AAE2004 Introduction to Aviation Systems
AAE
Design of Path Planning Algorithm for Aircraft Operation

Final Week: Discussion and Outlook

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Assisted by
Miss Hiu Yi HO (Queenie), Miss Yan Tung LEUNG (Nikki)

Lecturer's Information

- **Instructor**: Dr Li-Ta HSU
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- Office Hour: by appointment

- **Expertise:** GPS navigation, Autonomous driving, Pedestrian localization using Smartphone, Sensor Integration

Li-Ta HSU

1985.08 – Born in a fish farmer family in Tainan, Taiwan

2003.06 – Graduated from Kang Ming Senior High School, Taiwan

2007.06 – Bachelor of NCKU Department of Aeronautics and Astronautics (DAA), Taiwan

2010.09 – Ph.D. Candidate of NCKU DAA, Taiwan

2012.02 – Visiting Researcher in University College London, UK

2012.06 – Part-time Consultant for Spirent, UK

2013.07 – Visiting Researcher in Tokyo Marine University, Japan

2013.12 – Ph.D. of NCKU DAA, Taiwan

2014.04 – Postdoctoral Researcher in the University of Tokyo , Japan

2017.05 – Assistant Professor in AAE of PolyU, Hong Kong

2021.07 – Associate Professor in AAE of PolyU, Hong Kong

Ground Rules

For students

- Try to speak as much English as possible.
- Participate the class activates assigned.

For teaching staffs

- Reply your email with 3 working day.
- Open to any question regards to the subject

For us!

- Keep an open mind—enter the classroom dialogue with the expectation of learning something new. Look forward to learning about–and being challenged by–ideas, questions, and points of view that are different than your own.
- Arrive on time to the class and finish the class on time

Necessary Information

- Course Repository link: https://github.com/IPNL-POLYU/PolyU_AAE2004_Github_Project
- TA Information & Contact:
  - Group 1-5: Queenie Ho (hiu-yi.ho@connect.polyu.hk)
  - Group 6-10: Nikkie Leung (yan-tung.leung@connect.polyu.hk)

Why coding/programing is important for Aviation Engineering (specially after COVID-19)?

What are challenges to make this happen?

https://dronelife.com/

Infrastructure inspection

- Parcel Delivery

Infrastructure inspection

- building and bridge defects, etc.

Search and Rescue (SAR)

