The Hong Kong Polytechnic University

Subject Description Form

Please read the notes at the end of the table carefully before completing the form.

Subject Code	SO1D02
Subject Title	AI in Healthcare
Credit Value	3
Level	1
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The integration of Artificial Intelligence (AI) in healthcare is revolutionising the way we diagnose, treat, and manage diseases. The objectives of this course are to: • Educate students on the fundamental principles and diverse applications of AI in healthcare, including generative AI, image generation, and language generation. • Guide students to apply AI concepts to real-world scenarios, such as information search, disease diagnosis, outcome prediction, and disease management. • Encourage students to critically assess the accuracy and reliability of AI-generated information and its implications in healthcare. • Enhance continuous learning through self-reflection, peer-assessment, and staying updated with AI advancements. Students will gain a comprehensive understanding of how AI is transforming healthcare, appreciating both its benefits and limitations. They will also be equipped to debunk common misconceptions about AI in healthcare and advocate for its responsible and ethical use.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: a. Acquire a foundational understanding of AI technologies and their applications in healthcare, including advanced generative AI technology. b. Understand and articulate the processes involved in AI-driven disease diagnosis, outcome prediction, and disease management. c. Recognize the impact of AI on patient care, healthcare research and administration. d. Identify common challenges and ethical considerations associated with AI in healthcare, such as data privacy, bias, and transparency. e. Apply AI tools and techniques like ChatGPT and HuatuoGPT to analyse healthcare data and generate insights for improving patient outcomes and healthcare efficiency. f. Plan, design, create, and present information on a topic related to AI in healthcare.

	g. Critically evaluate information from diverse sources, assess the reliability of AI-generated data, and debunk myths about AI in healthcare.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	• **Introduction of AI** - **History of AI development** *AI development began in the mid-20th century with pioneers like Alan Turing and John McCarthy. The field has evolved through several phases, from early symbolic AI and expert systems to the current era of deep learning and neural networks, driven by advances in computational power and data availability.* - **Commonly used AI algorithms** *Include decision trees, neural networks, support vector machines, and clustering algorithms. These algorithms are used for tasks such as classification, regression, and pattern recognition, forming the backbone of many AI applications* - **Importance of AI in healthcare** *AI transforms healthcare by improving diagnostics, personalizing treatment plans, and enhancing patient care.* - **Current state-of-the-art large language models** *The area has seen a rise of LLM, from OpenAI's GPT-4/4o series and Google Gemini series to the cost-effective DeepSeek series, with emerging reasoning abilities.* • **Application of AI in healthcare** *AI applications in healthcare include predictive analytics for disease outbreaks, AI-driven diagnostic tools, robotic surgery, and personalized medicine. Opensource tools like ChatGPT, HuatuoGPT, and DeepSeek will be used and analyzed.* • **Healthcare data mining** *Healthcare data mining involves extracting useful information from large datasets to identify patterns and trends. This process aids in predictive analytics, improving patient care, and optimizing operational efficiency in healthcare settings.* • **Generative AI models** - **Image Generation** *Generative AI models like GANs (Generative Adversarial Networks) and diffusion models create realistic images from textual descriptions or other images, aiding in medical imaging and research.* - **Language Generation** *Models like GPT (Generative Pre-trained Transformer) generate human-like text, useful for creating medical reports, patient communication, and educational materials.* - **Foundation Model** *Large-scale models trained on diverse data provide a base for various AI applications. They can be fine-tuned for specific healthcare tasks, enhancing versatility and efficiency* • **Ethical issues of AI in healthcare** *Ethical concerns include data privacy, algorithmic bias, and accountability. Ensuring patient confidentiality, addressing biases in AI models, and establishing clear responsibility for AI-driven decisions are critical challenges.* • **Deployment of AI in healthcare** *Deploying AI in healthcare involves integrating AI systems into existing workflows, ensuring interoperability, and training*

