GRADUATE CERTIFICATE INTELLIGENT SENSING SYSTEMS (ITSS)

PRACTICE MODULE (IS04 FULL-TIME/PART-TIME MTECH)

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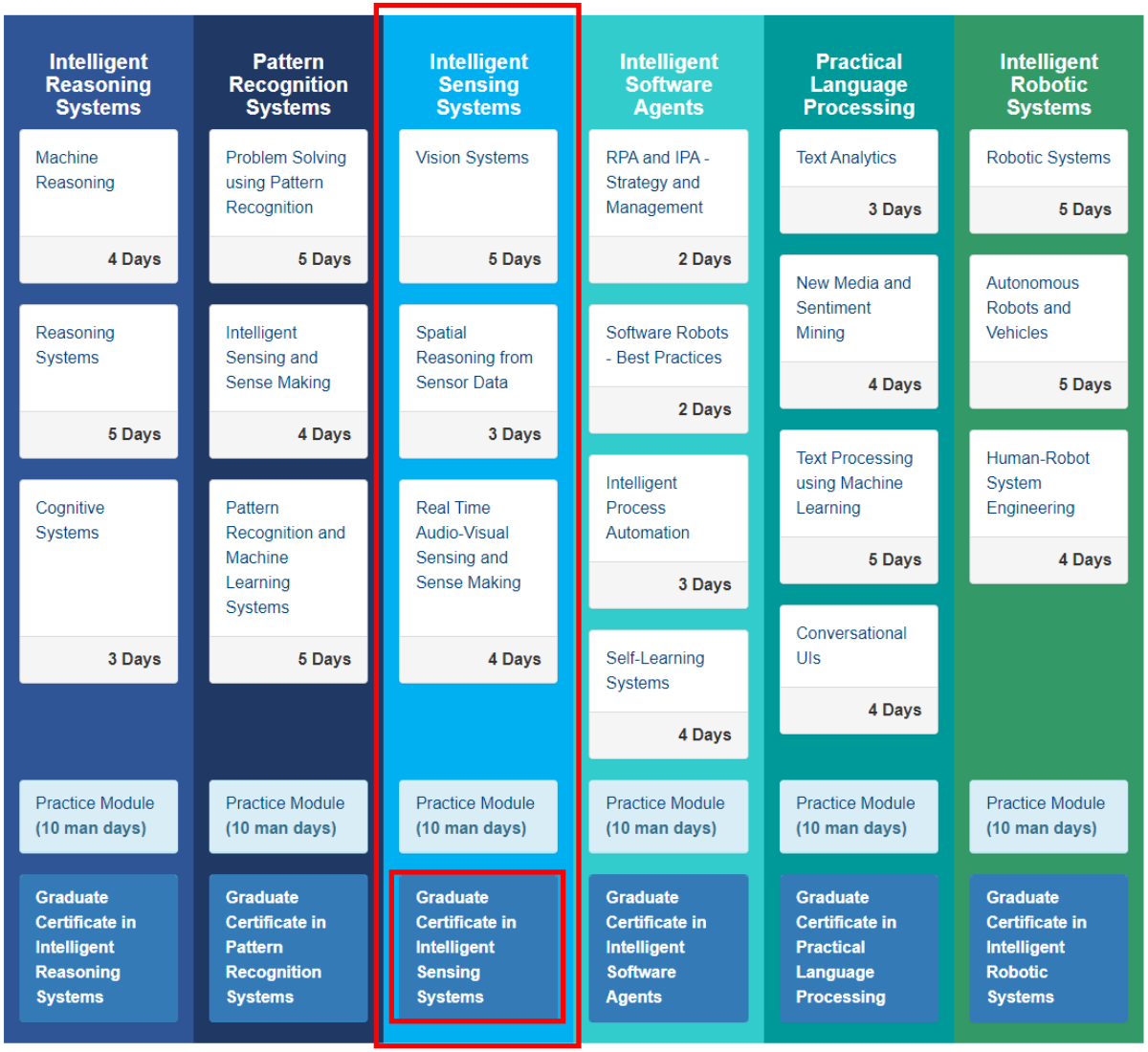
Graduate Certificate Intelligent Sensing Systems (ITSS)



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)

Vision Systems (VSE)

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.