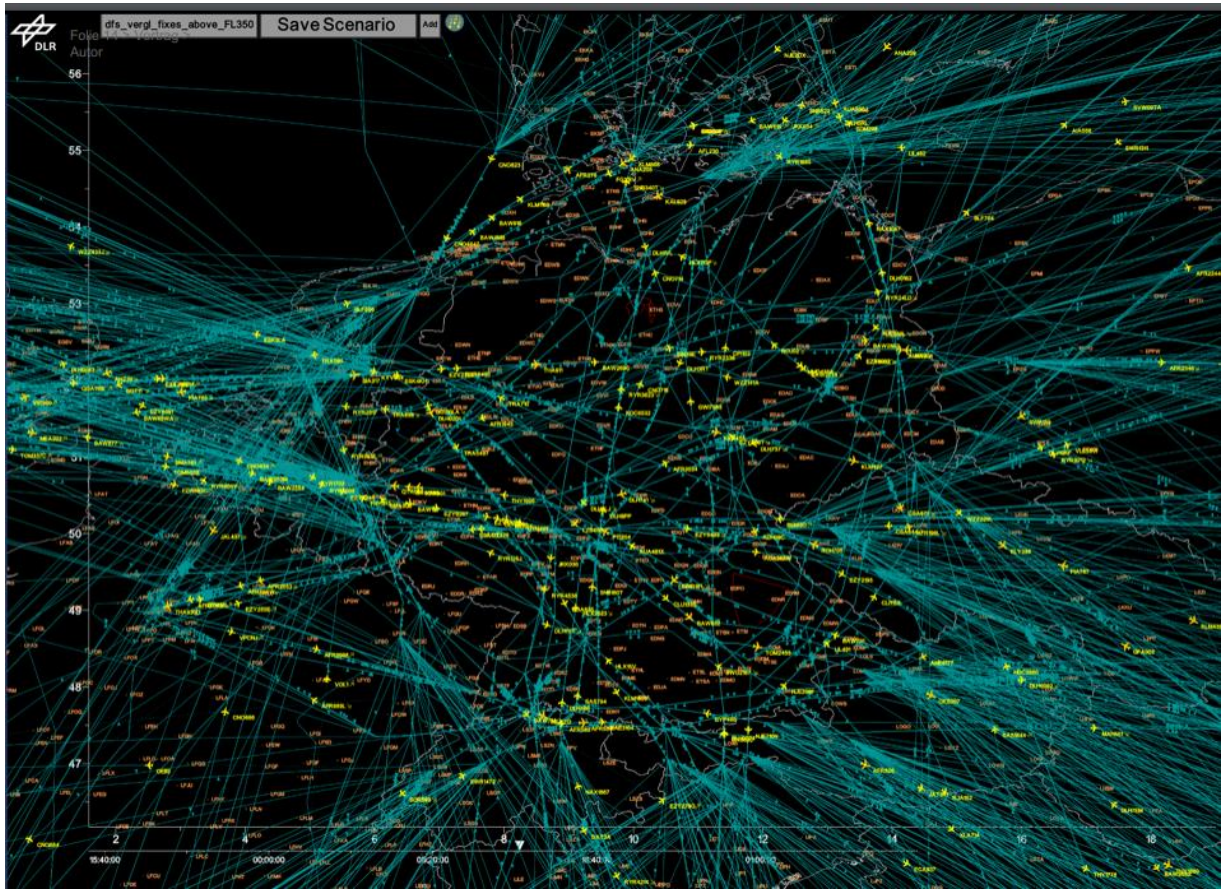
- disaster prevention and rescue,

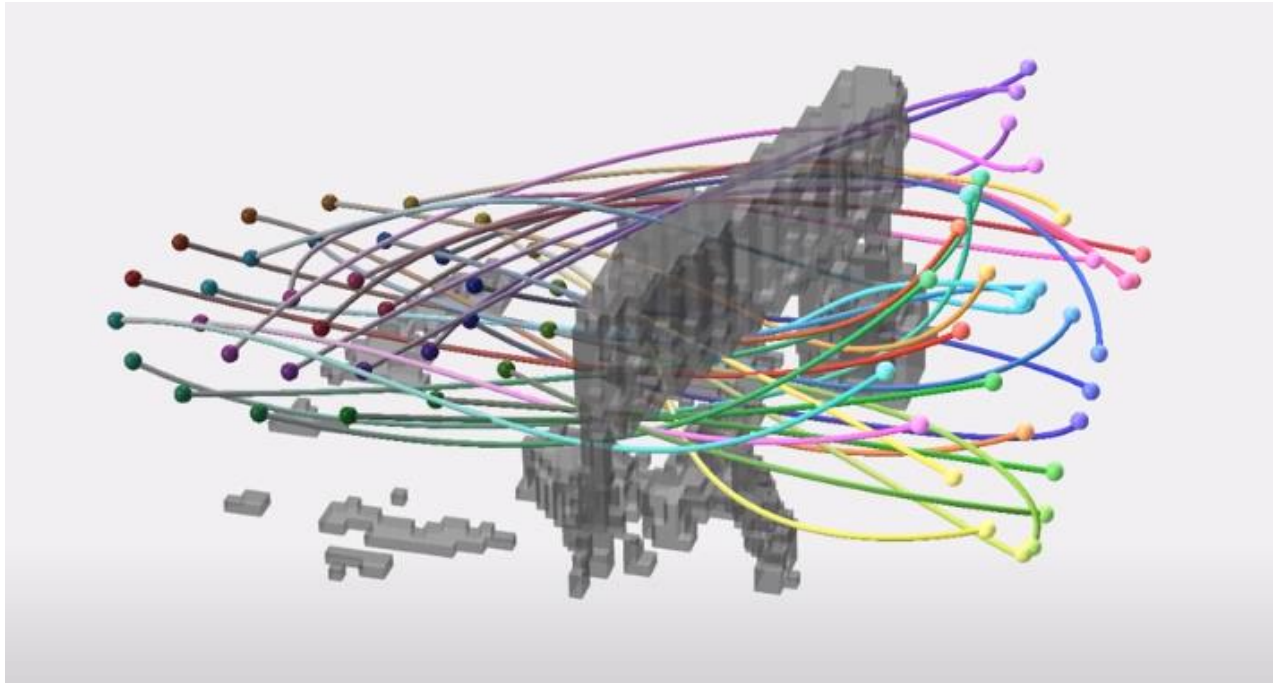
Smart transportation

- traffic monitoring management
- air quality monitoring

