Artificial Intelligence

Vrije Universiteit Amsterdam - Faculteit der Bètawetenschappen - Artificial Intelligence - 2022-2023

Our Artificial Intelligence (AI) Master programme is oriented towards Hybrid intelligence, where AI systems and humans collaborate. The AI master programme has a human-centric approach to AI. It is aimed at providing students with solid underpinnings in the technical and algorithmic aspects of AI, combined with a thorough understanding of human functioning from human-oriented sciences.

Students approach the study of AI both from a technical perspective, focusing on the understanding, analysis and development of novel AI algorithms, and from a societal and human perspective, looking into questions such as “how can we develop and evaluate computer-based technology that exploits knowledge about human functioning?” and “how can human and AI-technology complement each other and collaborate with each other?”

The first year includes courses that focus on core AI topics, while the second year is devoted to the track “Cognitive Science”, “AI for Health" or a coherent set of electives.

During the specialization phase, students can choose to follow the regular AI Master programme to deepen and broaden the knowledge of AI techniques by building up the knowledge obtained from the compulsory courses on the core AI topics. They can choose advanced elective courses in a more specialized AI topic (e.g. Learning Machines, Knowledge Representation on the Web), specific AI application area (e.g. support of people to have a healthy lifestyle and elderly care), or relevant scientific discipline (e.g. psychology, sociology, language, biomedical sciences. Another option is to continue in the track “Cognitive Science” or “AI for Health", which require an additional set of compulsory courses.

Graduates from the Master in Artificial Intelligence typically move on to pursue a career as a.o. Data Scientists, Machine Learning Engineers, or AI specialist at leading ICT companies such as IBM, Microsoft, Google, Facebook and Apple, Atos, Deloitte or Scientific AI researcher.

Info

Niveau	Master
Taal	Engels
Duur	2 years
Vorm	Voltijd
Studiepunten	120 EC
Faculteit	Faculteit der Bètawetenschappen

Onderwijs- en Examenregeling 2022-2023
Meer informatie over deze opleiding

Artificial Intelligence track Artificial Intelligence for Health

Omschrijving

AI for Health is a new track in collaboration with Medical Informatics (Amsterdam UMC, UvA) since the academic year 2021-2022. In this track you'll learn about Medical Informatics basics, Medical AI (with a focus on imaging techniques in medicine and natural language processing techniques in medicine), and how to combine machine learning and reasoning for health applications (VU), and AI for medical imaging (UvA/AI). Two courses will take place at Amsterdam UMC (location AMC), one at Science Park (UvA/AI), and one at the VU campus.

Opleidingsdelen

- AI track AI for Health compulsory courses
- Artificial Intelligence research project
- Artificial Intelligence Background constrained choice
- Artificial Intelligence Machine Learning constrained choice
- Artificial Intelligence electives
- Artificial Intelligence compulsory courses

AI track AI for Health compulsory courses

Vakken

Naam vak	Periode	Credits	Code
AI for Medical Imaging	P1	6.00EC	XMU_0045
Medical AI	P1	6.00EC	XMU_0038
Machine Learning and Reasoning for Health	P2	6.00EC	XM_0102
Medical Informatics Basics	P5+6	6.00EC	XMU_0037

Artificial Intelligence research project

Vakken

Naam vak	Periode	Credits	Code
Master Project AI	Ac. Year (sept)	30.00EC	X_400285

Artificial Intelligence Background constrained choice

Omschrijving

Students with an Artificial Intelligence/Computer Science bachelor degree should choose Cognitive psychology and its application. Other students should choose the course Skills for AI.

Vakken

Naam vak	Periode	Credits	Code
Cognitive Psychology and Its Applications	P1	6.00EC	XM_40010
Skills for AI	P1	6.00EC	XM_0077

Artificial Intelligence Machine Learning constrained choice

Omschrijving

Choose at least one of the machine learning courses.

Vakken

Naam vak	Periode	Credits	Code
Deep Learning	P2	6.00EC	XM_0083
Data Mining Techniques	P5	6.00EC	X_400108
Machine Learning for the Quantified Self	P6	6.00EC	XM_40012

Artificial Intelligence electives

Opleidingsdelen

- Artificial Intelligence electives Bioinformatics
- Artificial Intelligence electives Deepening AI
- Artificial Intelligence electives Health Sciences
- Artificial Intelligence electives Cognitive Science
- Artificial Intelligence other electives
- Artificial Intelligence electives Social Robotics
- Artificial Intelligence electives Language Technology

Artificial Intelligence electives Bioinformatics

Vakken

Naam vak	Periode	Credits	Code
Fundamentals of Bioinformatics	P1	6.00EC	X_405052
Algorithms in Sequence Analysis	P2	6.00EC	X_405050
Structural Bioinformatics	P4	6.00EC	X_405019
Bioinformatics for Translational Medicine	P5	6.00EC	X_405092

Artificial Intelligence electives Deepening AI

Vakken

Naam vak	Periode	Credits	Code
Mini-Master Project AI	Ac. Year (sept)	6.00EC	XM_400428
Advanced Machine Learning	P1	6.00EC	XM_0010
Intelligent Interactive Systems	P1	6.00EC	XMU_418023
Knowledge Organization	P1	6.00EC	X_405065
Behaviour Dynamics in Social Networks	P2	6.00EC	X_400113
Deep Learning	P2	6.00EC	XM_0083
Dynamic Programming and Reinforcement Learning	P2	6.00EC	XM_0093
Machine Learning and Reasoning for Health	P2	6.00EC	XM_0102
The Social Web	P2	6.00EC	X_405086
Learning Machines	P3	6.00EC	XM_0061
Machine Learning for Graphs	P3	6.00EC	XM_0119
Project Reinforcement Learning	P3	6.00EC	XM_0120
Advanced Logic	P4	6.00EC	X_405048
Entrepreneurship in Analytics and AI	P4	6.00EC	XM_0090
Knowledge Representation on the Web	P4	6.00EC	XM_0060
Applications of Modal Logic for AI	P5	6.00EC	XM_0082
Data Mining Techniques	P5	6.00EC	X_400108
Machine Learning for the Quantified Self	P6	6.00EC	XM_40012

Artificial Intelligence electives Health Sciences

Vakken

Naam vak	Periode	Credits	Code
Health Psychology	P1	6.00EC	AM_470730
Health Promotion and Disease Prevention	P2	6.00EC	AM_470811
Prevention of Mental Health Problems	P3	6.00EC	AM_470840

Artificial Intelligence electives Cognitive Science

Vakken

Naam vak	Periode	Credits	Code
Seminar Cognitive Neurosciences	P1	6.00EC	P_MSEMCNS_AI
Aging and age-related disorders	P2	6.00EC	P_MAGEDIS
Behaviour Dynamics in Social Networks	P2	6.00EC	X_400113
Memory and Memory Disorders	P2	6.00EC	P_MMEMORY
Neural Models of Cognitive Processes for AI	P2	6.00EC	P_NEUMOD_AI
Brain Imaging	P4	6.00EC	P_MBRIMAG_AI

Artificial Intelligence other electives

Vakken

Naam vak	Periode	Credits	Code
Web Data Processing Systems	P2	6.00EC	XM_40020
History of Digital Cultures	P3	6.00EC	XM_0134
ICT4D: Information and Communication Technology for Development	P5	6.00EC	X_405101
ICT4D in the Field	P6	6.00EC	XM_0008

Artificial Intelligence electives Social Robotics

Vakken

Naam vak	Periode	Credits	Code
Essentials of Media Psychology	P1	6.00EC	S_EMP
Communicative Robots	P2	6.00EC	L_AAMPLIN029
Socially Intelligent Robotics Project	P3	6.00EC	XM_0076
Social Robotics	P4	6.00EC	S_SR

Artificial Intelligence electives Language Technology

Vakken

Naam vak	Periode	Credits	Code
Programming in Python for Text Analysis	P1	6.00EC	L_AAMPLIN021
Subjectivity Mining	P1	6.00EC	L_AAMPLIN018
Communicative Robots	P2	6.00EC	L_AAMPLIN029
Language as Data	P2	6.00EC	L_PAMATLW001
Machine Learning for NLP	P2	6.00EC	L_AAMPLIN024
Applied Text Mining 1: Methods	P3	6.00EC	L_PAMATLW004
Advanced NLP	P4	6.00EC	L_AAMPLIN035
Applied Text Mining 2: Domains	P4	6.00EC	L_PAMATLW005

Artificial Intelligence compulsory courses

Omschrijving

These courses are obligatory for all AI master tracks.

Vakken

Naam vak	Periode	Credits	Code
Evolutionary Computing	P1	6.00EC	X_400111
Knowledge Representation	P2	6.00EC	XM_0059
Multi-Agent Systems	P2	6.00EC	XM_0052
Socially Intelligent Robotics	P2	6.00EC	XM_0074
AI and Society	P3	6.00EC	XM_0075

Naam vak	Periode	Credits	Code
Experimental Design and Data Analysis	P4	6.00EC	X_405078
Natural Language Processing	P5	6.00EC	XM_0121

Artificial Intelligence track Cognitive Science

Omschrijving

The Cognitive Science track focuses on the study of human cognition through computational methods. It is jointly organised by the Department of Cognitive Psychology (Faculty of Behavioural and Movement Sciences), and the Department of Computer Science (Faculty of Sciences), and includes courses from both departments.
Students in Cognitive Science come from a wide range of backgrounds –including psychology, computer science, artificial intelligence, philosophy, mathematics, neuroscience, and others – but they all share the common goal of getting a better understanding of the human mind through computational modelling. The developed models can roughly be applied from two perspectives. Firstly, from a more theoretical perspective, cognitive models (e.g., of perception, attention, or decision making) can serve as a useful tool for researchers to gain more insight in the dynamics of cognitive processes by building (and simulating) them. Secondly, from a more practical perspective, cognitive models can serve as a basis for the development of artefacts that either show or understand human-like behaviour. Examples of artefacts that show human- like behaviour are virtual characters in (serious) games, and examples of artefacts that understand human-like behaviour are intelligent support systems in cars or in military domains.

Opleidingsdelen

- Artificial Intelligence Background constrained choice
- Artificial Intelligence Machine Learning constrained choice
- AI research project Cognitive Science
- Artificial Intelligence track Cognitive Science compulsory courses
- Artificial Intelligence electives
- Artificial Intelligence compulsory courses

Artificial Intelligence Background constrained choice

Omschrijving

Students with an
Artificial Intelligence/Computer Science bachelor degree should choose Cognitive psychology and its application. Other students should choose the
course Skills for AI.

