Robot Navigation

Proseminar & Seminar

WS 2015/16

AIS Autonomous Intelligent Systems

Wolfram Burgard, Barbara Frank, Christoph Sprunk, ...

Organization & Requirements

- Blockseminar in the end of the term
- Two page abstract per topic
- One presentation per topic:
  45 min (30+10+5 min)
- One seminar report per topic:
  7 pages text (+ figures & literature)
- Collaborative (Proseminar only, if necessary): team of 2 students per topic

Schedule

- Assignment of topics:
  this week, please contact your supervisor for literature
- Two page abstract on your topic:
  due 20.11.15
- Talk: Wolfram Burgard “How to give a presentation”
  20.11.15, 16.00, SR 078-00-014

Schedule

- Discussion of slides with your supervisor: 2 weeks before presentation
- Presentations during 1 or 2 full days in Feb 2015
  - 11./12.02.16 or
  - 15.16.02.16
- Reports due: 1 week after presentation

Grading

- 60 % presentation
- 30 % report
- 10 % contribution in discussions

- Giving and receiving feedback after presentations will be practiced

What is Robot Navigation?

- How does the environment look like?
  ➡ Mapping
- Where is the robot in the environment?
  ➡ Localization
- How can the robot reach its goal?
  ➡ Motion planning
- How can it navigate safely?
  ➡ Collision avoidance

Proseminar Topics

Mapping

- B1: 3D Normal Distributions Transform Occupancy Maps: An Efficient Representation for Mapping in Dynamic Environments
  J. P. Saarinen, H. Andreasson, T. Stoyanov, A. J. Lilienthal, IJRR 2013.
- B2: ORB-SLAM: a Versatile and Accurate Monocular SLAM System
  R. Mur-Artal, J. M. M. Montiel, and J. D. Tardos, TRO 2015.

Localization

- B3: Experience-based Navigation for Long-term Localization
  W. Churchill, P. Newman, IJRR 2013.
- B4: The gist of maps - summarizing experience for lifelong localization
  Dymczyk, M.; Lynen, S.; Cieslewski, T.; Bosse, M.; Siegwart, R.; Furgale, P., ICRA 2015.

Motion and Path Planning

- B5: Online Graph Pruning for Pathfinding on Grid Maps
  D. Harabor, A. Grastien, AAAI 2011.
- B6: Drive the Drive: from Discrete Motion Plans to Smooth Drivable Trajectories
  H. Andreasson, J. Saarinen, M. Cirillo, T. Stoyanov, A. J. Lilienthal, Robotics 2014.

Navigation Systems

- B7: Reliable kinect-based navigation in large indoor environments
  Jalobeanu, M.; Shirakyan, G.; Parent, G.; Kikkeri, H.; Peasley, B.; Feniello, A., ICRA 2015.
- B8: Multi-Objective Cost-To-Go Functions on Robot Navigation in Dynamic Environments
  G. Ferrer, A. Sanfeliu, IROS 2015.
- B9: Learning Rough-Terrain Autonomous Navigation
  J. A. Bagnell, D. Bradley , D. Silver, B. Sofman, and A. Stentz, RA 2010.

Obstacle Avoidance

- B10: Reciprocally-Rotating Velocity Obstacles
  A. Giese, D. Latypov, N. M. Amato, ICRA 2014.

Exploration

- B11: Life-long spatio-temporal exploration of dynamic environment
  T. Krajnik, J. Santos, T. Duckett, ECMR 2015.
- B12: 3-D Exploration with an Air-Ground Robotic System
  J. Butzke, A. Dornbush and M. Likhachev, IRSO 2015.

Seminar Topics

More on SLAM

- M1: Full STEAM Ahead: Exactly Sparse Gaussian Process Regression for Batch Continuous-Time Trajectory Estimation on SE(3)
  S. Anderson, T. Barfoot, IROS 2015.
- M2: Reconstructing Street-Scenes in Real-Time From a Driving Car
  V. Usenko, J. Engel, J. Stueckler, D. Cremers, 3DV 2015.
- M3: DynamicFusion: Reconstruction and Tracking of Non-rigid Scenes
  R. Newcombe, D. Fox, S. Seitz, CVPR 2015.

Sensor Fusion

- M4: IMU Preintegration on Manifold for Efficient Visual-Inertial Maximum-a-Posteriori Estimation
  C. Forster, L. Carlone, F. Dellaert, D. Scaramuzza, RSS 2015.