Crowded Airspace in Cities

Challenges - Collaborative Path Planning

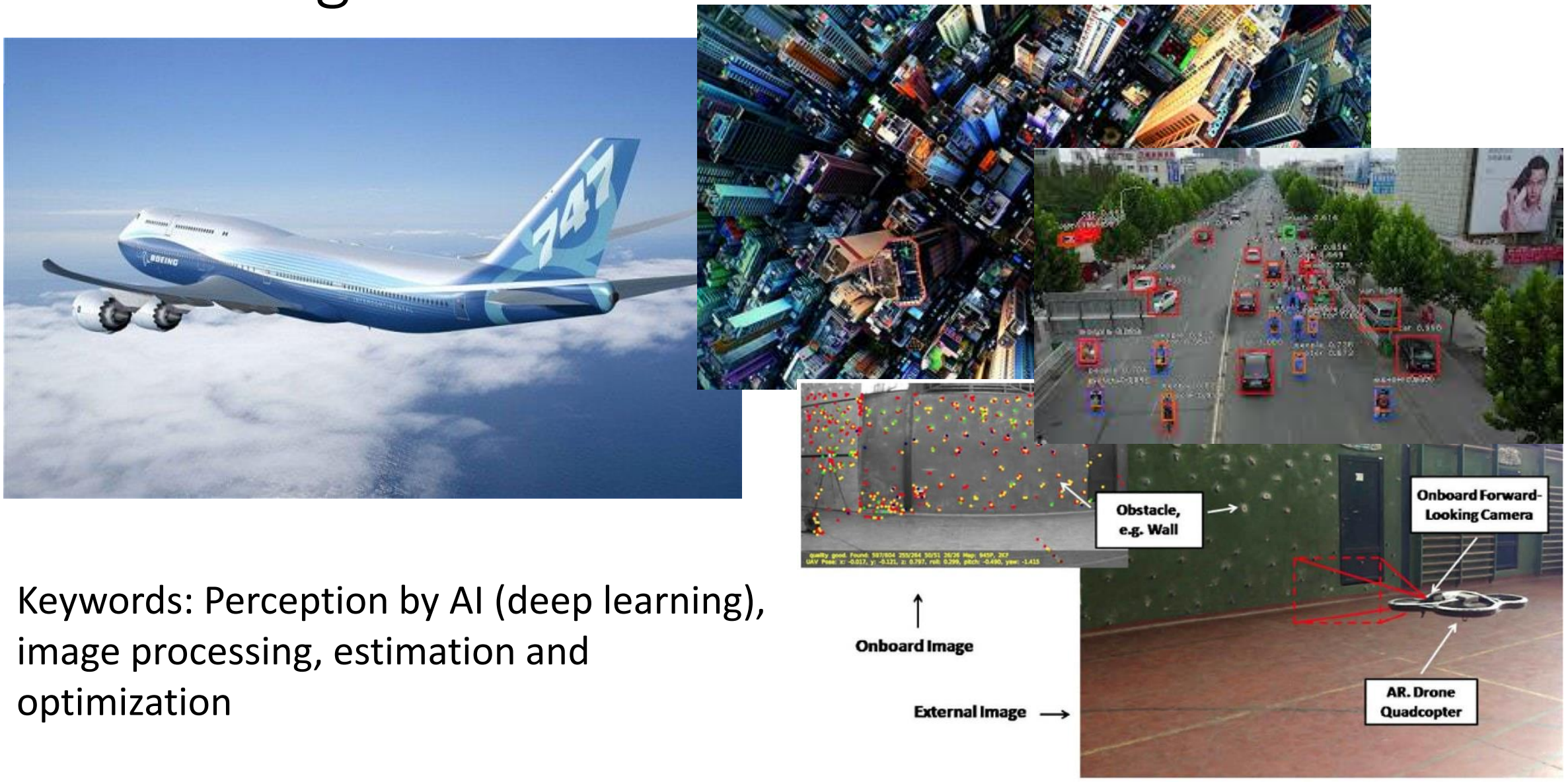




https://www.youtube.com/watch?v=7KIa9FlmbRc

Keywords: Path planning, traffic control, SWARM