Vakken

Naam vak	Periode	Credits	Code
Cognitive Psychology and Its Applications	P1	6.00EC	XM_40010
Skills for AI	P1	6.00EC	XM_0077

Artificial Intelligence Machine Learning constrained choice

Omschrijving

Choose at least one of the machine learning courses.

Vakken

Naam vak	Periode	Credits	Code
Deep Learning	P2	6.00EC	XM_0083
Data Mining Techniques	P5	6.00EC	X_400108
Machine Learning for the Quantified Self	P6	6.00EC	XM_40012

AI research project Cognitive Science

Omschrijving
This research project (psychology department) is an option for students following the Conginitive Science track.

Vakken

Naam vak	Periode	Credits	Code
Master Project AI	Ac. Year (sept)	30.00EC	X_400285
Master Thesis: Research Project Cognitive Science	Ac. Year (sept)	30.00EC	P_MTHRCSC

Artificial Intelligence track Cognitive Science compulsory courses

Vakken

Naam vak	Periode	Credits	Code
Seminar Cognitive Neurosciences	P1	6.00EC	P_MSEMCNS_AI
Neural Models of Cognitive Processes for AI	P2	6.00EC	P_NEUMOD_AI
Brain Imaging	P4	6.00EC	P_MBRIMAG_AI

Artificial Intelligence electives

Opleidingsdelen

- Artificial Intelligence electives Bioinformatics
- Artificial Intelligence electives Deepening AI
- Artificial Intelligence electives Health Sciences
- Artificial Intelligence electives Cognitive Science
- Artificial Intelligence other electives
- Artificial Intelligence electives Social Robotics
- Artificial Intelligence electives Language Technology

Artificial Intelligence electives Bioinformatics

Vakken

Naam vak	Periode	Credits	Code
Fundamentals of Bioinformatics	P1	6.00EC	X_405052
Algorithms in Sequence Analysis	P2	6.00EC	X_405050
Structural Bioinformatics	P4	6.00EC	X_405019
Bioinformatics for Translational Medicine	P5	6.00EC	X_405092

Artificial Intelligence electives Deepening AI

Vakken

Naam vak	Periode	Credits	Code
Mini-Master Project AI	Ac. Year (sept)	6.00EC	XM_400428
Advanced Machine Learning	P1	6.00EC	XM_0010
Intelligent Interactive Systems	P1	6.00EC	XMU_418023
Knowledge Organization	P1	6.00EC	X_405065
Behaviour Dynamics in Social Networks	P2	6.00EC	X_400113
Deep Learning	P2	6.00EC	XM_0083
Dynamic Programming and Reinforcement Learning	P2	6.00EC	XM_0093
Machine Learning and Reasoning for Health	P2	6.00EC	XM_0102
The Social Web	P2	6.00EC	X_405086
Learning Machines	P3	6.00EC	XM_0061
Machine Learning for Graphs	P3	6.00EC	XM_0119
Project Reinforcement Learning	P3	6.00EC	XM_0120

Naam vak	Periode	Credits	Code
Advanced Logic	P4	6.00EC	X_405048
Entrepreneurship in Analytics and AI	P4	6.00EC	XM_0090
Knowledge Representation on the Web	P4	6.00EC	XM_0060
Applications of Modal Logic for AI	P5	6.00EC	XM_0082
Data Mining Techniques	P5	6.00EC	X_400108
Machine Learning for the Quantified Self	P6	6.00EC	XM_40012

Artificial Intelligence electives Health Sciences

Vakken

Naam vak	Periode	Credits	Code
Health Psychology	P1	6.00EC	AM_470730
Health Promotion and Disease Prevention	P2	6.00EC	AM_470811
Prevention of Mental Health Problems	P3	6.00EC	AM_470840

Artificial Intelligence electives Cognitive Science

Vakken

Naam vak	Periode	Credits	Code
Seminar Cognitive Neurosciences	P1	6.00EC	P_MSEMCNS_AI
Aging and age-related disorders	P2	6.00EC	P_MAGEDIS
Behaviour Dynamics in Social Networks	P2	6.00EC	X_400113
Memory and Memory Disorders	P2	6.00EC	P_MMEMORY
Neural Models of Cognitive Processes for AI	P2	6.00EC	P_NEUMOD_AI
Brain Imaging	P4	6.00EC	P_MBRIMAG_AI

Artificial Intelligence other electives

Vakken

Naam vak	Periode	Credits	Code
Web Data Processing Systems	P2	6.00EC	XM_40020
History of Digital Cultures	P3	6.00EC	XM_0134
ICT4D: Information and Communication Technology for Development	P5	6.00EC	X_405101
ICT4D in the Field	P6	6.00EC	XM_0008

Artificial Intelligence electives Social Robotics

Vakken

Naam vak	Periode	Credits	Code
Essentials of Media Psychology	P1	6.00EC	S_EMP
Communicative Robots	P2	6.00EC	L_AAMPLIN029
Socially Intelligent Robotics Project	P3	6.00EC	XM_0076
Social Robotics	P4	6.00EC	S_SR

Artificial Intelligence electives Language Technology

Vakken

Naam vak	Periode	Credits	Code
Programming in Python for Text Analysis	P1	6.00EC	L_AAMPLIN021
Subjectivity Mining	P1	6.00EC	L_AAMPLIN018
Communicative Robots	P2	6.00EC	L_AAMPLIN029
Language as Data	P2	6.00EC	L_PAMATLW001

Naam vak	Periode	Credits	Code
Machine Learning for NLP	P2	6.00EC	L_AAMPLIN024
Applied Text Mining 1: Methods	P3	6.00EC	L_PAMATLW004
Advanced NLP	P4	6.00EC	L_AAMPLIN035
Applied Text Mining 2: Domains	P4	6.00EC	L_PAMATLW005

Artificial Intelligence compulsory courses

Omschrijving
These courses are obligatory for all AI master tracks.

Vakken

Naam vak	Periode	Credits	Code
Evolutionary Computing	P1	6.00EC	X_400111
Knowledge Representation	P2	6.00EC	XM_0059
Multi-Agent Systems	P2	6.00EC	XM_0052
Socially Intelligent Robotics	P2	6.00EC	XM_0074
AI and Society	P3	6.00EC	XM_0075
Experimental Design and Data Analysis	P4	6.00EC	X_405078
Natural Language Processing	P5	6.00EC	XM_0121

Artificial Intelligence main track Artificial Intelligence

Opleidingsdelen

- Artificial Intelligence research project
- Artificial Intelligence Background constrained choice
- Artificial Intelligence Machine Learning constrained choice
- Artificial Intelligence electives
- Artificial Intelligence compulsory courses

Artificial Intelligence research project

Vakken

Naam vak	Periode	Credits	Code
Master Project AI	Ac. Year (sept)	30.00EC	X_400285

Artificial Intelligence Background constrained choice

Omschrijving
Students with an
Artificial Intelligence/Computer Science bachelor degree should choose
Cognitive psychology and its application. Other students should choose
the
course Skills for AI.

Vakken

Naam vak	Periode	Credits	Code
Cognitive Psychology and Its Applications	P1	6.00EC	XM_40010
Skills for AI	P1	6.00EC	XM_0077

Artificial Intelligence Machine Learning constrained choice

Omschrijving
Choose at least one of the machine learning courses.

Vakken

Naam vak	Periode	Credits	Code
Deep Learning	P2	6.00EC	XM_0083
Data Mining Techniques	P5	6.00EC	X_400108
Machine Learning for the Quantified Self	P6	6.00EC	XM_40012

Artificial Intelligence electives

Opleidingsdelen

- Artificial Intelligence electives Bioinformatics
- Artificial Intelligence electives Deepening AI
- Artificial Intelligence electives Health Sciences
- Artificial Intelligence electives Cognitive Science
- Artificial Intelligence other electives
- Artificial Intelligence electives Social Robotics
- Artificial Intelligence electives Language Technology

Artificial Intelligence electives Bioinformatics

Vakken

Naam vak	Periode	Credits	Code
Fundamentals of Bioinformatics	P1	6.00EC	X_405052
Algorithms in Sequence Analysis	P2	6.00EC	X_405050
Structural Bioinformatics	P4	6.00EC	X_405019
Bioinformatics for Translational Medicine	P5	6.00EC	X_405092

Artificial Intelligence electives Deepening AI

Vakken

Naam vak	Periode	Credits	Code
Mini-Master Project AI	Ac. Year (sept)	6.00EC	XM_400428
Advanced Machine Learning	P1	6.00EC	XM_0010
Intelligent Interactive Systems	P1	6.00EC	XMU_418023
Knowledge Organization	P1	6.00EC	X_405065
Behaviour Dynamics in Social Networks	P2	6.00EC	X_400113
Deep Learning	P2	6.00EC	XM_0083
Dynamic Programming and Reinforcement Learning	P2	6.00EC	XM_0093
Machine Learning and Reasoning for Health	P2	6.00EC	XM_0102
The Social Web	P2	6.00EC	X_405086
Learning Machines	P3	6.00EC	XM_0061
Machine Learning for Graphs	P3	6.00EC	XM_0119
Project Reinforcement Learning	P3	6.00EC	XM_0120
Advanced Logic	P4	6.00EC	X_405048
Entrepreneurship in Analytics and AI	P4	6.00EC	XM_0090
Knowledge Representation on the Web	P4	6.00EC	XM_0060
Applications of Modal Logic for AI	P5	6.00EC	XM_0082
Data Mining Techniques	P5	6.00EC	X_400108
Machine Learning for the Quantified Self	P6	6.00EC	XM_40012

Artificial Intelligence electives Health Sciences

Vakken

Naam vak	Periode	Credits	Code
Health Psychology	P1	6.00EC	AM_470730
Health Promotion and Disease Prevention	P2	6.00EC	AM_470811
Prevention of Mental Health Problems	P3	6.00EC	AM_470840

Artificial Intelligence electives Cognitive Science

Vakken

Naam vak	Periode	Credits	Code
Seminar Cognitive Neurosciences	P1	6.00EC	P_MSEMCNS_AI
Aging and age-related disorders	P2	6.00EC	P_MAGEDIS
Behaviour Dynamics in Social Networks	P2	6.00EC	X_400113
Memory and Memory Disorders	P2	6.00EC	P_MMEMORY
Neural Models of Cognitive Processes for AI	P2	6.00EC	P_NEUMOD_AI
Brain Imaging	P4	6.00EC	P_MBRIMAG_AI

