

Fundamentals of Artificial Intelligence



VICTORIA UNIVERSITY OF
WELLINGTON
TE HERENGA WAKA

COMP307/AIML420

Introduction

Dr Heitor Murilo Gomes

Assoc. Prof. Aaron Chen

Prof. Bastiaan Kleijn

{heitor.gomes, aaron.chen, bastiaan.kleijn}@vuw.ac.nz

Team

- Heitor Murilo Gomes (heitor.gomes@vuw.ac.nz) – course coordinator
- Aaron Chen (aaron.chen@vuw.ac.nz)
- Bastiaan Kleijn (bastiaan.Kleijn@vuw.ac.nz)
- **Tutors**
 - Kaan Demir (head tutor)
 - Amer Saeed
 - Amer Hussain
 - Anjali de Silva
 - Peter Marshall
 - Nimasha Herath
 - Thi Mai Tram Chau
- Student representative? **Send emails to Heitor with your statements**

Introducing the lecturers...

Who is Aaron Chen?



You

who is Aaron Chen?



ChatGPT

Aaron Chen is an Australian comedian and actor known for his unique style of humor and performances. He has gained recognition for his stand-up comedy shows, appearances on television programs, and performances at comedy festivals.

Who is Aaron Chen?

Associate Professor Aaron Chen



Aaron Chen obtained his B.Eng degree from Beijing Institute of Technology in China and PhD degree from Nanyang Technological University (NTU) in Singapore respectively. In the past, he worked as a teaching fellow and visiting assistant professor at school of EEE, NTU. He also worked as a lecturer and postgraduate programme leader in the Department of Computing at Unitec institute of technology. Since February 2012, he became a senior lecturer in the School of Engineering and Computer Science at Victoria University of Wellington.

Who is Bastiaan Kleijn?



You

who is Bastiaan Kleijn?



ChatGPT

As of my last update in January 2022, Bastiaan Kleijn is a Dutch DJ, producer, and electronic music artist. He gained prominence in the electronic music scene for his unique blend of melodic techno, deep house, and progressive house.

Who is Bastiaan Kleijn?



Professor Bastiaan Kleijn

Bastiaan joined Victoria in 2010. He is also a **Researcher (part-time) at Google (since 2010)**. He was simultaneously a Professor at Delft University of Technology (2011-2021). Until 2014 he was a Professor at KTH - the Royal Institute of Technology - in Stockholm, where he was Head of the Sound and Image Processing Laboratory. He was a **founder of Global IP Solutions, a company that provided the original enabling audio technology to Skype and later developed audio and video processing technologies for communication over the Internet for companies such as IBM, Cisco, and Google.** The company was acquired by Google in 2010. Before moving to Sweden, Bastiaan worked in the Research Division of AT&T Bell Laboratories in Murray Hill, New Jersey, mostly in the area of speech processing. **The main speech coding algorithm currently used in all mobile telephones world-wide (EVS) is based on a principle he developed there.** Bastiaan holds a Ph.D. in Electrical Engineering from Delft University of Technology, a Ph.D. in Soil Science from the University of California (UCR), an MS in Physics (UCR) and an MS in Electrical Engineering from Stanford. He has been an IEEE Fellow since 1999 and a Fellow of the Royal Society of New Zealand since 2021.

Who is Heitor Gomes?



You

who is Heitor Gomes?

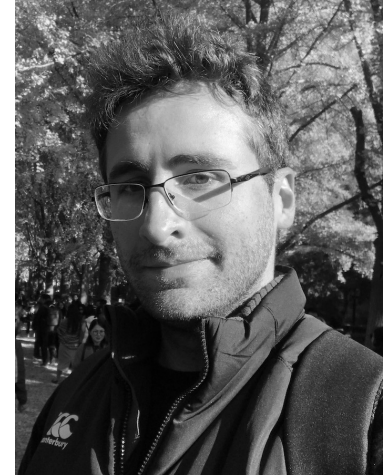


ChatGPT

Heitor Gomes is a Brazilian musician known for his skill as a bassist. He has been recognized for his work with various musical acts and bands, particularly in the realms of jazz, fusion, and Brazilian music.

Who is Heitor Gomes?

Senior Lecturer Heitor Murilo Gomes



Joined VuW in 2022, before that he worked at University of Waikato (2019-2022), Paris Télécom (2017-2019), and various positions in Brazil.