collabation, IoT, Connect vehicles, and Smart Cities

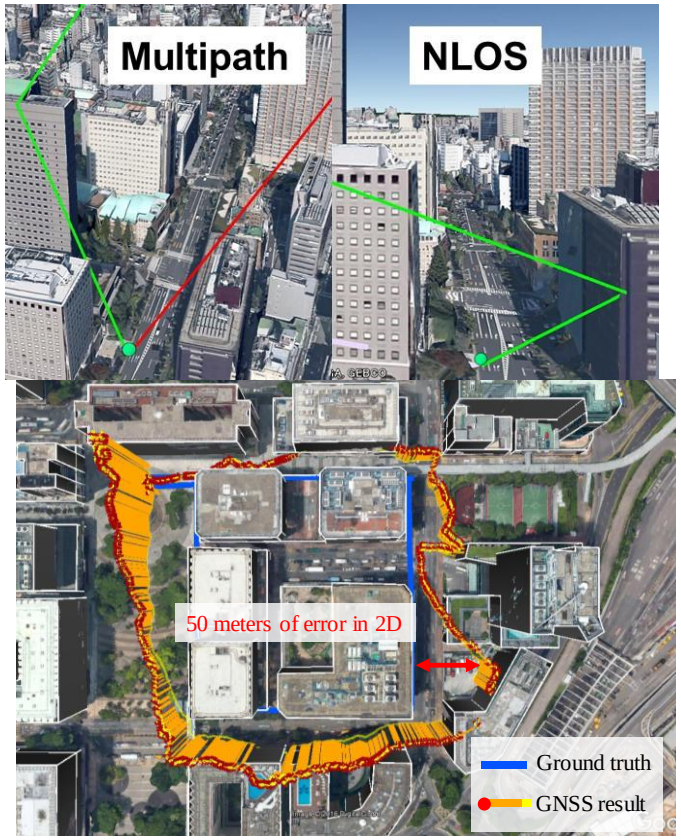
Challenges – Collision Avoidance



Keywords: Perception by AI (deep learning), image processing, estimation and optimization