Robot Learning (I)

- M5: Unsupervised online learning for long-term autonomy
  L. Ott, F. Ramos, IJRR 2013.
- M6: Natural Terrain Classification using 3D Ladar Data for Ground Robot Mobility
  J.-F. Lalonde, N. Vandapel, D. F. Huber and M. Herbert, JFR 2006.
- M7: Self-supervised Learning to Visually Detect the Terrain Surface for Autonomous Robots Operating in Forested Terrain
  S. Zhou, H. Chen, M. McDaniel, T. Nishihata, P. Salesses, K. Iagnemma, JFR 2012.

Robot Learning (II)

- M8: Autonomous Helicopter Aerobatics through Apprenticeship Learning
  P. Abbeel, A. Coates and A. Y. Ng, IJRR 2010.
- M9: 3D Convolutional Neural Networks for Landing Zone Detection from LiDAR
  D. Maturana and S. Scherer, IROS 2015.

Motion Planning (I)

- M10: Multi-Heuristic A*
  S. Aine, S. Swaminathan, V.Narayanan, V. Hwang and M. Likhachev, IJRR 2015.
- M11: Planning in the Continuous Domain: a Generalized Belief Space Approach for Autonomous Navigation in Unknown Environments
  V. Indelman, L. Carlone, F. Dellaert, IJRR 2015.

Motion Planning (II)

- M12: An Asymptotically-Optimal Sampling-Based Algorithm for Bi-Directional Motion Planning
  J. Starek, J. V. Gomez, E. Schmerling, L. Janson and M. Moreno, L. Pavone, IROS 2015.