Spatial Reasoning from Sensor Data (SRSD)

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).

Real Time Audio-Visual Sensing and Sense Making (RTAVS)

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.
- Please form your teams in 'Class Groups' in Canvas.
- Participants are to source for suitable projects, either from the sponsor companies (if any) or your own ideas.
- 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. 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, audio-visual data, etc

Assessment

	Assessment	Percentage
Group component	Practice module proposal presentation	5%
	Practice module final deliverables • Literature review (5%) • Technology/Experiment (20%) • Final report and recorded 10-min presentation (10%)	35%
Individual component	Individual contribution (e.g., peer review, etc.)	10%
	Final written exam for the whole certificate	50%
	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)

Schedule

	Full-time	Part-time/Stackable
Practice module briefing	13 January, 2023, Friday, 5pm	7 January, 2023, Saturday, 5pm
Proposal presentation (10 minutes presentation + 5 minutes Q&A)	10 March, 2023, Friday (tentative)	1 April, 2023, Saturday (tentative)
Written exam	16 May, 2022, Tuesday	
Final project deliverables submission	21 May, 2022, Sunday, 1159pm	

Submissions

Submission	Your submitted files	Remarks
Proposal presentation submission	• Fill in the project proposal presentation "ITSS_Project_Proposal_Presentation_Template.PPTX". • You need to upload BEFORE the actual presentation day.	One PPTX file per team
Final submission (everything)	• Source code and dataset (a GitHub link or a cloud storage link, e.g., Dropbox). • Report (8-10 pages, Latex source files, use the template "ITSS_Project_Report_Template.zip"). Recommended collaborative writing tool: Overleaf, https://www.overleaf.com. • Zip everything into a single zip file	One Zip file per team
Final submission (report pdf)	• A single final report pdf file as same as that in the above zipped file.	One pdf file per team
Final submission (recorded presentation)	• There is no final in-person presentation, we will mark your recorded presentation video (10 minutes).	One mp4 file per team
Cert peer evaluation form submission	• Fill in the form "ITSS_Project_Peer_Evaluation.docx" (available in "Practice module" folder)	One pdf file per student
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 submission	• A simple txt file that contains the URL of your works in any online platform. You also can submit a report or ppt, if your study is confidential and cannot be released to the public.	One text or ppt or pdf file per student

Past ITSS practice project examples

Surveillance	Healthcare
• A vision system that recognize, count and correct physical exercises • Emotion recognition using voice, facial and body posture • Facial attendance with anti-spoofing protection • Crowd surveillance	• Hand washing steps recognition system • Air drawing with hand posture recognition and tracking • Lip reading • Audio-visual intelligent infant activities tracking
Consumer electronics	**Manufacture**
• Tennis sports video analytics • Automatic werewolf referee system using computer vision • SNAP-IT-FIND-IT image retrieval application • Humanized video chat agent in kiosk machine • Paper plane folding guidance	• Real-time computer interface control with human pose estimation • Vision-based operator activity recognition for personnel efficiency analysis

FAQ

No.	Question	Clarification
1	Do we need to show 'experimental results' in the proposal presentation?	It is not *required*. Its purpose is to provide early feedback to ensure you are on the right track.
2	Do we need to provide an implementation in a mobile phone APP or AWS cloud?	It is not required. The APP and cloud implementation are beyond the requirement of this practice module.
3	Do we need to provide user manual as part of project deliverables?	No need.
4	Can we use Word to write project report?	No. Please use Latex.
5	Can we use public dataset?	Yes, but you need to show your understanding (e.g., cleaning, augmentation, etc) on this public dataset.
6	Is dataset creation effort marked?	All dataset creation efforts are appreciated, including self-collecting, cleaning a public dataset, etc.
7	Is there any final presentation after project is finished?	No. There is no in-person final presentation. We will mark your recorded presentation video.
8	What do we need to provide in the final recorded video presentation?	It is similar to your in-person presentation. It is a recorded video with 10 minutes duration.
9	What do we need to provide in the literature review in the final report?	Review the relevant works, including research papers, commercial solutions.
10	What do we need to provide in the experimental results?	Experiments are required to provide performance evaluation by comparing your system with either the existing systems (e.g., reference code) or different choices of modules inside your system (e.g., backbone, model hyper-parameters, ablation study).

Thank you!

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