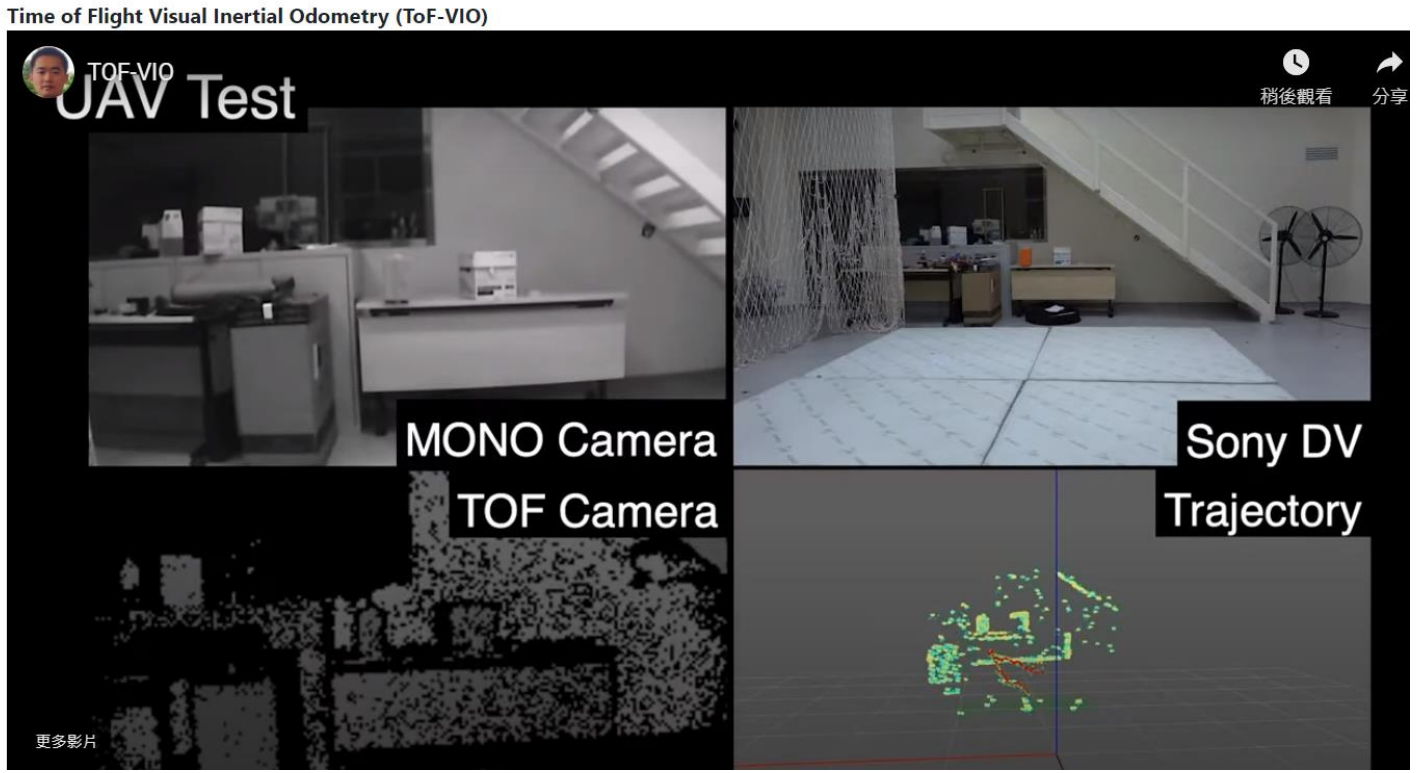
Challenges – Navigation in Challenged Environments

Challenge in GNSS Positioning



Visual Navigation

https://www.polyu.edu.hk/researchgrp/cywen/index.php/en/mav-uav/perception-slam.html

