TECHNION
Israel Institute
of Technology

DEPARTMENT OF
AEROSPACE ENGINEERING

Vision-Aided Navigation (086761) - Spring 2016

Lecturer: Assist. Prof. Vadim Indelman
(Office: Lady Davis 738, Phone: 04-829-3815, email: vadim.indelman@technion.ac.il)
Course Schedule: Mondays, 14:30-17:30
Room: Lady Davis 283
Office Hours: Tuesday 13:30-15:30, or by appointment
Course Website:

- http://vindelman.net.technion.ac.il/teaching/
- http://piazza.com/technion.ac.il/spring2016/086761/home

1. Syllabus

Inertial and dead reckoning navigation, probabilistic information fusion, vision aided navigation (VAN), simultaneous localization and mapping (SLAM), 3D reconstruction, visual-inertial bundle adjustment (BA), cooperative navigation and SLAM, active state estimation and belief-space planning.

2. Grading Policy

Homework assignments: 30%
There will be 5-6 homework assignments combining theoretical and practical aspects covered in class. Each homework assignment will be given 2 weeks to complete. Assignments should be submitted before the lecture, i.e. before Monday 14:30. Working in groups of two is acceptable and encouraged.

Midterm exam: 25%

Project: 45%
The project will consist of reading scientific material (typically 1-2 papers), giving an oral presentation in class, and submitting a report. The project should be performed in groups of TBD students and be submitted by the last lecture.

3. Prerequisites

104034 Introduction to probability
086777 Estimation

4. Course Schedule

Course **tentative** weekly schedule (will probably change during the semester):

Week	Date	Topic
1	14.03.16	Introduction, 3D rigid transformations and 6DOF poses, Dead reckoning
2	21.03.16	Probability basics, Bayesian inference, Extended Kalman filter
3	28.03.16	Projective camera geometry, Feature detection and matching
4	04.04.16	Structure from Motion, Multiple view geometry, Bundle adjustment
5	11.04.16	SLAM and VAN
6	18.04.16	Graphical Models, iSAM
7	02.05.16	iSAM, visual-inertial SLAM
8	16.05.16	Guest lecture
9	23.05.16	Overview: Multi-robot navigation and SLAM, robust perception
10	30.05.16	Overview: Active SLAM, Belief space planning
11	06.06.16	Project presentations
12	13.06.16	Project presentations
13	20.06.16	Project presentations

5. Textbooks

[1] Farrell, Jay. Aided navigation: GPS with high rate sensors. New York: McGraw-Hill, 2008.
[2] Thrun, Sebastian, Wolfram Burgard, and Dieter Fox. Probabilistic robotics. MIT press, 2005.
[3] Hartley, Richard, and Andrew Zisserman. Multiple view geometry in computer vision. Cambridge university press, 2003.