Research areas: **machine learning for data streams** and **continual learning**.

Worked on **several research and applied projects**, currently working on **semi-supervised learning** for evolving data streams (Marsden fund), **concept drifts on energy data** (internal fund), **continual learning for class incremental problems** (MBIE fund), and several **open-source** machine learning projects.

<https://heitorgomes.com/>

Lectures & Tutorials

Lectures

- Tuesday 12:00 - 12:50 – LT205, Hugh Mackenzie, Kelburn
- Thursday 12:00 - 12:50 – LT205, Hugh Mackenzie, Kelburn

Tutorials

- Friday 12:00 - 12:50 – LT205, Hugh Mackenzie, Kelburn

Helpdesks

Our helpdesks will be held in **CO242B**

- No helpdesk during public holidays
- No helpdesk in the first week
- No scheduled labs

- Monday: 3:00-4:00 PM
- Tuesday: 3:00-4:00 PM
- Wednesday: 3:00-4:00 PM
- Thursday: 3:00-4:00 PM
- Friday: 3:00-4:00 PM

- From the last **Thursday to Wednesday** of the week due:
Helpdesk from 2:00 to 3:00 PM + normal helpdesk hours.

Paper structure

- The course is taught mainly in-person*
- Lectures and tutorials are given in person and **recorded**
- **All learning materials are available online**
- **AIML420 content is also shown in the COMP307 page**

https://ecs.wgtn.ac.nz/Courses/COMP307_2024T1/

- **Helpdesks are in-person**
- Special cases will be handled case by case
 - If you are attending remotely, reach out to the course coordinator

Course Objectives

- Understand and apply fundamental concepts and techniques of Artificial Intelligence
- Form a basis for further learning and research in AI
 - part of **AI Specialization** in **COMP** and **SWEN** majors
 - prerequisite of 400 AI courses (AIML 425, 426, 428, partly 427, 429)
 - requirement for AI summer research scholarships
 - requirement/preference for AI related Honours projects
- Past students applied AI techniques to their applications: COMP, CGRA, CYBR, ECEN, NWEN, RESE and SWEN
- One of the most popular and largest 300 (and 400) level courses

Course Topics

Introduction:	1 lecture
Machine learning:	5 lectures
Search techniques:	2 lectures
Neural networks:	3 lectures
Reasoning under uncertainty:	4 lectures
Planning and Scheduling:	4 lectures
Evolutionary computing:	2 lectures
Other topics:	2 lectures

Materials

- Stuart J. Russell and Peter Norvig, **Artificial Intelligence: A Modern Approach**, Prentice-Hall, NJ, 2nd edition 2002, 3rd edition 2009, or the 2014 (PNIE version), or a newer version
 - Not required
 - There are a lot of materials available online
- Lectures and tutorials
- Check the course outline on the website for more details

Materials

Assignments (COMP307, AIML420):

- | | |
|--|----------------|
| 1. Machine Learning (16, 15) | Due on Week 5 |
| 2. Neural Networks (15, 14) | Due on Week 7 |
| 3. Reasoning under uncertainty (10, 8) | Due on Week 10 |
| 4. Planning and Scheduling (9, 7) | Due on Week 12 |

3 late days to be used cross all the assignments

Further extension **ONLY** for special cases

Exam (Assessment week): (50, 50)

(AIML420 only) Literature review essay (6)

To pass the course you must obtain at least a C- grade overall

Workload

- Lectures and tutorials: 3 hours per week
- Reading, review, assignments: ~7 hours per week

- More time might be required if you didn't adhere to all the prerequisites

- In general terms:
 - Math: basic linear algebra and probabilities
 - Coding: need to know your way around a language like Python or Java

Rules and Policies

Plagiarism

- The University has clear rules for Plagiarism and what is considered Plagiarism
- You are encouraged to read “What is plagiarism?”

<https://www.wgtn.ac.nz/students/study/exams/academic-integrity/plagiarism>

1. Complete and near complete plagiarism
2. Patchwork plagiarism
3. Inadvertent or lazy plagiarism
4. Submitting the same work in more than one course

What about AI tools?



ChatGPT

What about AI tools?

“AI stops being a good idea when you are not learning [...]”

Source (accessed on 24/02/24):

<https://www.wgtn.ac.nz/students/study/exams/academic-integrity/student-use-of-artificial-intelligence>

What about AI tools?