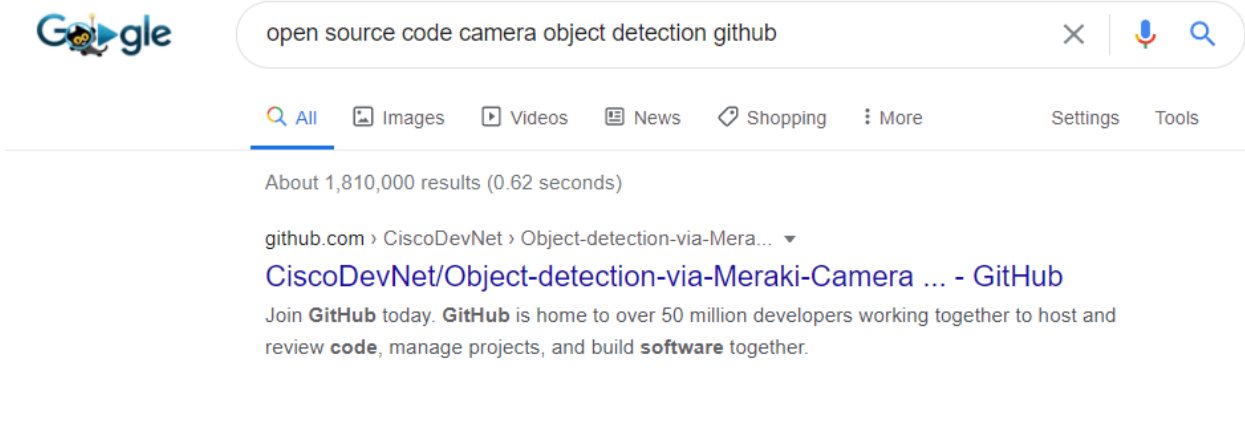


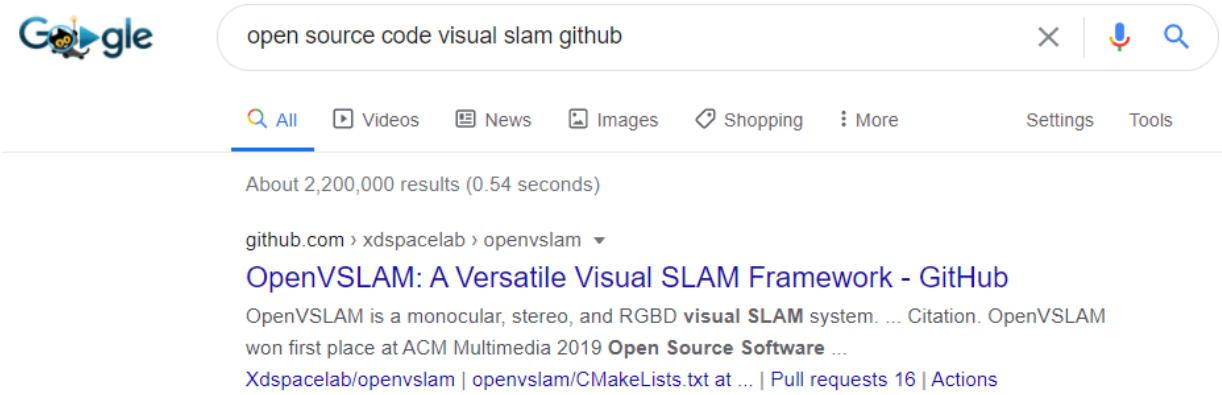
Keywords: GNSS, inertial navigation system, visual positioning, simultaneous localization and mapping (SLAM), sensor fusion, filtering.