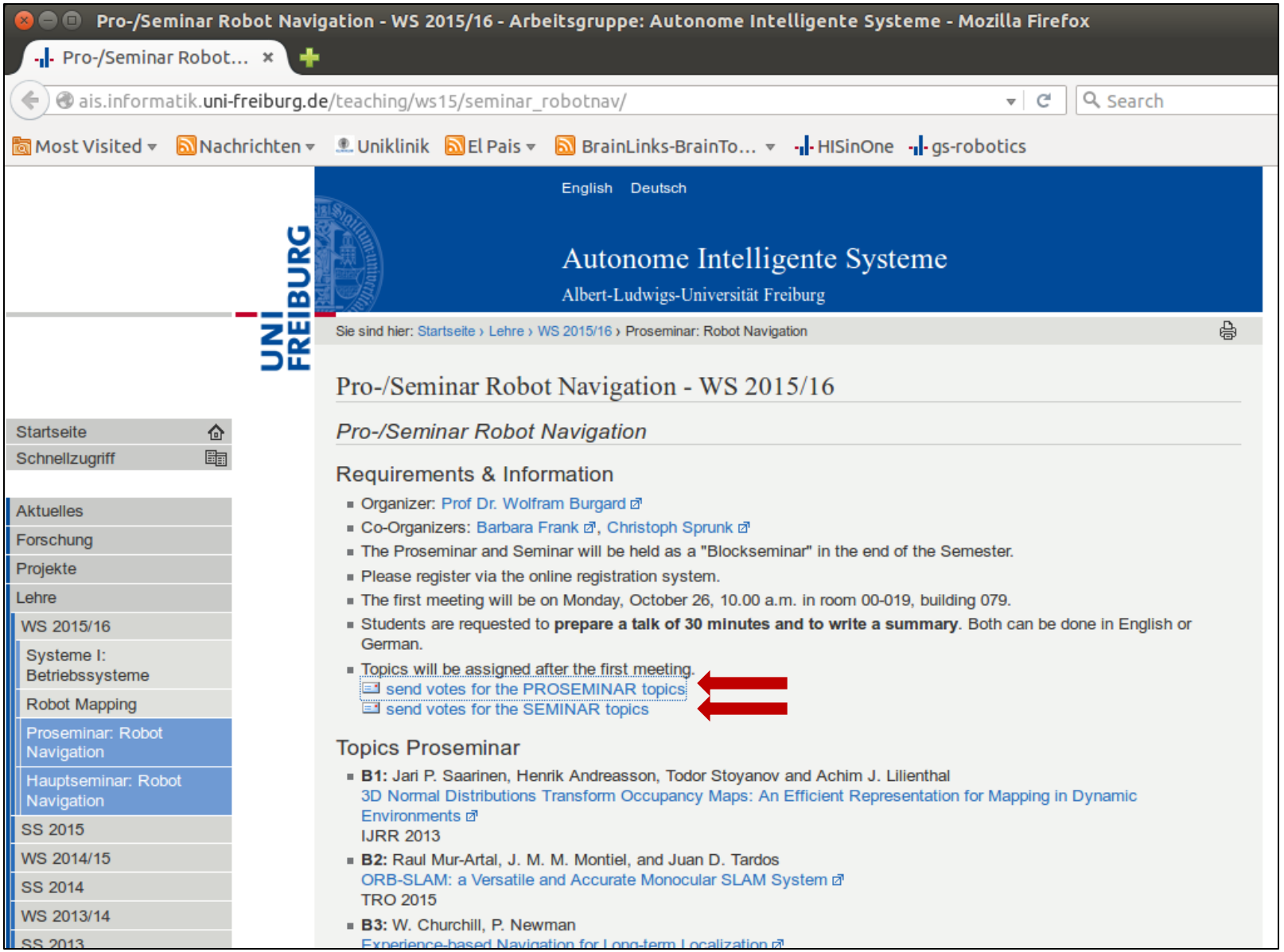
Navigation Systems

- M13: Running Jumps Over Obstacles in High-Speed Quadrupeds
  H.-W. Park, P. Wensing, S. Kim, RSS 2015.
- M14: Detection of Principal Directions in Unknown Environments for Autonomous Navigation
  D. Dolgov, S. Thrun, RSS 2008.

Topic Assignment

- Globally optimal assignment based on your preferences
- Please send us an email with your votes for all papers by Wednesday, October 28, 2015

How to Send Your Votes



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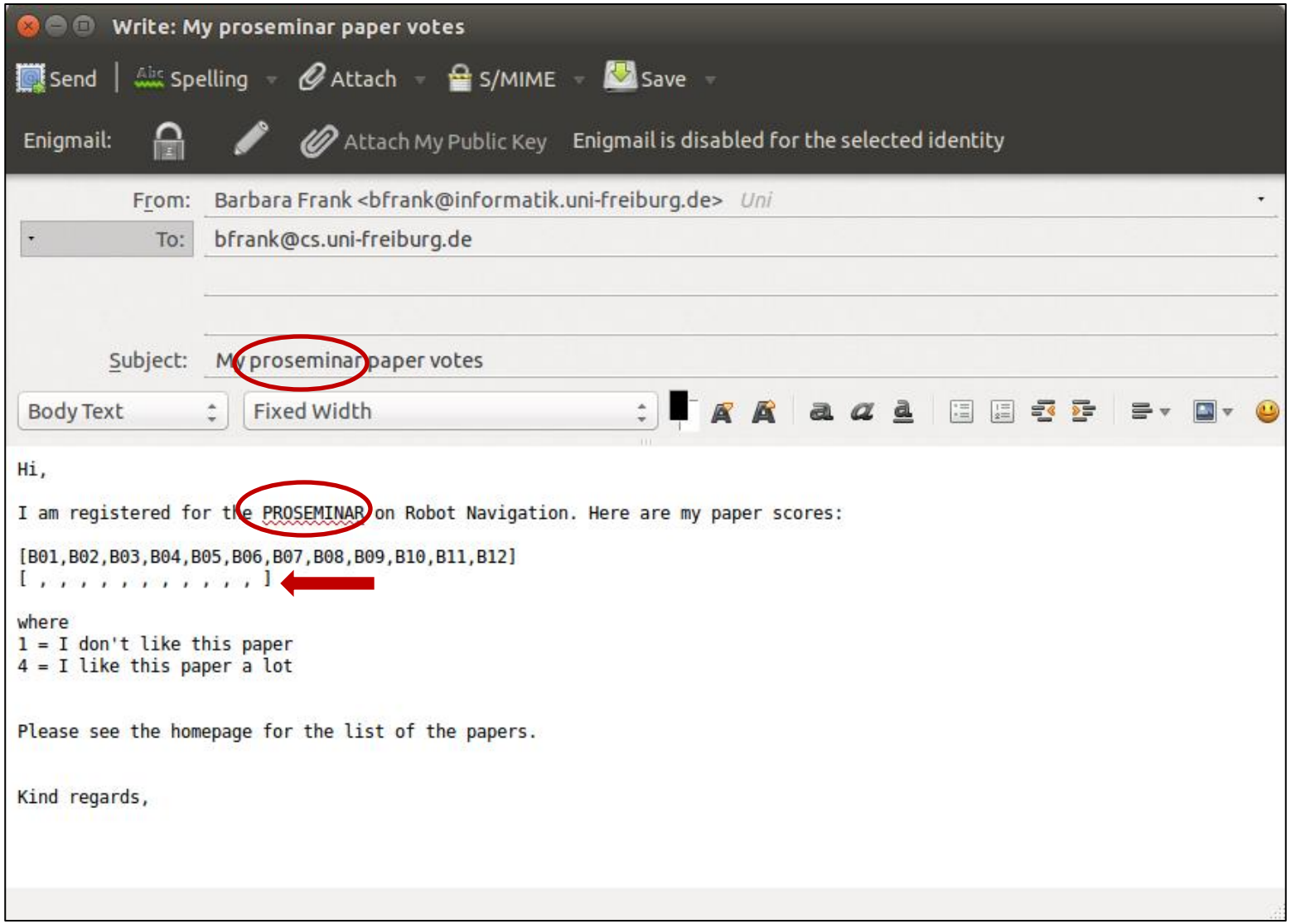

