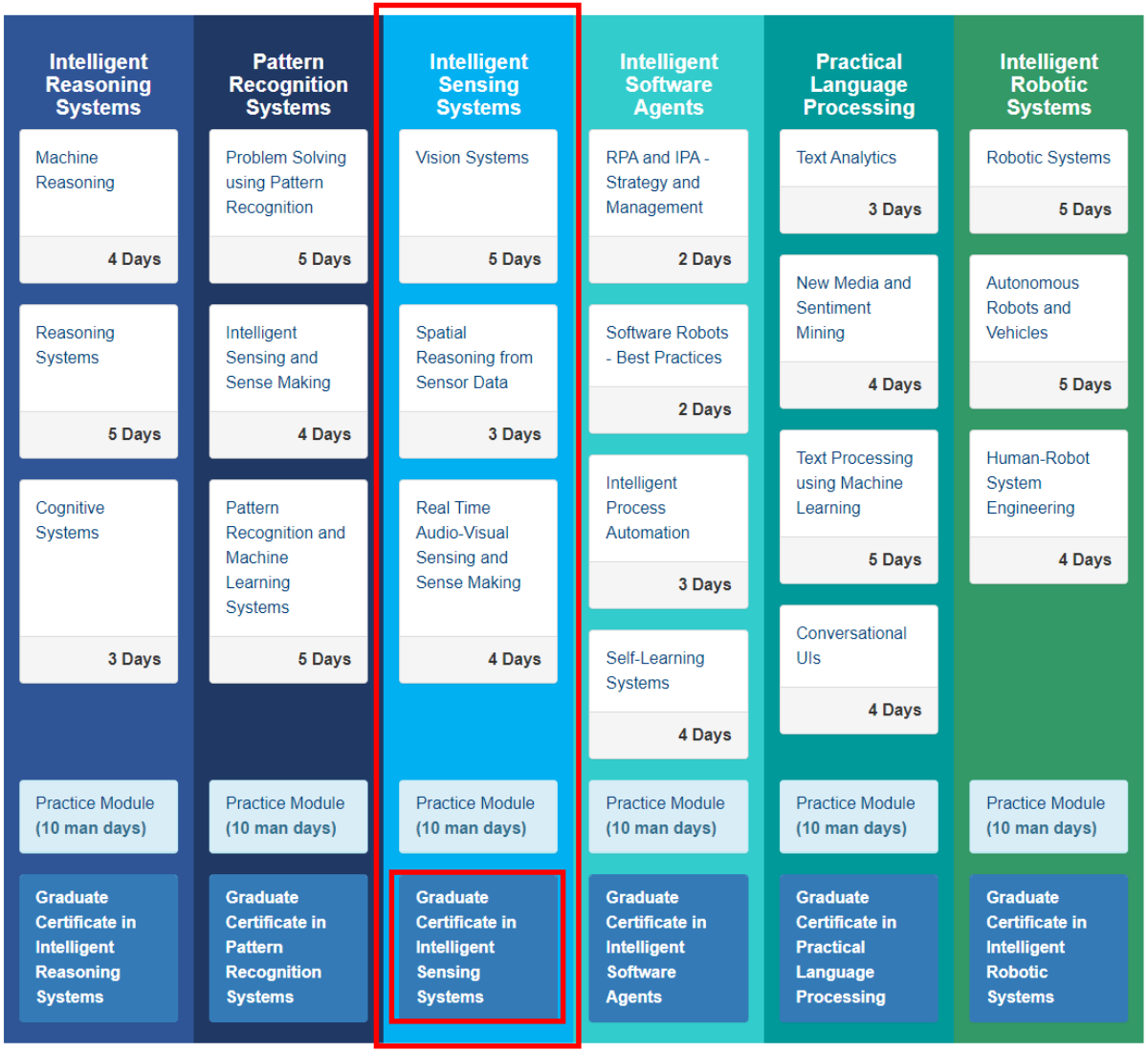
GRADUATE CERTIFICATE INTELLIGENT SENSING SYSTEMS (ITSS)

PRACTICE MODULE (IS02 PART-TIME THROUGH-TRAIN)

Dr TIAN Jing

tianjing@nus.edu.sg

Graduate Certificate Intelligent Sensing Systems (ITSS)



Standard Grading Scheme		CAP
A+	85 - 100	5.0
A	80 - 84	5.0
A-	75 - 79	4.5
B+	70 - 74	4.0
B	65 - 69	3.5
B-	60 - 64	3.0
C+	55 - 59	2.5
C	50 - 54	2.0
D+	45 - 49	1.5
D	40 - 44	1.0
F (Fail)	0 - 39	0.0

Graduate Certificate Intelligent Sensing Systems (ITSS)

Overview: This graduate certificate teaches the skills and techniques required to build Intelligent Sensing Systems that are able to make decisions based on visual and audio sensory signals. Example systems include object detection and human behavior understanding in video surveillance, defect segmentation in manufacture, 3D vision localisation for robot and vehicle control, human activity recognition using audio-visual data, etc.