Artificial Intelligence other electives

Vakken

Naam vak	Periode	Credits	Code
Web Data Processing Systems	P2	6.00EC	XM_40020
History of Digital Cultures	P3	6.00EC	XM_0134
ICT4D: Information and Communication Technology for Development	P5	6.00EC	X_405101
ICT4D in the Field	P6	6.00EC	XM_0008

Artificial Intelligence electives Social Robotics

Vakken

Naam vak	Periode	Credits	Code
Essentials of Media Psychology	P1	6.00EC	S_EMP
Communicative Robots	P2	6.00EC	L_AAMPLIN029
Socially Intelligent Robotics Project	P3	6.00EC	XM_0076
Social Robotics	P4	6.00EC	S_SR

Artificial Intelligence electives Language Technology

Vakken

Naam vak	Periode	Credits	Code
Programming in Python for Text Analysis	P1	6.00EC	L_AAMPLIN021
Subjectivity Mining	P1	6.00EC	L_AAMPLIN018
Communicative Robots	P2	6.00EC	L_AAMPLIN029
Language as Data	P2	6.00EC	L_PAMATLW001
Machine Learning for NLP	P2	6.00EC	L_AAMPLIN024
Applied Text Mining 1: Methods	P3	6.00EC	L_PAMATLW004
Advanced NLP	P4	6.00EC	L_AAMPLIN035
Applied Text Mining 2: Domains	P4	6.00EC	L_PAMATLW005

Artificial Intelligence compulsory courses

Omschrijving

These courses are obligatory for all AI master tracks.

Vakken

Naam vak	Periode	Credits	Code
Evolutionary Computing	P1	6.00EC	X_400111
Knowledge Representation	P2	6.00EC	XM_0059
Multi-Agent Systems	P2	6.00EC	XM_0052
Socially Intelligent Robotics	P2	6.00EC	XM_0074
AI and Society	P3	6.00EC	XM_0075

Naam vak	Periode	Credits	Code
Experimental Design and Data Analysis	P4	6.00EC	X_405078
Natural Language Processing	P5	6.00EC	XM_0121

Courses

Advanced Logic

Vakcode	X_405048
Studiepunten	6.00
Periode	P4
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. F. van Raamsdonk
Examinator	dr. F. van Raamsdonk
Betrokken Docenten	dr. F. van Raamsdonk
Onderwijsvormen	Partial Exam, Lecture, Seminar

Doel vak

The objective of the course Advanced Logic is to obtain a basic understanding of modal logic.

At the end of the course, the student should:
- be able to give proofs using Kripke semantics, to show (non-)definability of operators and frame properties; (Knowledge and understanding) (Applying knowledge and understanding)
- be able to understand decidability issues and use tableaux and sequents; (Knowledge and understanding) (Applying knowledge and understanding)
- be able to show (non-)bisimilarity, also informally in a game-approach; (Applying knowledge and understanding) (Making judgements)
- be able to reason about the definability of frame properties and modal operators; (Applying knowledge and understanding) (Making judgements) (Communication)
- be able to make elementary derivations in Hilbert style systems; (Applying knowledge and understanding)
- be able to prove properties about regular programs in propositional dynamic logic; (Applying knowledge and understanding)
- have acquired some flexibility in dealing with different versions of modal logic. (Applying knowledge and understanding) (Making judgements)

Inhoud vak

The course Advanced Logic is concerned with modal logic and its application to computer science. We study some themes from the book Modal Logics for Open Minds by Johan van Benthem, in particular: basic modal logic and possible world semantics, bisimulation and invariance, modal definability, and expressive power, decidability, proof systems, dynamic logic, epistemic logic.

Aanvullende informatie onderwijsvormen

2 lectures and 1 exercise class per week, for the duration of 7 weeks.

Toetsvorm

The is a written closed-book midterm exam about the first half of the material.
There is a written closed-book final exam about all material.

If the grade for the midterm is higher than the grade for the final exam, then the midterm counts for 20% of the final grade (midterm-grade + 4*final-exam-grade)/5), otherwise the final grade is the grade of the final exam.

Literatuur

Johan van Benthem, Modal Logics for Open Minds, CSLI Publications 2010.

Aanvullende informatie doelgroep

MSc Artificial Intelligence
MSc Computer Science
MSc Computer Security

Toelichting Canvas

We use Canvas for the schedule of the course, and to make available the slides for the lectures and the exercises for the exercise classes.
We use Canvas further to provide feedback to the homework assignments, to give the grade for the midterm, and for announcements.

Aanbevolen voorkennis

Basic knowledge of the syntax and semantics of first-order proposition and predicate logic, as for example taught in the Bachelor course Logic and Modelling (X_401015).

Advanced Machine Learning

Vakcode	XM_0010
Studiepunten	6.00
Periode	P1
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. S. Bhulai
Examinator	prof. dr. S. Bhulai
Betrokken Docenten	prof. dr. S. Bhulai
Onderwijsvormen	Lecture

Doel vak

There are several learning objectives for this course. After completion of this course, the student should be able to:
1. understand the capabilities and the limitations of machine learning,
2. implement machine learning algorithms in Python,
3. know relevant machine learning algorithms for both supervised and unsupervised learning problems,
4. select the right machine learning models for real-world use cases,
5. understand when to apply online learning, reinforcement learning, and deep learning,
6. interpret the outcomes of machine learning algorithms.

Inhoud vak

Machine learning is the science of getting computers to act without being explicitly programmed. Machine learning is so pervasive today that it is used in everyday life without knowing it. In this course, you will learn about the most effective machine learning techniques, and gain practice implementing them and getting them to work yourself. We will discuss the theoretical underpinnings as well as the practical know-how needed to apply these techniques to new problems.

Aanvullende informatie onderwijsvormen

Lectures (14 x 2 hours) including guest speakers, and tutorials (7 x 2 hours).

Toetsvorm

Tutorial and programming assignments (10% of the final grade) and a written exam (90% of the final grade). Both parts have to be passed with at least a 5.5.

Vereiste voorkennis

The VU course Linear Algebra and the VU course Statistics, or equivalent courses.

Literatuur

Slides and additional material that will be posted on Canvas.

Aanvullende informatie doelgroep

mBA, mBA-D, mMath, mSFM, mCS

Advanced NLP

Vakcode	L_AAMPLIN035
Studiepunten	6.00
Periode	P4
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Geesteswetenschappen
Vakcoördinator	prof. dr. A.S. Fokkens
Examinator	prof. dr. A.S. Fokkens
Betrokken Docenten	prof. dr. A.S. Fokkens, dr. P.J.M. Sommerauer
Onderwijsvormen	Lecture, Seminar

Doel vak

The goal of this course is to gain deep insight in the working of natural language processing methods. In particular, we cover:

1. how to design a system for a complex NLP task
2. how to implement this system
3. how to analyse the workings of the system through evaluation and interpretability methods

Inhoud vak

Natural Language Processing (NLP) is a highly dynamic research field that mainly operates on the interface between linguistics and computer science. In order to get computers to deal well with natural language, it is important to understand both how language works and how computational methods work. We treat a higher level complex NLP task, carrying out experiments and analysing models that carry this task out. Through these analyses, we aim to deepen our understanding of how these models work and what their strengths and weaknesses are.

Aanvullende informatie onderwijsvormen

Lectures and interactive workgroups.

Toetsvorm

A practical component (portfolio of assignments) and a (possible take-home) exam. All components need to get a passing grade (at least 5.5) in order to pass the course.

Vereiste voorkennis

This is an advanced NLP course that assumes a solid background in linguistics, machine learning and NLP and programming skills to carry out practical assignments. Students must have completed at least two NLP courses at a master level successfully. Be aware that most students following this course have taken 3 or 4 courses on NLP at a Master level and have a solid background in linguistics.

Literatuur

TBA

Aanvullende informatie doelgroep

Students of the Text Mining specialisation (of the Master's programme in Linguistics). This course can also be followed by students of other Master's programs with appropriate background knowledge.

Aanbevolen voorkennis

Linguistics, machine learning, programming, NLP (basic concepts in these fields will be assumed to be known and not explained).

Aging and age-related disorders

Vakcode	P_MAGEDIS
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Gedrags- en Bewegingswetenschappen
Vakcoördinator	dr. S.A.M. Sikkes
Examinator	dr. S.A.M. Sikkes
Betrokken Docenten	E. Butterbrod, dr. S.A.M. Sikkes
Onderwijsvormen	Lecture

Doel vak

Provide an advanced course on the neuropathological, cognitive and behavioural consequences of aging and age- related neurodegenerative diseases, with a focus on dementia.

Inhoud vak

Aging and dementia will be related to
neuropathological characteristics, brain structure, functioning and networks. (Disease) trajectories will be explained in terms of cognitive,
behavioral and functional outcomes, for the various subtypes of dementia. Specific attention will be given to the concept of preclinical disease and the earliest clinical symptoms in dementia.

Aanvullende informatie onderwijsvormen

Plenary lectures, e-learning, assignments

Toetsvorm

Open-end questions

Literatuur

Recent research papers will be used as learning material.

Aanvullende informatie doelgroep

Aanvullende informatie doelgroep

Master students

Aanbevolen voorkennis

The course is mainly relevant for students with a background in psychology, neuroscience, health sciences. Recommended prior reading: Fundamental of Human Neuropsychology (Kolb & Whishaw)

AI and Society

Vakcode	XM_0075
Studiepunten	6.00
Periode	P3
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. M.C.A. Klein
Examinator	dr. M.C.A. Klein
Betrokken Docenten	drs. E.M. Maassen MSc, dr. M.C.A. Klein
Onderwijsvormen	Study Group, Lecture

Doel vak

After this course, students have a better knowledge and understanding of the societal questions that are related to AI; they are able to applying their knowledge and understanding about AI technology to contribute to the societal discussion; students are able to make judgments about societal consequences of applying AI technology.

With respect to communication skills, students have learned to articulate their informed opinions in a public debate. Students have improved their learning skill of critical thinking.

This course is particular focused on the Dublin descriptors:
- Making judgements: students have to make judgments on awareness of, and responsibility concerning, the ethical, normative and social consequences of Artificial Intelligence in the society.
- Communication skills (posters, essays, reports, and discussions).