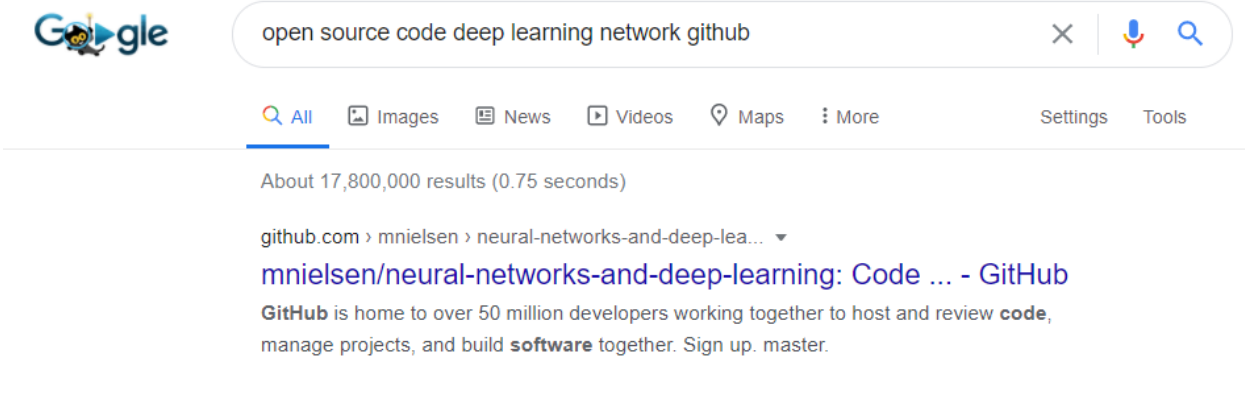
Integrity and Safety

Keywords:
Airworthiness, Reliability, Compliance (regulation-wise)
Statistics and modelling (mathematics-wise)

Most of the sample open-source codes can be found in GitHub







To do list in your 4 years…

1. To initiate one hand-on project (by coding or manufacturing) related to your passion.
   - Manufacturing an UAV, Enabling autonomous function of an UAV, etc
2. To find news and articles (by hashtag or club in social networks) that related to your interests.
   - Accumulating your domain knowledge and expand your network with someone who have similar passion to you.
3. To find the issues/problems (in your network, village, city, nation, area and the world) you cared and try to find solutions to these challenges.

(Video) AI and Data Science in Aviation

- https://www.youtube.com/watch?v=D8NlYPtPgwA
- 1:18 - Revenue Management
- 3:36 - In-flight sales and food supply
- 5:03 - Fuel consumption optimization
- 6:36 - Boarding and checking bags with facial recognition
- 8:33 - Preparing a plane for the next flight