Key Takeaways:

- Develop, design and integrate intelligent systems that can reason and make decisions based on visual and audio inputs.
- Build intelligent sensing systems, such as object detection, segmentation, and tracking; video analytics and behavior understanding; 3D and RGB-D vision processing; multiple modal data sense making from audio-visual data
- Apply current best practices and tools for building intelligent sensing systems, implementation and optimisations.

Reference: https://www.iss.nus.edu.sg/stackable-certificate-programmes/intelligent-systems/graduate-certificate-in-intelligent-sensing-systems

Graduate Certificate Intelligent Sensing Systems (ITSS)

NICF - Vision Systems

This course will provide participants with the comprehensive knowledge of computer vision methods and technologies, and the practical skills to design and build vision systems to solve real-world problems. Participants will benefit from a careful balance of lectures and practical workshops, and some of the topics covered will include concepts and techniques for vision system, video modelling and representation, video processing and analysis, feature extraction and representation, vision system using machine learning such as detection, recognition, segmentation, design, build and evaluate real-time vision system, etc.

NICF- Spatial Reasoning from Sensor Data

This course presents the core theory and algorithms of spatial reasoning from sensor data, and practical skills and strategies for real-world applications through workshop sessions. 3-D scene representation and reconstruction from visual data, active vision and 3-D spatial reasoning, recent advances in 3-D scanning and tracking technology (e.g. LIDAR), 3-D representation schemes that accommodate kinematic, dynamic and probabilistic computations into a single framework. Application areas discussed will include video games, robotics and engineering, augmented reality (AR) and virtual reality (VR).

NICF-Real Time Audio-Visual Sensing and Sense Making

This 4-day course presents the core technologies of audio-visual sensing and sense making fundamentals, and practical audio/video analytics skills and strategies for real-world industrial implementations through workshop sessions. The course will cover the how to process, integrate, interpret and act upon both audio and visual data in real time, such as fundamentals of audio processing in spatial and frequency domain, audio analytics and video analytics, motion and tracking, video classification and event recognition, as well as practical workshop sessions that allow participants to analyse, articulate and apply the new skills in their work and that of their teams and organisations.

Practice Module

The main objectives of this module is to strengthen the participants' understanding of practical skills and knowledge of application acquired in the courses in respective certificate in a supervised manner. Also, to enable participants to demonstrate their proficiency across all of the skills that they have learned in the course modules and hence be certified as competent at the Certificate level.

It is also attached to a formal grading mechanism so that the certificate may be used as one component in the NUS-ISS Stackable Master of Technology (MTech) in Artificial Intelligence

Project scope and team size

- Team size: 2-4 members.
- Participants are to source for suitable projects, either from your own organizations, or your own ideas. ISS will provide guidance by reviewing the suitability of a project.
- The practice module will take an estimated 10 days of effort by participants. These days are not expected to be continuous and may stretch over many weeks.

Project scope: The team may propose any practical application that demonstrates the advantage of intelligent sensing techniques using the skills taught in this certificate. Note that we will evaluate the project scope case by case. The project needs to develop and integrate at least one of following aspects, such as
• Image analytics, such as object detection, segmentation
• Video analytics, such as object tracking, action recognition, surveillance
• Multiple modality sensor data analytics, such as RGB-D image, point cloud data, audio-visual data, etc

Schedule

Date	Agenda	Description	Remark
9 January 2021 (Saturday)	Module Briefing	The participants are briefed on the requirements, conduct and assessment of the practice module.	First day of VSE course
20 March 2021 (Saturday)	Proposal presentation	The participants present their proposals for review by the lecturers. The lecturers provide the review comments. 10 minutes presentation + 5 minutes Q&A.	After SRSD course (zoom online)
Proposal presentation submission: 20 March 2021 (Saturday), 1159pm.			
19 May 2020	Written Exam	Three-hour written examination	
Final project deliverables submission: 23 May 2021 (Sunday), 1159pm.			