Inhoud vak

During this course, we will explore the role of AI in the society. Based on recent scientific literature and the portrayal of AI in contemporary movies and popular press, students and teachers will discuss topics such as the consequences of AI for the labour market and (in)equality, the ethical considerations around autonomous systems, the risks of biases and misuse of algorithms, the legal aspects of AI and the questions about the control over AI systems. In addition, we will explore possible ways to counteract negative effects. We will also reflect on the role of AI experts in this societal discussion.

Each week we discuss a specific theme, which is illustrated by a movie and presented by a guest speaker. Attendance to the plenary discussion meetings is obligatory.

During the course, a number of reports based on literature have to be written, which are reviewed by other students. The final product of the course is an opinion article (essay) for our online magazine ai-society.vu.nl. The course is concluded with a plenary symposium where all articles are presented in the form of a poster.

Aanvullende informatie onderwijsvormen

Plenary session with movies, guest speakers, discussion meetings, group work. The attendance of plenary sessions is obligatory.

Toetsvorm

Reports, poster and essay. The average of the weekly reports counts for 45%, the final essay also counts for 45%, and the poster counts for 10%. There is no option for a resit.

Aanvullende informatie doelgroep

Master Artificial Intelligence (only year 1)

AI for Medical Imaging

Vakcode	XMU_0045
Studiepunten	6.00
Periode	P1
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	S.M.A. Zaghow
Examinator	
Betrokken Docenten	
Onderwijsvormen	

Inhoud vak

https://studiegids.uva.nl/xmlpages/page/2022-2023/zoek-vak/vak/99131

Afwijkende intekenprocedure

This course is offered by the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Algorithms in Sequence Analysis

Vakcode	X_405050
Studiepunten	6.00
Periode	P2
Vakniveau	600
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	D. Muysken
Examinator	prof. dr. J. Heringa
Betrokken Docenten	L. Hoekstra, dr. S. Pissis, prof. dr. J. Heringa, D. Muysken, S. Lakbir MSc, dr. S. Abeln, dr. ir. K.A. Feenstra
Onderwijsvormen	Lecture, Computer lab

Doel vak

Have you ever wondered how we can track a gene across 3 billion years of evolution? Or how you can use the genome information of a given cancer patient to find out what may be wrong? Sequence alignment can be used to compare genomes, genes or proteins from bacteria all the way to humans, while further derived algorithms may be employed to make a phylogeny (to find out about evolutionary relationships), find a functional motif in a protein sequence, or a viral sequence in a genome. In this course we focus on the most important algorithms for biological sequence analysis that can be applied to real scientific problems in biology.

Course Objectives [Dublin descriptors]:

- Students will obtain in-depth knowledge about the theory of sequence analysis methods. They will become aware of the major issues, methodology and available algorithms in sequence analysis. Upon completion of the course they will be able to implement several of the most important algorithms in sequence analysis, including dynamic programming and Hidden Markov Models (HMMs) [Knowledge and understanding].

- Students will develop understanding and skills to apply sequence analysis algorithms to protein and DNA sequences. They will gain hands-on experience in tackling biological problems using sequence analysis algorithms, including the statistical framework of HMMs and algorithms used in genome sequencing and analysis [Applying knowledge and understanding].

- Upon completion of the course students will be able to decide which algorithm is best suited for a particular biological sequence analysis problem [Making judgements].

- During this course students are required to read through scientific and technical literature and learn to translate algorithms described in text and formal mathematical notation into computer code [Learning skills].

Inhoud vak

Theory:
- Dynamic programming, database searching, pairwise and multiple alignment, probabilistic methods including HMMs, pattern matching, entropy measures, evolutionary models, and phylogeny.

Practical:
- Programming (in Python) an alignment algorithm based on dynamic programming;
- Aligning sequencing data from tumors to the human genome and analysing structural variants;
- Programming (in Python) an implementation of HMMs and using it to predict protein domain structure.

Aanvullende informatie onderwijsvormen

13 lectures: 2 two-hour lectures per week.
13 computer practicals and associated assignments: 2 two-hour hands-on sessions per week.

Toetsvorm

The final grade for this course will consist of 50% practical work (see above) and 50% theoretical assessment.
The theoretical assessment will be an oral and/or written exam (depending on number of students).

Further assessment and grading details will be posted on Canvas (resits and compensation rules).

Vereiste voorkennis

Bachelor in any science discipline (including medicine).
Basic programming skills (Python) and an interest in biological problems.

Literatuur

Course material on Canvas.

Books: Durbin, R., Eddy, S.R., Krogh, A., Mitchison, G.. Biological Sequence Analysis. Cambridge University Press, 1998, 350 pp., ISBN 0521629713.

Recommended reading: Marketa Zvelebil and Jeremy O. Baum Understanding Bioinformatics. Garland Science 2008. ISBN-10: 0-8153-4024-9

Aanvullende informatie doelgroep

M Bioinformatics and Systems Biology
M Biomolecular Sciences
M Artificial Intelligence
M Computational Science

Overige informatie

BYOD policy (Bring Your Own Device)
We expect students in this course to use their own laptop. This laptop should at the very least support an SSH client, for remote shell access to the VU Linux servers. Ideally, this laptop supports a command line shell, Python 3 and a text editor with syntax highlighting -- either standalone (e.g. Atom or Sublime Text) or as part of a simple IDE (e.g. Spyder). As such, we recommend the Anaconda python distribution regardless of operating system, along with PuTTy or PowerShell for Windows users specifically.

If you are considering purchasing new hardware, we recommend the following:
o Processor: Intel i5 / AMD Ryzen 5 or above
o Memory: At least 4GB RAM
o Storage: At least 512GB harddisk space
o Operating System: Ubuntu 16.04

The course is taught in English.

Applications of Modal Logic for AI

Vakcode	XM_0082
Studiepunten	6.00
Periode	P5
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. V.N. Stebletsova
Examinator	dr. V.N. Stebletsova
Betrokken Docenten	dr. V.N. Stebletsova
Onderwijsvormen	Seminar, Lecture

Doel vak

Knowledge and understanding: at the end of the course, students will be familiar with basic knowledge of some most known Modal Logics in the field and their applications in AI. □
Applying knowledge and understanding: students will be able to formalise real-life processes based on concepts of knowledge, time, and strategic reasoning as models for appropriate logics.
Making judgements: Students will be able to reason about and assess the application decisions of Modal Logics in AI.
Communication skills: students will be able to write a scientific reports about an application of a modal logic in AI in a group of students.
Learning skills: students will be trained in writing.
specifications/queries for properties of process systems based on concepts of knowledge, time, and strategic reasoning using a particular modal language and verifying those properties by model checking.

Inhoud vak

After the first lecture which contains an introduction to the syntax and semantics of basic modal logic, we continue our lectures starting with real-life problems from various fields of AI and showing how they can be solved with different types of modal logic. Namely:
— how Epistemic Logic is useful in multi-agent field of AI, planning, decision making, in social robotics;
— how Temporal Logic is useful in planning, synthesis of provably correct strategies;
— how Dynamic Epistemic Logic is useful in epistemic planning. Epistemic planning in AI can be used for decision making in multi-agent situations with distributed knowledge and capabilities;
— how Alternating-time Temporal Logic is useful in specification and verification of open systems involving multiple autonomous agents

Our intention is to get acquainted with recent research in the field.

The course includes also practical knowledge concerning MCMAS, an open-source, OBDD-based symbolic model checker tailored to the verification of Multi-Agent Systems (MAS).

Aanvullende informatie onderwijsvormen

During 7 weeks, 2 lectures (both 1.5 hours) and 1 exercise class (2 hours) each week.

Toetsvorm

Homework assignments 40%
Survey 50%
Presentation of survey 10%

Resit for the assignments, no resit for the group survey and presentation.

Literatuur

Reading materials — see Canvas page of the course.

Aanvullende informatie doelgroep

Master Artificial Intelligence

Aanbevolen voorkennis

Basic knowledge of syntax and semantics of propositional and first-order predicate logic

Applied Text Mining 1: Methods

Vakcode	L_PAMATLW004
Studiepunten	6.00
Periode	P3
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Geesteswetenschappen
Vakcoördinator	dr. E. Maks
Examinator	dr. E. Maks
Betrokken Docenten	dr. R. Morante Vallejo, dr. E. Maks
Onderwijsvormen	Seminar

Doel vak

After finishing this course, students will be able to:

• Describe the steps needed to solve an NLP task.
• Define a natural language processing task.
• Design machine learning experiments to solve a task, taking informed decisions based on existing literature.
• Collect data that can be used to train a machine learning system.
• Perform annotation tasks and calculate inter-annotator agreement.
• Use existing software for the analysis of natural language and combine software to features to build a supervised classifier.
• Extract features.
• Perform classification experiments.
• Combine the output of different tools and classifiers.
• Analyse the output of an NLP pipeline.
• Evaluate and interpret the results of a classifier.
• Perform error analysis and analyse the weaknesses and strengths of a system.
• Report about NLP experiments.

Inhoud vak

The course will address the following phases of an NLP task:
• Task definition and experiment design. The first step in solving an NLP task is defining the problem, establishing what are the steps to be taken and designing the actions/experiments that will be performed at every step. This course focuses on applying supervised machine learning methods.
• Data collection. A machine learning system has to be trained on annotated data. This phase is devoted to locating the data that are already available, and, if necessary, creating new data. Additionally, data need to be annotated to create evaluation sets. Annotation can be performed either by a small team of annotators or by crowdsourcing. Annotation experiments will be performed including the calculation of inter-annotator agreement.
• Data preprocessing. Once textual data are available, they need to be preprocessed to convert them into a specific machine-readable format. If the texts are in an unstructured format, they will have to be converted into a structured format. Additionally, texts need to be processed with NLP tools and/or pipelines (part-of-speech taggers, named entity recognizers, parsers, semantic role labelers, etc.) in order to obtain the information that the machine learning system will use to build a model and make predictions. We call this process “feature extraction”. For this course, the texts will be processed with existing current NLP tools and platforms, such as Standford CoreNLP, Stanza, Spacy, etc.
• Feature extraction. Once the texts have been preprocessed, features can be extracted. Which features are necessary will be determined by reading existing previous work and/or based on knowledge about the task.
• Classification experiments. Experiments will be designed following an experimental protocol. This protocol will include specifications about the following elements: description of data, data partition, baseline system, classifiers to be used and motivation, features, evaluation, and error analysis. Experiments will be performed using standard machine learning libraries.
• Final report. The design and results of the experiments will be summarized in a short report, that will be peer-reviewed by other students.

