Lecture 01: Introduction

T2: Perception in Robotics. (Instructor: Gonzalo Ferrer, TA: Robert Karklinsh)

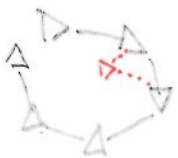
Q: Why are you here? What are your expectations?

Def: Perception: "Awareness of something through the senses"

- Representation / Structure } world } { Cameras, Lidar, Acc's }
- Meaningfull for algorithms: State

Q: What are the challenges or need capabilities?

- *Sensing → { Calibration, Segmentation, Object classification, Semantic classific., Place recognition *, Outlier rejection *, Data association * }
- *State estimation / Sensor fusion
  - Pose estimation *
  - Mapping **
  - localization ** (SLAM)
  - Data fusion *
  - Tracking.



* Course Goals
  - Mastering (≠ surveying) a set of core algorithms
  - Development on new Technology
  - Research

* Prerequisites : - Basic programming skills (Python)
- Probability : L 1.5 on canvas. Check.
- Lin. Algebra : Review material Undergrad course:
Geometry, $Ax = b$, Spectral decomp.

* Class Structure

16 lectures

Monday	16:00 - 18:00	(423?)
Tuesday	10:00 - 12:00	(~~423~~) R339
Friday	13:00 - 15:00	(~~Red 351~~) R339

30% Problem-Sets PS1 : Probability.
PS2 : Localization
PS3 : SLAM

30% Midterm exam (3 - Dec - 2019)

40% Final project

* PS Policy
follow submission instructions
-15%/day Lateness
Regrade (+1 week)

* Office hours

Prof. Ferrer	Friday	15:00 - 17:00 (RED-344)
Robert Karklinsh	Thursday	18:00 - 20:00

* Material

Class notes

Prof. notes (on Canvas the day before)

Book: "Probabilistic Robotics" (3rd ed.) Thrun, Burgard and Fox

Selected papers each lecture on Canvas.

* Final project

- 3 Students (±1)

1) Proposal 1 page doc. Viability of the project.

2) Progress (Optional) 3 page doc Milestone

3) Presentation 12' + 3' questions

4) Paper: final project document. IEEE Template.

* Probability check (lecture on this on Canvas if necessary)

Product Rule $p(x,y) = p(x|y)\,p(y)$

Total Probability $p(x) = \int p(x,y)\,dy$ (Marginalization)

$p(x|z) = \int p(x,y|z)\,dy$

Independent random variables $p(x,y) = p(x)\,p(y)$

Bayes Theorem

$$p(x|y) = \frac{p(y|x)\,p(x)}{p(y)} = \frac{p(y|x)\,p(x)}{\int p(x,y)\,dx}$$