Title (Units): **COMP3076 AI and Generative Arts (3,2,1)**

Course Aims: Over recent years, Artificial Intelligence (AI) and generative machine learning have attracted much attention among the art community. Generative models, powered by deep learning have brought about various ground-breaking artistic innovations. This course, i.e., AI and Generative Arts, aims to explore issues in AI's applications to arts and creativity. We will look at principles and algorithms for generating and creating art design. Students will develop a conceptual understanding of machine learning and apply practical solutions to algorithms as part of their creative practices.

Prerequisite: COMP1015 Computing for Creatives I and COMP2037 Computing for Creatives II

Course Intended Learning Outcomes (CILOs):
Upon successful completion of this course, students should be able to:

No.	Course Intended Learning Outcomes (CILOs)
	Knowledge
1	Explain core concepts of machine learning for generative arts.
2	Describe the basic principles of generative models, and the elements required and the procedures to train them.
3	Compare and identify different machine learning models and propose reasonable solutions to achieve creative art goals;
4	Integrate and apply the knowledge learnt to develop art installation prototypes that involve generative models.

Calendar Description: This course aims at exploring issues in the applications of AI to arts and creativity. We will look at principles and algorithms for generation and creation of art design. Students will develop a conceptual understanding of machine learning, and apply practical solutions of algorithms as part of their creative practices. The course will start with the study of deep neural networks. Students will learn to understand the basic principles of neural networks with minimal mathematical requirements. After learning and experimenting with Convolutional Neural Networks (CNN) applications such as image classification and segmentation, the class will move on to introduce Generative Adversarial Networks (GANs). The history of GANs and different derivative structures will be introduced through examples of creative applications. Generative arts in various other multimedia modalities such as text, music, and motion will be briefly introduced as case studies for more inspiration. Finally, students will apply the knowledge learnt to develop art installation prototypes that involve generative models in a group collaborative project.

Teaching and Learning Activities (TLAs):

CILOs	Type of TLA
1 - 3	Students will learn knowledge of generative machine learning through lectures. The learning experience will be highly participatory with interactive conversations and discussions. Lab sessions are designed to deepen the students' understanding of knowledge learned from lectures. The instructor will facilitate node programming concepts and techniques through live coding. Written assignment(s), laboratory exercise(s)/assignment(s), and online test will be designed to evaluate the student's level of understanding.
2 - 4	Based on the theories they have learnt, students are required to form into small groups to develop an art design project using generative machine learning models. Each group is required to give a demo presentation on their project. Instructor(s), teaching assistant and other students would ask questions related to their project and give them feedbacks. In this way, we could assess their understanding of the theories, development engineering details, and share artistic inspirations among the students.

Assessment:

No.	Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
1	Continuous Assessment	100%	1 - 4	Written assignment(s)/term paper(s) (15%), laboratory assignments15online test (15%), online test (15%), group collaborative project proposal (5%), project presentation and demonstration (10%), project report (30%), and online showcase (10%) are designed to measure how well students have learned the fundamentals and major concepts of this course, and the skills they have acquired for art content generation. The project should contain both technical component and art design. It will be evaluated by (i) initial proposal, (ii) presentation and demonstration, (iii) final report and (iv) an online showcase.

Assessment Rubrics:

Course Content and CILOs Mapping:

Content		CILO No.
I	Introduction to AI and Generative Arts	1,2
II	Introduction to Deep Learning and Neural Networks	1,2
III	Generative Arts: GAN and Neural Artistic Style Modelling	1-3
IV	Stable Diffusion	1-4
V	Generative Arts across Modalities	1-4

References:

- Pearson, Matt. Generative Art: A practical Guide using Processing. Simon and Schuster, 2011.
- David Forsyth and Jean Ponce: Computer Vision: A Modern Approach, Prentice hall, 2011
- Goodfellow, Bengio, and Courville, Deep Learning, MIT Press, 2016.
- Andrew Zhu and Matthew Fisher, Using Stable Diffusion with Python: Leverage Python to control and automate high-quality AI image generation using Stable Diffusion, Packt Publishing, June 2024
- IEEE Transactions on Pattern Analysis and Machine Intelligence.
- https://aiartists.org

Course Content:

Topic

I. Introduction to AI and Generative Arts
A. General introduction to Generative art, AI, deep learning, and neural networks
B. Popular machine learning frameworks and tools for generative arts
C. AI generative arts case studies

II. Introduction to Deep Learning and Neural Networks
A. Deep neural networks: Key components and basic architecture of deep neural network, datasets, loss functions, and backpropagation
B. Convolutional Neural Network, Transformer, Foundation Models
C. Deep learning in Vision: and Segmentation, Detection, Classification, In-painting and Out-painting, Colorization, Upscaling

D. Fine-tuning of pre-trained models

III. Generative Arts: GAN and Neural Artistic Style Modelling
A. Deep Learning for Generative Arts: from CNN to AutoEncoder, VAE, and GAN
B. Neural style modelling: Content vs. style, feature extraction, texture synthesis, pastiche
C. Neural style transfer

IV. Stable Diffusion
A. Diffusion Models
B. Encoder, latent space and decoder
C. Characteristics and properties
D. ControlNet

V. Generative Arts across Modalities
A. Text content generation: Language Models
B. Multimodal foundation models: CLIP Model