Aanvullende informatie onderwijsvormen

This course is mostly practical. The lecturer will provide the basic theory related to every methodological step, which the students will apply to solve the task. A few sessions are devoted to theoretical aspects, while most sessions will be interactive and devoted to discuss progress, doubts and problems encountered. Students will work in groups. Contact hours: 2x2 hours per week.

Toetsvorm

The course is graded by partial group assignments (50%) and a final report (50%). All components must be graded at least 5.5.

Vereiste voorkennis

Students must have participated in:
Introduction to Human Language Technology (L_AAMPALG016) OR Natural Language Processing Technology (L_AAMAALG005)
AND
Language as Data (L_PAMATLW001) OR Subjectivity Mining (L_AAMPLIN018)
AND
Machine Learning for NLP (L_AAMPLIN024)OR Machine Learning for the Quantified Self (XM_40012) OR Advanced Machine Learning (XM_0010)

Aanvullende informatie doelgroep

Master's students in Linguistics (specialisation Text Mining) and other master's students with a background in linguistics, programming and natural language processing (see prerequisites!)

Applied Text Mining 2: Domains

Vakcode	L_PAMATLW005
Studiepunten	6.00
Periode	P4
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Geesteswetenschappen
Vakcoördinator	prof. dr. A.S. Fokkens
Examinator	prof. dr. A.S. Fokkens
Betrokken Docenten	prof. dr. A.S. Fokkens
Onderwijsvormen	Seminar

Doel vak

This course prepares students for their text mining internship. They learn to develop a text mining research hypothesis starting from a real-world problem and acquire fundamental research techniques for conducting a literature study of related work and preparing a data plan. The course furthermore covers the basics of domain adaptation and ethics which are a fundamental component of applying text mining in real world scenarios.

Inhoud vak

In their thesis, students need to be able to combine the practical needs and techniques they encounter during their internship with academic standards. At the same time, the real world scenario includes a good understanding of how to deal with data from different domains and what ethical concerns may arise when using NLP in various scenarios. In this course, scientific methods acquired during the Master's programme will be intensified. Text Mining projects require a combination of data collection and analysis skills with the ability to work with state-of-the-art NLP methods and models. In this course, students prepare for their thesis by setting up their research question and the outline for their thesis together with the their supervisor. In parallel, students study the basics of domain adaptation and ethics. Knowledge and ideas about ethics and domain adaptation are shared in discussions about the individual projects.

Aanvullende informatie onderwijsvormen

In the first week, interactive methodological lectures introduce best practices and methods in text mining research. In the remainder of the course, students are grouped with a supervisor according to their topics and develop their research plan and methodology in cooperation with the internship organization.

Toetsvorm

Toetsvorm

Students submit a written thesis plan and a portfolio covering ethics and domain adaptation. The course is graded as a pass/fail.

Vereiste voorkennis

Students must have participated in Applied Text Mining 1: Methods.

Aanvullende informatie doelgroep

Students in the Master's programme Linguistics (specialisation: Text Mining)

Behaviour Dynamics in Social Networks

Vakcode	X_400113
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. J. Treur
Examinator	prof. dr. J. Treur
Betrokken Docenten	prof. dr. J. Treur
Onderwijsvormen	Lecture, Practical

Doel vak

By the end of the course, students will be able to:
1) identify different types of mental and social processes; (Knowledge and understanding)
2) understand how individual and social behaviour emerges from mechanisms known from Cognitive, Affective and Social Neuroscience, and from Cognitive and Social Sciences; (Knowledge and understanding)
3) construct network models for mental and social interaction processes; (Applying knowledge and understanding) (Making judgements)
4) perform analysis based on these models using Network-Oriented Modeling software tools and empirical data. (Applying knowledge and understanding) (Lifelong learning skills)

Inhoud vak

This is a multidisciplinary course, also accessible for students from other disciplines such as Neuroscience, Psychology, Health Sciences or Social Sciences.
Behaviour dynamics occurs in different forms, contexts, and complexity. Complexity can occur in the mental processes within persons, in social interaction processes, or in both. Both types of processes can be adaptive: mental processes can change due to learning, and social interactions can also evolve over time. Theories and findings from Cognitive, Affective and Social Neuroscience and also from Cognitive, Health and
Social Sciences are presented and used to get insight into the underlying
mechanisms that form a solid scientific basis for modelling of these processes. A Network-Oriented Modeling approach based on adaptive networks is used to model both these internal mental processes (as mental networks) and social interaction processes (as social networks). These network models can not only cover dynamics of causal effects but also adaptive dynamics of changing causal connections and higher-order adaptiveness, such as for metaplasticity in Cognitive Neuroscience describing when and to which extent plasticity of connections should occur.
During the course, several examples are presented. These

examples cover imagination by internal simulation, integration of emotions in all kinds of mental and social processes, learning of emotion regulation, ownership, and attribution of actions, empathic social responses, development
of shared understanding and collective action, and different principles for evolving social networks and for organisational learning. The dynamics of such processes are modeled,
simulated and analysed (including verification and validation) in this course using a dedicated and easy to use modelling environment for Network-Oriented Modeling; no programming is needed. In the last four to five
weeks of the course, a more ambitious final assignment is addressed, which can be worked out to a paper that may be submitted to an international conference, where it could be presented and provide a publication. A public Website for this course with more details is available at

https://www.researchgate.net/project/Behaviour-Dynamics-in-Social-Networ
The YouTube channel for the course with videos for the lectures and final assignments is available at
https://m.youtube.com/channel/UCaeA1Wcvv7jpDGgDda17L3g.

Aanvullende informatie onderwijsvormen

Combinations of lectures and practical assignments, with extensive and multiple feedback rounds whenever needed. Benjamin Bloom's Mastery Learning approach is used (e.g., see
https://en.wikipedia.org/wiki/Mastery_learning).

Toetsvorm

Practical assignments (50%) and a final assignment (50%), including presentation of the final assignment. All assignments can be redone after feedback from the lecturer until the 90% result is achieved according to the Mastery Learning Method followed.

Vereiste voorkennis

None

Literatuur

1. Chapters 3, 7 and 11 of:
Treur, J., Network-Oriented Modeling: Addressing Complexity of Cognitive, Affective and Social Interactions. Springer Nature Publishers, 2016.
URL: http://www.springer.com/gp/book/9783319452111
Free downloadable from the VU at doi:
http://dx.doi.org/10.1007/978-3-319-45213-5
Table of Contents: https://www.researchgate.net/publication/305930006

2. Chapters 1 to 9 of:
Treur, J., Network-Oriented Modeling for Adaptive Networks: Designing Higher-Order Adaptive Biological, Mental, and Social Network Models. Springer Nature Publishers, 2020.
URL: https://www.springer.com/gp/book/9783030314446
Free downloadable from the VU at doi:
https://doi.org/10.1007/978-3-030-31445-3
Table of Contents: https://www.researchgate.net/publication/334576216

3. Chapters 1, 2, 17, 18, 19 (perhaps plus one or two more) of:
Treur, J., van Ments, L. (eds.), Mental Models and their Dynamics, Adaptation and Control: a Self-Modeling Network Modeling Approach. Springer Nature Publishers, 2022.
https://doi.org/10.1007/978-3-030-85821-6
Table of Contents:
https://www.researchgate.net/publication/350409515

Aanvullende informatie doelgroep

- MSc study Artificial Intelligence
- MSc study Management, Policy Analysis and Entrepreneurship in Health and Life Sciences
- MSc study Computational Science
- MSc studies in Neurological, Behavioural and Social Sciences
- MSc study Computer Science
- MSc study Business Analytics
- Any other students interested in multidisciplinary approaches combining psychological, neurological, and/or social elements with computational elements.

Aanbevolen voorkennis

None

Bioinformatics for Translational Medicine

Vakcode	X_405092
Studiepunten	6.00
Periode	P5
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	D. Muysken
Examinator	dr. E. Bosdriesz
Betrokken Docenten	dr. S. Abeln, dr. E. Bosdriesz, D. Muysken, T. Stohn
Onderwijsvormen	Lecture, Practical

Doel vak

Observations from biological high-throughput experiments allow us to improve diagnosis and give a personalized treatment plan for patients. However, integrating data from several sources and using this data for predictions is non-trivial.

This is a theoretical and practical Bioinformatics course on computational methods for Translational Medicine; we will focus on Bioinformatics methods that are used to predict the clinical outcome for patients and analysis methods to obtain deeper understanding of complex diseases, by combining data from various high-throughput experiments such as proteomics, microarrays and next-generation sequencing as well as existing biological databases.

Goals [Dublin descriptors]
• At the end of the course, students will be aware of Bioinformatics methods that are applicable to the area of Translational Medicine [knowledge and understanding].
• Students should be able to combine these methods to come to a creative solution to get new insights from large-scale biological experiments [applying knowledge and understanding].
• At the end of the course, students will have hands-on experience in handling large biological datasets, and will understand the complexity of the biological data both from high-throughput experiments and existing biological databases [applying knowledge and understanding].
* At the end of the course, students will be able to work as a team to execute a large, complex biomedical bioinformatics project, and report on the results [communication]
• The student will become familiar with a few in-depth research topics that lie within the expertise area of several (Bioinformatics) researchers, among others from the VU, UvA, AUMC and NKI [making judgements, learning skills].

Inhoud vak

Theory
• Computational analysis of molecular profiling techniques, such as WGS, WES, proteomics, RNA sequencing, and arrayCGH.
• Computational methods applied to these data types, such as: machine learning, normalisation, regularization, feature selection, classification, read mapping, clustering.
• All data analysis is relevant in a clinical setting, for diagnosis, treatment decisions or biomarker discovery.

Practical
• A large assignment for which you have to build a classifier based on molecular profiling data (the precise data-set is to be determined). You need to hand in predictions, write a paper and give a presentation. Note that this is a group project, and to participate in this practical you need to have obtained at least 12 ECT from Master-level courses.
• A smaller assignment that involves analysing and understanding molecular profiling data of another modality than the large classifier assignment.

Aanvullende informatie onderwijsvormen

• 13 lectures (2 two-hour lectures per week)
• 12 computer practicals (2 two-hour sessions per week)

Toetsvorm

The final grade for this course will consist of 50% practical work (see above) and 50% theoretical assessment.