“AI stops being a good idea when you are not learning [...]”

“[...] AI may produce inaccurate or biased content, [...] imaginary ideas and inaccurate or outdated data.”

Source (accessed on 24/02/24):

<https://www.wgtn.ac.nz/students/study/exams/academic-integrity/student-use-of-artificial-intelligence>

What about AI tools?

“AI stops being a good idea when you are not learning [...]”

“[...] AI may produce inaccurate or biased content, [...] imaginary ideas and inaccurate or outdated data.”

“Generative AI like ChatGPT has “hallucinations” so can’t be relied on to generate high-quality summaries or text.”

Source (accessed on 24/02/24):

<https://www.wgtn.ac.nz/students/study/exams/academic-integrity/student-use-of-artificial-intelligence>

What about AI tools?

“AI stops being a good idea when you are not learning [...]”

“[...] AI may produce inaccurate or biased content, [...] imaginary ideas and inaccurate or outdated data.”

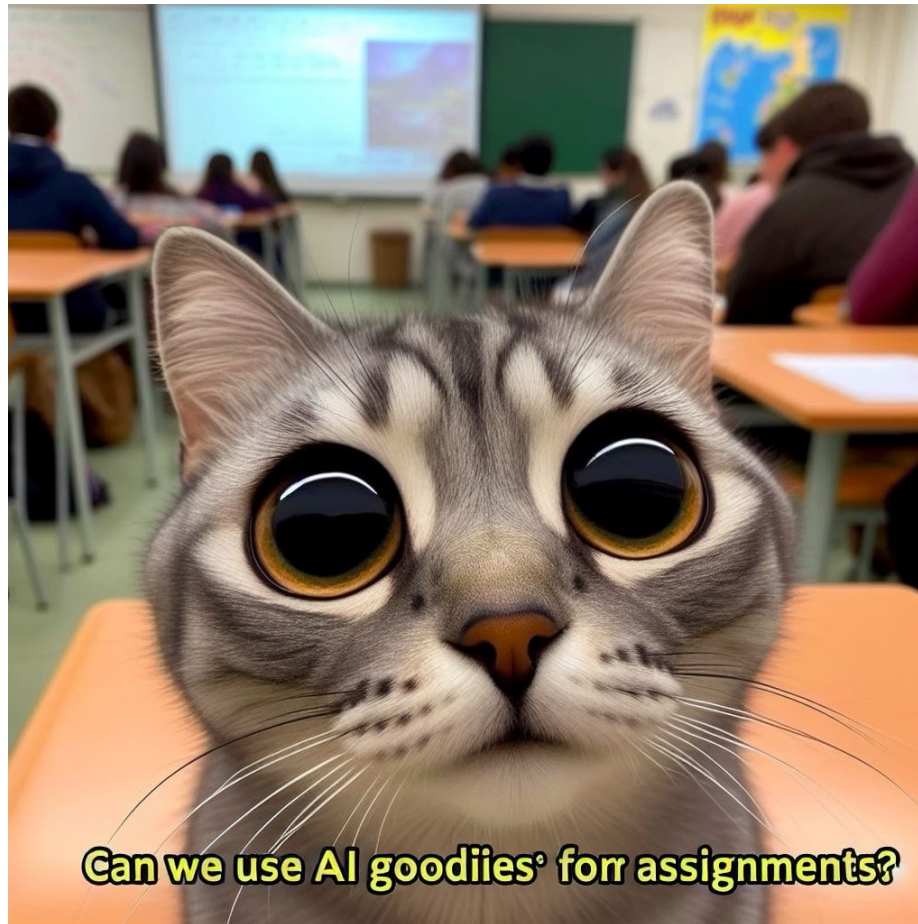
“Generative AI like ChatGPT has “hallucinations” so can’t be relied on to generate high-quality summaries or text.”

*“Users of AI all need to **become critical users of AI**, and understand **what the AI can and can’t do well.**”*

Source (accessed on 24/02/24):

<https://www.wgtn.ac.nz/students/study/exams/academic-integrity/student-use-of-artificial-intelligence>

But...