	healthcare professionals. Successful deployment requires collaboration between technologists and healthcare providers. • **What AI can and can't do in healthcare** *AI can analyze vast amounts of data quickly, assist in diagnostics, personalize treatment plans, and automate routine tasks, enhancing efficiency and accuracy.* *AI cannot replace the nuanced decision-making and empathy of human healthcare providers. It struggles with understanding context and making ethical judgments.* - Group work - Short presentation on a topic of choice to deliver AI in healthcare.
Teaching/Learning Methodology *(Note 3)*	**Online component:** This subject will be delivered using a blended-learning approach. The online modules contain reading materials, virtual labs, knowledge checks, assignments, and reflective writings designed to help students understand the applications of AI in healthcare, including generative AI, disease diagnosis, outcome prediction, and disease management. Students are required to complete each module according to the timetable described in the teaching schedule. Self-paced practical sessions will be facilitated by interactive AI simulation tools. These tools can be installed on students' digital devices to encourage active learning and consolidate understanding. **Face-to-Face Component:** Mini-lectures and tutorials will be used to explore and clarify key issues of the main topics and conduct hands-on in-class activities for using AI tools. The face-to-face component will serve as the primary forum to encourage critical thinking through the use of case studies, real-life examples, and evidence from the literature. Additionally, this platform will foster collaboration between students and staff, facilitating a staff-student partnership and co-creation of the curriculum. **Online Small-Group Tutorials/Discussions:** Small-group tutorials and discussions will offer students an interactive platform to actively engage in their learning process. By reflecting, discussing, and debating issues related to AI in healthcare, students will interpret and evaluate information from different resources and employ appropriate analytical methods to solve problems. Students will learn to take responsibility for their own learning and cultivate a desire for lifelong learning. **Poster/Video (or PowerPoint Show) Project:** The Poster/Video (or PowerPoint Show) Project offers students the opportunity to explore, design, and create various methods of presenting information, instructions, or advice on AI in healthcare. This Project encourages students' teamwork, allowing students to collaborate in planning, designing, and producing an effective strategy to showcase their collective efforts.

	This methodology aims to deliver a well-rounded and engaging learning experience by blending theoretical knowledge with practical applications in the field of AI in healthcare.
Assessment Methods in Alignment with Intended Learning Outcomes *(Note 4)*	

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						
		a	b	c	d	e	f	g
1. Assignments and reflective writings	30	✓	✓	✓	✓	✓	✓	✓
2. Quiz	10	✓	✓	✓	✓	✓		
3. Class participation	10	✓	✓	✓	✓	✓	✓	✓
4. Poster/Video Project	50	*	*	*	*	*	✓	✓
	(* depending on the topics selected by the students, these objectives may also be applicable)							
Total	100 %							

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assignments and reflective writings. Assignments will assess students' comprehension of the course materials. Students will also be asked to write their reflection on what they have learned and how this knowledge has impacted their lives.

Quiz will be conducted to encourage continuous learning. MCQs will be used to assess students' mastery of details and specific knowledge.

Class participation will encourage students to actively participate in class activities, discussions and idea exchanges. It assesses their ability to transform information into knowledge and knowledge into judgement, which is essential for debunking myths.

Poster/Video Project. Students will be encouraged to design creative presentations to showcase what they have learned from discussion and research. Knowing that their audience includes both staff and peers will foster a sense of ownership and motivate them to produce high quality, well-crafted work on their chosen topics.

	In addition to staff assessment, peers will be invited to evaluate the presentations of each project.	
Student Study Effort Expected	Class contact:	
	▪ Online/face-to-face lectures	18 Hrs.
	▪ Online/face-to-face tutorials/small-group discussions	17 Hrs.
	▪ Poster/Video presentation	4 Hrs
	Other student study effort:	
	▪ Assignments and reflective writings	10 Hrs.
	▪ Meetings/ Self study/Online search for information	60 Hrs.
	Total student study effort	109Hrs.
Reading List and References	Books: Peter Lee, Carey Goldberg, Isaac Kohane. *The AI Revolution in Medicine: GPT-4 and Beyond.* London: Pearson, 2023. Jag Singh M.D. *Future Care: Sensors, Artificial Intelligence, and the Reinvention of Medicine.* Rochester: Mayo Clinic Press, 2023. SB Wade. *Transforming Healthcare: Harnessing the Power of Artificial Intelligence for Enhanced Patient Care.* Independently published, 2023. Tools: ChatGPT: https://chatgpt.com/ Genmni: https://gemini.google.com/app Qwen: https://tongyi.aliyun.com/qianwen/ Mistral: https://mistral.ai/ Google Health AI: https://ai.google/applied-ai/health/, https://health.google/health-research/ HuatuoGPT: https://www.huatuogpt.cn/ Deepseek: https://www.deepseek.com/ *note the list may change based on the latest developments	

Note 1: Intended Learning Outcomes
Intended learning outcomes should state what students should be able to do or attain upon subject completion. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/Indicative Syllabus
The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology
This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method is intended to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

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