Practical assessment (50%):
• Classifier assignment (45%)
• Other data modality assignment (5%)

Theoretical assessment (50%):
• Oral or written exam (depending on number of course students)
• The exam is based on a selection of 8-10 scientific papers in the field of Bioinformatics & Translational Medicine.

Vereiste voorkennis

Importantly: to participate in the group assignment, you need to have obtained a minimum of 12 ECT of Master level courses. In addition, some basic programming skills (either in R or Python) are required, as well as some basic knowledge on molecular biology. If you are not following the Master Bioinformatics and Systems Biology, it is advisable to first follow the Master course
"Fundamentals of Bioinformatics".

Literatuur

• Course material on Canvas, including slides and recordings of lectures.
• 8-10 scientific papers are provided, and make up the course syllabus.

Aanvullende informatie doelgroep

M Artificial Intelligence
M Bioinformatics and Systems Biology
M Biomolecular Sciences
M Oncology
M Computational Science

Overige informatie

The course is taught in English.

• Compulsory course for students in Master Bioinformatics and Systems Biology

• Optional course for students with a Bachelor in Physics, Chemistry, Mathematics, Computer Science, Biology, or
Biomedical Sciences (see requirements below).

Aanbevolen voorkennis

If you are not following the Master Bioinformatics and Systems Biology, it is advisable to
first follow the Master course "Fundamentals of Bioinformatics".

Brain Imaging

Vakcode	P_MBRIMAG_AI
Studiepunten	6.00
Periode	P4
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Gedrags- en Bewegingswetenschappen
Vakcoördinator	dr. T.H.J. Knapen
Examinator	dr. T.H.J. Knapen
Betrokken Docenten	dr. T.H.J. Knapen, mr. R. van de Klundert MSc, mr. S. Zhang MSc
Onderwijsvormen	Seminar, Lecture

Doel vak

The goal of this course is to give you an idea of the awesome possibilities and annoying pitfalls of functional brain imaging, but most importantly, to give you a solid foundation for further learning. At the end of the course, you will be able to devise a valid fMRI experiment, and perform the basic analysis on the resulting data using state-of-the-art open science and open source tools.

Inhoud vak

In this course we will teach you the ins and outs of brain imaging, that is, fMRI. We will teach you everything from the basics of signal analysis, to experimental design, to statistics. Some of the newest cutting-edge techniques, including pattern classification analysis, connectivity modeling, and resting state network analysis, are also discussed.

Aanvullende informatie onderwijsvormen

Every week, there will be one or two lectures, interspliced with 3 or 4 practicals/'werkcolleges'.
The course is broadly divided into two parts; the first half of the course serves to teach you the very basics of signal analysis and experimentation. We believe this basis is necessary to later start to think independently and academically about research in your future field. In this first phase of the course the weekly lecture will treat theory while the practicals will allow you to wet your toes with this material. This way we try to combine theory and practice.
In the second half of the course, you will already know a lot about what Brain Imaging entails. Then, we will switch gears a bit, and teach you what's going on in the neuroimaging field right now. That means that during the weekly lecture we will use research articles to illustrate the state of the art. In the practicals we'll move towards letting you perform an entire fMRI analysis yourselves. In this second part of the course we'll also focus more and more on recent articles that show us the state-of-the-art in neuroimaging.

Toetsvorm

Final Exam, open-end & MC questions 60%
Practical assignments 40%

Vereiste voorkennis

Fluency in the Python programming language.

Literatuur

We will use articles describing current research.

Overige informatie

Prior knowledge of Python programming and statistics is recommended.

Cognitive Psychology and its Applications

Vakcode	XM_40010
Studiepunten	6.00
Periode	P1
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. A.V. Belopolskiy
Examinator	dr. A.V. Belopolskiy
Betrokken Docenten	dr. A.V. Belopolskiy
Onderwijsvormen	Hoorcollege

Doel vak

De cursus beoogt een overzicht te geven van de cognitieve psychologie en haar toepassingen. Studenten zullen:
- de rol begrijpen van menselijke cognitieve vermogens en beperkingen in het ontwerp van producten, werkplekken en grote systemen. (Kennis en begrip)
-kennis maken met de belangrijkste gebieden van menselijke factoren en met de belangrijkste theorieën en bevindingen over menselijke prestaties. (Kennis en begrip)
-begrijpen waar in het proces kennis moet worden toegepast en welke methoden dat kunnen worden gebruikt om menselijke prestaties te analyseren. (pas kennis toe en begrip)
-leren hoe een toegepast probleem in mens-machine te benaderen en op te lossen systemen. (Maak een oordeel) (Vaardigheden voor een leven lang leren)

Inhoud vak

De cursus behandelt een aantal centrale principes uit het gebied van de cognitieve psychologie en hoe deze principes kunnen worden toegepast in de ontwerp van moderne mens-machinesystemen, inclusief mens-computersystemen. Diverse onderwerpen komen aan bod zoals mentale belasting, besluitvorming, rijgedrag, routevinding, medische besluitvorming en display design.

Aanvullende informatie onderwijsvormen

Hoorcolleges (~18 uur) en praktijkopdrachten (~6 uur)

Toetsvorm

Praktische onderzoeksopdracht en presentatie (30%), Open eindexamen (70%). Deze evaluaties staan los van elkaar en kunnen niet worden gebruikt om elkaar te compenseren. Een verbeterde versie van de onderzoeksopdracht kan worden gebruikt voor hertentamen. Voor het open eindexamen is een herkansing nodig. Deze onderdelen kunnen afzonderlijk worden herbekeken.

Communicative Robots

Vakcode	L_AAMPLIN029
Studiepunten	6.00
Periode	P2
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Geesteswetenschappen
Vakcoördinator	prof. dr. P.T.J.M. Vossen
Examinator	prof. dr. P.T.J.M. Vossen
Betrokken Docenten	prof. dr. P.T.J.M. Vossen
Onderwijsvormen	Seminar

Doel vak

In the Spinoza research project we study the relation between the world and how people and robots make reference to the world. The central theme of this course is the relation between identity, reference and perspective. What things do we identify in a shared space or situation, how do we refer to these things and what is the perspective of the communicating partners when referring in different ways.

Robots are fun to work with. Especially social robots that can communicate with people. Robots are also very complex laboratories in which you can you can implement multimodal communication models and study how people communicate with robots and vice versa. In this course, you will experiment with our robot models Leolani en Alani and learn about the complexity of multimodal communication in real-world physical contexts.

Inhoud vak

You will learn about the architecture of a communicating robot and its different components, starting from the sensors that pick up signals (audio and vision), the language understanding and generation models and the brain in which the robot
stores all interpretations of the encounters with people. You will read overview papers that explain the state-of-the-art of human-robot communication and you will interact with the robot and report on the findings. You will gain a deep insight in what it takes to build a communicative robot, what the difficulties are and how to evaluate multimodal interactions.

Aanvullende informatie onderwijsvormen

There are two classes per week, each two hours. There will be regular classes in which we discuss literature, explain the robot models and explain the major concepts and there will be hands on sessions during which you work in small groups with the robot. Students can work together in small groups but the grading is individual on your report on your experiment.

Toetsvorm

You will write a report about your experiment with the robot, either focusing on behavioural observations or on the computational modelling of
one of the components.

Vereiste voorkennis

Students do not need to program but if they want they can. The programming language is Python. Students without programming skills can do experiments on the multimodal communication and the impact on people.

Aanvullende informatie doelgroep

Students Research Master Humanities, Track Linguistics - Human Language Technology; students Master Artificial Intelligence

Data Mining Techniques

Vakcode	X_400108
Studiepunten	6.00
Periode	P5
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. M. Hoogendoorn
Examinator	prof. dr. M. Hoogendoorn
Betrokken Docenten	prof. dr. M. Hoogendoorn
Onderwijsvormen	Lecture, Computer lab

Doel vak

The aim of the course is that students acquire data mining knowledge and skills that they can apply in a business environment. More precisely, the following learning goals are distinguished:
1. Understand the data mining process
2. Understand exploratory data analysis
3. Understand feature engineering
4. Understand classification techniques
5. Understand regression techniques
6. Understand association rules and recommender systems
7. Understand current state of the art in data mining
8. Understand ethical concerns and evaluation of results
9. Learning to argue for choices (rationale)

The course if focused on the Dublin descriptors Applying Knowledge and Understanding (since the aim is to improve the practical skills); Making judgements (which technique is appropriate, how to best apply Data Mining for a specific case); Communication skills (how to report on your approach, choices and your results), and Learning skills (able to find new relevant techniques, assess their suitability, etc.).

How the aims are to be achieved: Students will acquire knowledge and skills mainly through the following: an overview of the most common data mining algorithms and techniques (in lectures), a survey of typical and interesting data mining applications, and practical assignments to gain "hands on" experience. The application of skills in a business environment will be simulated through various assignments of the course.

Inhoud vak

The course is intended to introduce Data Mining Techniques to students that are new to the field as well as to more experienced students. The main aim is to gain a more practical perspective towards Data Mining Techniques/Machine Learning. Lectures will cover more basic things for those new to the field (general introduction into Data Mining, classical algorithms such as decision trees, association rules, neural networks, ensemble learning, etc.) and on top will discuss advanced topics including deep learning, recommender systems, big data infrastructures, and text mining. A number of successful applications in the area will also be discussed. In addition to lectures, there will be an extensive practical part, where students will experiment with various data mining algorithms and data sets. The grade for the course will be based on these practical assignments (i.e., there will be no final examination).

Aanvullende informatie onderwijsvormen

Lectures (h) and practical sessions (pra). Lectures are planned to be interactive: there will be small questions, etc.

Toetsvorm

Practical assignments (i.e. there is no exam). There will be two assignments done in groups of three. For the first assignment there is a choice: going for a basic assignment (suited for those new to the domain) or a more advanced one (for students with more experiences). The second assignment is the same to all and will involve an in class Kaggle competition. For the regular assignments the first assignment counts for 40% and the second for 60%. The grade of both assignments needs to be sufficient to pass the course.

There is an option to resit one of the assignments when an insufficient grade is obtained (only when the other assignment grade is sufficient). This involves improving your assignment to at least a sufficient level within two weeks after having received your grade for the second assignment. The maximum grade of the resit is a 6.0.