Reasonable use of AI

- Do not use AI tools to provide you with answers for your assignments
 - Examples of how you should **not** use it:
 - Write code to solve the assignment for you
 - Copy and paste output from it and use it as an answer

Reasonable use of AI

- Do not use AI tools to provide you with answers for your assignments
 - Examples of how you should **not** use it:
 - Write code to solve the assignment for you
 - Copy and paste output from it and use it as an answer
- You may use it to improve your learning
 - Examples of how you may use it:
 - Verify your understanding of a topic, keeping in mind that the tool may hallucinate and provide you with a false sense of correctness
 - Help with your writing. Do not ask it to “rewrite it” instead ask it to provide feedback, then you can read the interpretation and improve your writing

Reasonable use of AI

- Do not use AI tools to provide you with answers for your assignments
 - Examples of how you should **not** use it:
 - Write code to solve the assignment for you
 - Copy and paste output from it and use it as an answer
- You may use it to improve your learning
 - Examples of how you may use it:
 - Verify your understanding of a topic, keeping in mind that the tool may hallucinate and provide you with a false sense of correctness
 - Help with your writing. Do not ask it to “rewrite it” instead ask it to provide feedback, then you can read the interpretation and improve your writing
- **Tutors are not expected to help you use AI tools**
- **You are not forced to use AI tools**
- **When in doubt, ask the course coordinator first**

Introduction to AI

What is AI?

- Programming computers to **solve tasks** that would traditionally require **human intelligence**
- An attempt to **understand intelligence** through the creation of intelligent systems
- **Approximate solutions** to tackle complex problems beyond current capabilities, like NP-hard problems
- To tackle problems generated by AI

Some AI Applications

- Speech recognition
- **Image and signal processing**
- Monitoring crops
- Autonomous robots
- Energy consumption prediction

- **Natural language processing** 🔥
- **Chatbots** 🔥
- Personalised web search

- Bioinformatics, health informatics
- Medical diagnosis
- Specialised medical test interpretation

AI: Engineering or Science?

Engineering

- Building intelligent systems to solve problems
- Understanding mechanisms, algorithms, representations for building intelligent systems

Science

- Understanding nature of intelligence (human or otherwise)
- Implementing models of intelligence to evaluate and understand them

AI: Symbolic and Computational

Symbolic AI: Representation and Reasoning at an abstract level

- Representations and algorithms that manipulate symbols
- The physical symbol system hypothesis: A machine manipulating physical symbols has the necessary and sufficient means for general intelligence.

("Classic") Not as popular as its counterpart

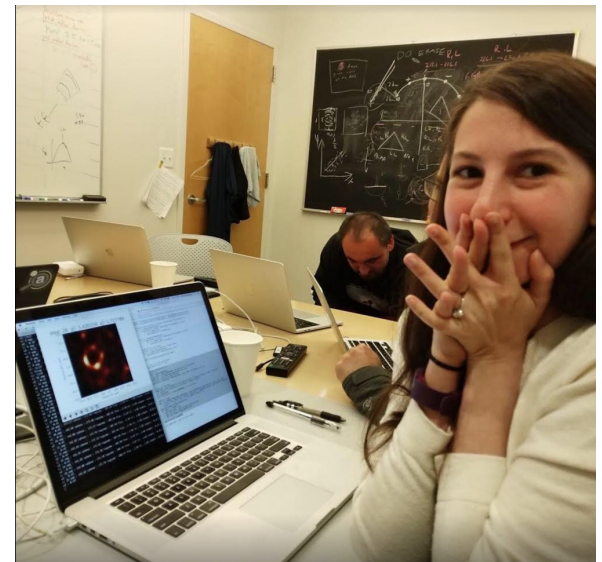
Computational AI:

- Representation and reasoning using lower-level mechanisms
- Probability based models and computation
- Neural Networks
- Genetic and Evolutionary Computation Algorithms
- Fuzzy systems

("Modern") More popular

Why should you study AI ?!

- Career opportunities
 - Several jobs in technology requires proficiency with AI
- Understanding AI
 - AI influences virtually everyone's life
- Advancing technology
 - Important advances in a variety of fields rely on AI



Katherine Louise Bouman

<https://www.nytimes.com/2019/04/11/science/katie-bouman-black-hole.html>

Bouman, Katherine L., et al. "Computational imaging for VLBI image reconstruction." *IEEE CVPR*, 2016.

Wrap-up

- AI is a hot topic right now for its practical applications
- This course provides a general view of several AI topics from machine learning to evolutionary computing
- You will have the opportunity to implement several algorithms, and learn the fundamentals to prepare you for more advanced topics
- **Next lecture:** Machine learning paradigms