Assessment

	Assessment	Percentage
Group component	Practice module proposal presentation	5%
	Practice module final deliverables • Literature review (10%) • Technology/Novelty/Experiment (20%) • Final report writing (10%)	40%
Individual component	Practice module peer review	5%
	In-class quiz (i.e., VSE, 4%, SRSD, 3%, RTAVS, 4%)	10%
	Final written exam for the whole certificate	40%
	Bonus task (optional): Create a tutorial for either an explanation of a fundamental topic related with computer vision, or a hands-on practice of tool/library. Examples (but not limited to): • Explanation of mAP in object detection, https://towardsdatascience.com/breaking-down-mean-average-precision-map-ae462f623a52 • How to train YOLOv4 using custom dataset in Colab, https://medium.com/@SrikarNamburu/implementingyolov4-to-detect-custom-objects-using-google-colab-6691c98b15ff	5% (optional)

Submissions

	LumiNUS folder	Your submitted files	Remarks
Proposal submission Due on 20 March 2021, 1159pm	\\Practice Module\\Proposal presentation submission	• Fill in the project proposal presentation "ITSS_Project_Proposal_Presentation_Template.PPTX". • You can upload AFTER your presentation.	One PPTX file per team
Final submission Due on 23 May 2021, 1159pm	\\Practice Module\\Final submission (everything)	• Source code and dataset (you can provide a cloud storage link, e.g., Dropbox, not uploading huge files into LumiNUS). • Report (8-10 pages, Latex source files and final pdf file, use the template "ITSS_Project_Report_Template.zip" provided in LumiNUS). Recommended online writing tool, Overleaf, https://www.overleaf.com. • A demo video file (e.g., processed video output, etc). • Zip everything into a single zip file	One Zip file per team
Final submission Due on 23 May 2021, 1159pm	\\Practice Module\\Final submission (report pdf)	• A single final report pdf file as same as in the above zipped file.	One pdf file per team
Peer evaluation form Due on 23 May 2021, 1159pm	\\Practice Module\\Cert peer evaluation form submission	• Fill in the form "ITSS_Project_Peer_Evaluation.docx" (available in "Practice module" folder)	One pdf file per student
Individual project report Due on 23 May 2021, 1159pm	\\Practice Module\\Cert individual report submission	• Fill in the form "ITSS_Project_Individual_Report.docx" (available in "Practice module" folder), up to 2 pages.	One pdf file per student
Bonus task Due on 23 May 2021, 1159pm	\\Practice Module\\Bonus task submission	• A simple txt file that contains the URL of your works in any online platform. • See next slide for details.	One txt file per student

Past project examples

Surveillance	Healthcare
• A vision system that recognize, count and correct physical exercises • Emotion recognition using voice, facial and body posture • Fall detection using OpenPose	• Hand washing steps recognition system • Static sign language recognition and translation
Transportation	**Manufacture**
• Green man estimator: A vision based intelligent pedestrian crossing system • Image retrieval for location prediction • Intelligent lane detection and tracking for autonomous vehicle navigation	• Real-time computer interface control with human pose estimation • Vision-based operator activity recognition for personnel efficiency analysis
Consumer electronics	**Other related topics**
• Tennis sports video analytics • Automatic werewolf referee system using computer vision	• CS231n (Stanford), http://cs231n.stanford.edu/project.html • CS230 (Stanford), https://cs230.stanford.edu/project/

Examples in past semesters: http://bit.ly/2G4I72j

FAQ

No.	Question	Clarification
1	Do we need to show 'experimental results' in the proposal presentation?	No need. It is a proposal presentation, not a progress review. The purpose of the proposal presentation is to provide early feedback to ensure you are on the right track.
2	Do I need to develop a user interface, or just run script from the terminal.	No need user interface. A pure computer vision model run via the terminal is fine.
3	Do I need to provide user manual as part of deliverables?	No need.
4	Can I use Word to write project report?	No. Please use Latex.
5	Can I use public dataset?	Yes, you can. In this case, your project will be more evaluated in the technical aspect, as you will spend less efforts on the dataset that is well organized. Also, it would be good to use your own data to 'test' your system although it is trained from a public dataset.
6	Do we need to record a video powerpoint presentation in final submission as in PRS Cert?	No need.
7	Do we need to record a product introduction video presentation in final submission as in IRS Cert?	No need.
8	What do we need to provide in the demo video?	It is a technical demonstration of your developed system. For example, you can overlay your processed results on the image data (e.g., detected object contour, recognized results, etc).
9	Is there any final presentation after project is finished?	No.
10	Can I do a solo project?	It is not encouraged to do solo project.

Thank you!

Email: tianjing@nus.edu.sg