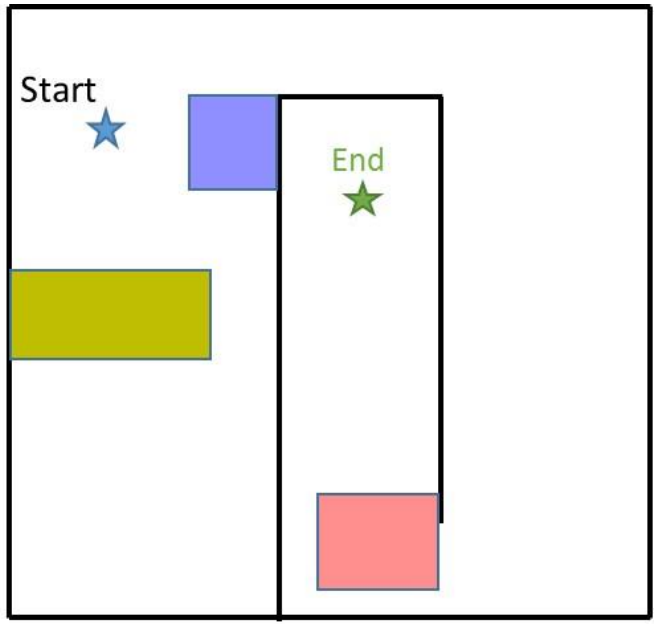
Dialogues and Discussions

Dare to ask and communication is the first step of your success

In this project, we do…

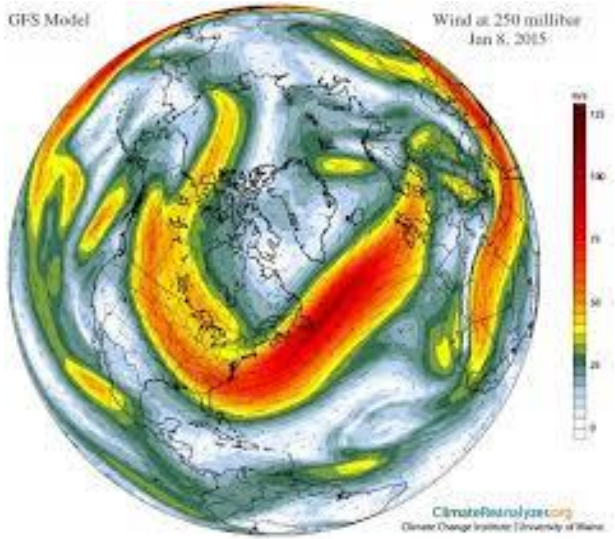
Aircraft Model	C_F	ΔF	C_T	ΔT	C_c	ΔF_a	ΔT_a	C_P	ΔP
PolyU-A380	1	1	2	5	10	0.2	0.2	-2	2

$$C = C_F \cdot \Delta F + C_T \cdot \Delta T + C_c + C_P \cdot \Delta P$$

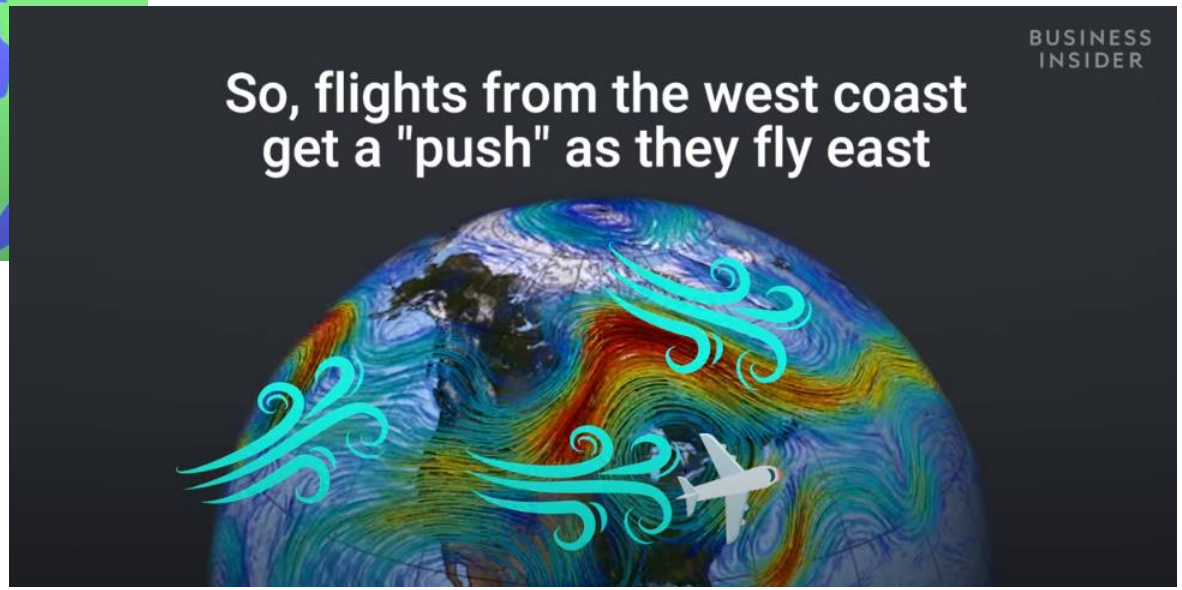


But in the real life,

Aircraft Model	C_F	ΔF	C_T	ΔT	C_c	ΔF_a	ΔT_a	C_P	ΔP	…
Your designed aircraft	?	?	?	?	?	?	?	?	?	?



What does C_p mean? Jet Stream Winds



https://www.youtube.com/watch?v=tMN1f4dvpHI

Final To do list in this project

1. Finish as much tasks (using Python) as you can
2. Write a report to introduce your project and reflect what you have learned
3. Make a video presentation to share and communication your ideas and projects
4. Submit the peer evaluation form individually