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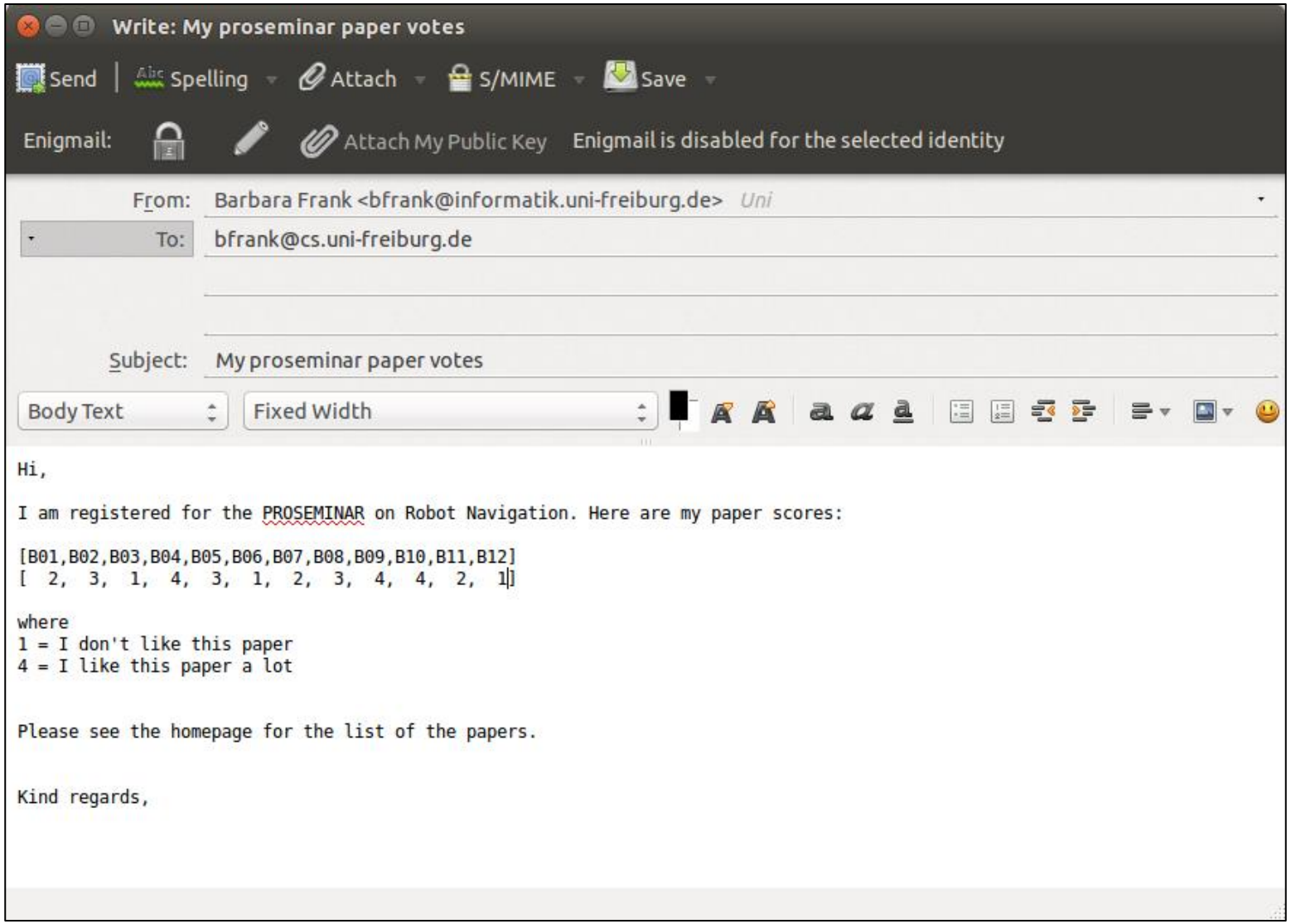

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