informatik.uni-freiburg.de), or simply drop by!!!

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Social Robotics Laboratory