Literatuur

Optional: Ian H. Witten, Eibe Frank, Mark A. Hall, and Christopher J. Pal. Data Mining: Practical Machine Learning Tools and Techniques (Fourth Edition). Morgan Kaufmann, 2016 978-0128042915.

Aanvullende informatie doelgroep

Master Artificial Intelligence, Master Computer Science, Master Bioinformatics and Systems Biology

Aanbevolen voorkennis

1. Statistics
2. Programming Skills

Deep Learning

Vakcode	XM_0083
Studiepunten	6.00
Periode	P2
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. S. Yu
Examinator	dr. S. Yu
Betrokken Docenten	dr. M. Cochez, dr. P. Bloem, dr. S. Yu
Onderwijsvormen	Lecture, Practical

Doel vak

1. Knowledge and understanding
- Be able to explain the main components of a deep learning architecture: fully-connected layers, convolutional layers, activation functions, LSTM, and GRU.
- Be able to explain and derive the backpropagation algorithm.
- Be able to explain different commonly used deep architectures.
- Be able to explain Variational Autoencoders and Generative Adversarial Networks and indicate differences between these two.
- Be able to explain the difference between discriminative and generative models.

2. Applying knowledge and understanding
- How before-mentioned layers work and where to use them.
- How to formulate a neural network for a specific problem.
- How to analyze the performance of a neural network.
- What neural network fits best for a given problem.

3. Making judgments
- What deep learning model to use for a given problem (e.g., generative vs discriminative).
- What layers of a neural network are suitable for a given problem.

4. Communication skills
- Presenting an analysis in a written form (a short report) for each assignment.

5. Learning skills
- Able to read (some) state-of-the-art papers.
- Able to develop (to some extent) available deep learning libraries.

Inhoud vak

Deep learning becomes the leading learning and modeling paradigm in machine learning. During this course, we will present basic components of deep learning, such as:
- different layers (e.g., linear layers, convolutional layers, pooling layers, recurrent layers);
- non-linear activation functions (e.g., sigmoid, ReLU);
- backpropagation;
- learning algorithms (e.g., ADAM);
- other (e.g., dropout).

Further, we will show how to build deep architectures like LeNet and AlexNet. We will explain potential pitfalls and possible solutions, e.g., by using residual connections and dense architectures.

After discussing discriminative models, we will turn them into generative models. We will start with linear latent variable models like the probabilistic PCA. Then we will discuss a non-linear version of the pPCA, namely, Variational Auto-Encoders (VAEs). Both pPCA and VAE are so-called prescribed models that require formulating the likelihood function. On the other hand, we can alleviate it by considering implicit distribution. This is the main idea behind Generative Adversarial Networks (GANs). We will also discuss state-of-the-art models like autoregressive models and flow-based models.

At the end of the course, we will outline recent developments in deep learning. Namely, we will present the attention mechanism, transformer networks, and deep embeddings. In the end, we will discuss Reinforcement Learning and Deep Reinforcement Learning.

Aanvullende informatie onderwijsvormen

The course consists of two parts: a written exam and practical assignments. The written exam is supported by lectures (two/three per week). The assignments are supported by practical sessions led by TAs. The first two assignments are carried out individually and the remaining assignments are done in small groups. No resit is possible for the practical assignments.

Toetsvorm

Final exam (50%) and practical assignments (50%).

Literatuur

The literature will be made available on Canvas.
Two suggested books:
- Goodfellow, I., Bengio, Y., & Courville, A. (2016). "Deep learning". MIT press.
- Tomczak, J. M. (2022). "Deep Generative Modeling". Springer, Cham.

Aanvullende informatie doelgroep

Master Artificial Intelligence

Master Business Analytics

Aanbevolen voorkennis

- Calculus
- Linear Algebra
- Statistics & Probability Theory
- Programming (Python)
- Machine Learning

Dynamic Programming and Reinforcement Learning

Vakcode	XM_0093
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. G.M. Koole
Examinator	prof. dr. G.M. Koole
Betrokken Docenten	prof. dr. G.M. Koole, V.G.M. Francois Lavet
Onderwijsvormen	Seminar, Lecture

Doel vak

Dynamic Programming (DP) and Reinforcement Learning (RL) are fields concerned with decision making over time. After completing this course, the student
- is familiar with the commonly used algorithms for solving dynamic optimization problems;
- understands the main features of these algorithms, their strengths and weaknesses including their convergence properties;
- can implement them in an appropriate language;
- can model real-world decision problems into a DP or RL framework and solve moderately sized problems;
- has knowledge of the historical development of DP and RL and has an idea of possible future developments.

Inhoud vak

This course is concerned with reinforcement learning and its origin dynamic programming. These are fields dealing with goal-directed decision making over time, such as finding your way in an unknown area, playing a game or pricing airline tickets.
We look at these areas from different angles:
- we deal with full-information "planning" problems, but also with partial-information "learning" problems
- we consider different algorithms, some of which are guaranteed to find the best solution, but also heuristics
- we consider high-dimensional problems (such as games) and methods to solve them
- we look at small toy problems to understand algorithms and sharpen our intuition, but also bigger problems for which we learn how to implement algorithms (in python)
- we look at different types of applications, both from AI (search problems, games) and OR

Aanvullende informatie onderwijsvormen

Lectures and practical work integrated

Toetsvorm

Programming exercises and final exam.
The 4 assignments each count for 10% and the exam for 60%.

The minimal passing grade for the exam is 5.0.

Literatuur

Slides and lecture notes

Aanvullende informatie doelgroep

mBA, mAI, mCS, mBa-D, mMath, mSFM

Aanbevolen voorkennis

Programming experience in python

Entrepreneurship in Analytics and AI

Vakcode	XM_0090
Studiepunten	6.00
Periode	P4
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. W. Stam
Examinator	prof. dr. W. Stam
Betrokken Docenten	prof. dr. G.M. Koole, prof. dr. W. Stam
Onderwijsvormen	Partial Exam, Seminar, Lecture

Doel vak

After having finished this course successfully, the student is able to:
- Master the obliged literature on entrepreneurship from the course.
- Critically make use of theoretical foundations for practice-based ideas.
- Think ‘out of the box’ concerning entrepreneurial ideas.
- Approach entrepreneurial challenges with extra confidence.
- Develop a business idea according the regular criteria.
- Thoroughly communicate the business plan in a short pitch.

Inhoud vak

In recent years, entrepreneurship education has shifted from the exclusive domains of business administration and economics to many other domains as well, including beta sciences.
This course is based on three pillars:
- The transfer of academic knowledge in the field of entrepreneurship, during lectures and study of academic papers and books.
- The development of personal entrepreneurial soft skills, which may contribute to entrepreneurial success, during interactive workshops.
- To come from a business idea to a solid business plan, with the help of the adjusted Business Model Canvas (BMC) approach and the study of an own real life case.

Scientific research is not an explicit part of this course, but will be dealt directly and indirectly within all three pillars.

Aanvullende informatie onderwijsvormen

Lectures, consultancy sessions.
Presence with all lectures and consultancy sessions is mandatory.

Toetsvorm

This course loads 6 ECs. The final grade for this course is based on the written exam (50%) and the BMC (50%). Both forms of examination should be sufficient, i.e. a grade of at least 5.5. The written exam is an individual assignment whereas the BMC is a team assignment. Next to

these two obligatory aspects of the course, a number of small assignments have to be delivered (pass/fail assessment). Additional to the regular lectures, consultancy sessions are organized, in which the groups meet with one of the lecturers, for the further development of their own real life cases.

Literatuur

To be determined.

Essentials of Media Psychology

Vakcode	S_EMP
Studiepunten	6.00
Periode	P1
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Sociale Wetenschappen
Vakcoördinator	prof. dr. E.A. Konijn
Examinator	prof. dr. E.A. Konijn
Betrokken Docenten	prof. dr. E.A. Konijn, dr. K.E. Balint, dr. D.F. Preciado Vanegas
Onderwijsvormen	Study Group, Lecture

Doel vak

Upon completion of this course, students are able to:
• Articulate the core themes in the field of Media Psychology.
• Describe and evaluate the main theories of Media Psychology.
• Discuss and compare key findings in fundamental areas of Media Psychology and the future of new media and communication technology.
• Apply a critical-reflective attitude about up-to-date and interdisciplinary scientific research in the field in an area of their choice.
• Apply a media psychological approach to their own media use, and interpret their media use in terms of media psychological theories.

Inhoud vak

Media Psychology is on the rise as a relatively new research field, although a number of research efforts bridging psychology and media effects research have existed for some time. Media Psychology today focuses on individual differences and psychological mechanisms underlying media effects and media use in general, thereby including the selection of particular content, differences in perceptions, and experiences that underlie differences in effects. This course includes both traditional mass media (TV, film), and also new media (VR, internet, video games), on the one hand discussing a continuous line of theorizing and on the other hand discussing differences between the two and new approaches. This unique course will focus on essentials of Media Psychology and discuss core lines of research and compare key findings in fundamental areas of Media Psychology: Selective media use, message processing and learning from media, media violence, media addiction, the role of emotions in media processing, media reality, media psycho(physio)logy, morality issues and media, interactive media and digital gaming, media and psychological well-being, and the future of new media and communication technology.
Within these lines of research, questions that will be addressed are, among others: Is there a need for a distinct field of media psychology? What is the debate on media violence? How do media affect individuals' brains, bodies, and behaviors, and who is most susceptible to these effects? How do we know the difference between fiction and reality as represented in media fare? How can new media and communication technology contribute to the well-being of individuals and society at llarge? What media psychological theories can be built on when designing and adapting new technologies, and how can we use them to harness our

fascination with media in positive ways?

Aanvullende informatie onderwijsvormen

Lectures and workgroups.

Toetsvorm

Individual digital examination (60%) and short, individual- and group-based graded assignments (40% in total).

Literatuur

A selection of chapters from recent books and a selection of specific journal articles will available via online databases.

Aanvullende informatie doelgroep

Master students in Communication Science, track Media Psychology. Master students Pedagogy (Pediatrics), Education, HCI, CMC, and others are welcome.

Overige informatie

This is an English-language course (including assessments and assignments). Foreign exchange students are especially welcomed to join this class. This course is obligatory for master students who are following the track Media Psychology at FSW-VU.

Evolutionary Computing

Vakcode	X_400111
Studiepunten	6.00
Periode	P1
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. A.E. Eiben
Examinator	prof. dr. A.E. Eiben
Betrokken Docenten	dr. ir. E. Ferrante, prof. dr. A.E. Eiben, dr. K. da Silva Miras de Araujo
Onderwijsvormen	Lecture

Doel vak

This course has a threefold objective:

1) (Knowledge & Understanding) To learn about computational methods based on Darwinian principles of evolution.
2) (Applying knowledge and understanding, Communication) To use such methods as problem solvers and as simulation tools; to determine adequate algorithm setups depending on the problem at hand.
3) (Applying knowledge and understanding, Lifelong learning skills) To gain hands-on experience in performing computational experiments with evolutionary algorithms.

Inhoud vak

This course is about constructing, applying and studying algorithmsbased on the Darwinian evolution theory. Driven by selection (survivalof the fittest, mating of the fittest) and randomised reproduction (mutation, recombination), an evolutionary process is being emulated and solutions for a given problem are being "bred". During this course various flavours within evolutionary computing are treated, including genetic algorithms, evolution strategies, evolutionary programming, genetic programming, differential evolution, particle swarm optimisation.

Applications in optimisation, constraint handling, machine learning, and robotics are discussed. Specific subjects handled include: genetic structures (representations), selection techniques, sexual and asexual reproduction operators, (self-)adaptivity and methodological aspects, such as algorithm design & tuning and performance assessment. Special attention is paid to the field of evolutionary robotics where the bodies (morphology, hardware) and the brains (controller, software) are evolved simultaneously. Hands-on-experience with evolutionary algorithms is gained through a compulsory programming assignment.

Aanvullende informatie onderwijsvormen

Oral lectures and compulsory Python programming assignment (in teams of 3 to 5). A limited number of highly motivated students can replace the programming assignment by a special research assignment under the personal supervision of the lecturer(s). These research projects aim at publications with the students as first authors of the paper.

Toetsvorm

Written exam and programming assignment. To pass the course as a whole, you must pass both the exam and the programming assignment. For the final grade they will count with the same weight: Grade= 0.5 x Exam + 0.5 x Pr.Assgmt. Notice that no resit is possible for the programming assignment, but you can complete this course a year later, keeping the exam grade (if > 5.5) and redo the programming assignment only.

Vereiste voorkennis

Python programming skills are necessary to do the practical assignment. If you cannot program, you cannot complete this course.

Literatuur

Eiben, A.E., Smith, J.E., Introduction to Evolutionary Computing, Springer, 2015, 2nd edition, ISBN 978-3-662-44873-1. In addition, a number of papers to provide extra information on specific topics will be made available via Canvas.

Aanvullende informatie doelgroep

MSc Artificial Intelligence
MSc Econometrics and Operations Research
MSc Finance
MSc Business Analytics
MSc Computer Science
MSc Parallel and Distributed Computer Systems

Overige informatie

Attending the lectures in real life is not mandatory, but highly recommended. Active participation in the team work for the programming assignment is a must!

Toelichting Canvas

Video recordings of the lectures made during the COVID period are still available on Canvas for self-study.

Experimental Design and Data Analysis

Vakcode	X_405078
Studiepunten	6.00
Periode	P4
Vakniveau	400
Onderwijstaal	Engels

Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. E.N. Belitser
Examinator	dr. E.N. Belitser
Betrokken Docenten	dr. E.N. Belitser, prof. dr. ir. F.H. van der Meulen
Onderwijsvormen	Lecture, Practical

Doel vak

In this course, students will get acquainted with the most common experimental designs and regression models, nonparametric tests and bootstrap methods will also be discussed.

Upon completion of this course, students will be able to:
- design experiments and analyze the results according to the design, (Knowledge and understanding) (Applying knowledge and understanding) (Making judgements)
- analyze data using the common ANOVA designs, (Applying knowledge and understanding) (Making judgements)
- analyze data using linear regression or a generalized linear regression model, (Applying knowledge and understanding) (Making judgements)
- perform basic nonparametric tests, (Applying knowledge and understanding)
- perform bootstrap and permutation tests. (Applying knowledge and understanding)

Inhoud vak

Regression models try to explain or predict a dependent variable using measured independent variables. Statistical methods are needed if there is random variation in the dependent variables. We will discuss multiple linear regression, analyses of variance (ANOVA), ANCOVA, lasso, generalized linear regression models. All methods will be illustrated with practical examples. It is necessary that the study is well designed in all these models in order to draw sound conclusions from an experiment or survey. In this course a few well known designs (completely randomized, randomized block etc.) and the associated analyses of variance are discussed. Among other topics are non-parametric testing methods and bootstrap methods such as Wilcoxon test, Kolmogorov-Smirnov test, rank correlation tests, permutation and bootstrap tests. All analyses are carried out by using the statistical package R.

Aanvullende informatie onderwijsvormen

Lectures, practical sessions.

Toetsvorm

Several regular assignments (carried out in teamwork) during the course and an exam at the end. The final grade is computed as follows: 65% the average of the regular assignments and 35% the grade of the exam (has to be at least 5.0). Mode of re-examination: if insufficient, there is a resit only for the exam.

Literatuur

Slides of the lectures, R manual.

Introductory books on statistics (containing the prerequisite knowledge for this course) are for example:
- Statistical reasoning for everyday life, by J.O. Bennett, W. Briggs, M.F.Triola;
- Elementary Statistics, by Mario Triola (12th edition, Pearson New International Edition);
- Probability and Statistics for Computer Scientists by Michael Baron (2nd edition, 2014 CRC Press).

For more background on the topics in this course, the following books (emphasis on the implementation in R) are recommended:
- Linear models with R, by J.J. Faraway;
- Extending the linear model with R, by J.J. Faraway.

Aanvullende informatie doelgroep

MSc Artificial Intelligence
MSc Computer Science

Overige informatie

Assignments are to be solved using the statistical package R (http://www.r-project.org).

Toelichting Canvas

All the information about the course will be available on Canvas.

Aanbevolen voorkennis

A course in statistics of at least the same level as Statistical Methods (XB_40013), knowledge of probability theory, the statistical software R and its application to data analysis. Having this background knowledge is highly recommended to be able to follow and complete this course successfully.

Fundamentals of Bioinformatics

Vakcode	X_405052
Studiepunten	6.00
Periode	P1
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	D. Muysken
Examinator	dr. ir. K.A. Feenstra
Betrokken Docenten	L. Hoekstra, dr. ir. K.A. Feenstra, prof. dr. J. Heringa, dr. D. Molenaar, dr. S. Abeln, dr. S. Pissis, D. Muysken, dr. M. Postma
Onderwijsvormen	Partial Exam, Lecture, Computer lab, Seminar

Doel vak

Are you interested in Bioinformatics? Do you want to find out how biology can make an exciting application domain? Or do you want to learn what more you could do with your data, and with less effort? Enter here to start!

Fundamentals of Bioinformatics (FoB) is the starting course of the Bioinformatics master. It aims to give you a broad overview of important topics relevant to the field, with a focus on current open problems. You will be made aware of these open problems during practical sessions that will cover active research in a major Bioinformatics problem (mutation impact prediction). Based on your background, you will be assigned to separate classes where you will be working to fill gaps in your background knowledge in programming and/or biology.

Course Objectives [Dublin descriptors]:
* To make you aware of gaps in your own background knowledge [learning skills]
* To address gaps in your background knowledge (programming, mathematics and molecular biology) and skills [knowledge and understanding]
* To make you aware of the major issues when developing and benchmarking new methodology in bioinformatics research [making judgements]

* To work together in a group of diverse backgrounds, to discuss and report the results [communication]
* To apply and understand fundamental methods in bioinformatics, e.g. sequence alignment, impact prediction, and to understand and use fundamental concepts in bioinformatics, e.g. homology, evolutionary conservation, and gene function [applying knowledge and understanding].

Inhoud vak

Topics:
• Evolution, genomics, sequence alignment, Blast/PSI-Blast, FAIR data, benchmarking, machine learning, genome assembly, mutation impact prediction, protein stucture analysis, substitution matrices, scientific writing

Project:
• Group project to benchmark different mutation impact prediction approaches. The groups will be composed to include different BSc backgrounds.

Background knowledge (1 out of 3, see below):
- Molecular cell biology
- Programming and computational thinking in Python
- Calculus and linear algebra

Aanvullende informatie onderwijsvormen

• 8 lectures (two-hour lecture in the morning, two days per week)
Exercises during/in between lectures

• 12 computer practicals for the group project - compulsory attendance (online or on campus)
(two hour sessions following the morning lectures, two days per week), supervised.

Feedback (theoretical and practical) will be given during the computer practical sessions.

Conversion classes for background knowledge:
- Molecular cell biology (7 x double lectures)
- Programming and computational thinking in Python (10 computer practicals)

Depending on their background, students will be assigned 1 of the 2 conversion classes. Students that are already well versed in both topics (molecular biology and programming) may be assigned to the following class, which is organised as part of the Introduction to Systems Biology:
- Calculus and linear algebra (10 maths classes)

Toetsvorm

• Programming or Biology classes (Maths classes will count towards Introduction to Systems Biology) [~30%]

• Project work [~30%] :
◦ Project reports

• Digital exam to assess [~40%]:
◦ Exercises and question (as provided in lectures)
◦ Concept learned during the project (individual)
◦ Lecture topics

Further assessment and grading details will be posted on Canvas (resits and compensation rules)

Vereiste voorkennis

Bachelor in any science discipline (including medicine), or strong programming background.

Literatuur

• course material (slides, scientific papers) on canvas.vu.nl
• book: Marketa Zvelebil and Jeremy O. Baum Understanding Bioinformatics Garland Science 2008 ISBN-10: 0-8153-4024-9

Aanvullende informatie doelgroep

M Artificial Intelligence
M Bioinformatics and Systems Biology
M Biomolecular Sciences
M Oncology
M Computational Science

Overige informatie

BYOD policy (Bring Your Own Device)
We expect students in this course to use their own laptop. This laptop should at the very least support an SSH client, for remote shell access to the VU Linux servers. We will help you to set this up.

Aanbevolen voorkennis

Programming in Python, Molecular Biology

Health Promotion and Disease Prevention

Vakcode	AM_470811
Studiepunten	6.00
Periode	P2
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	E.L. Ibouanga MSc
Examinator	dr. M.C. Adriaanse
Betrokken Docenten	B.M. van Dongen MSc, dr. M.C. Adriaanse
Onderwijsvormen	Study Group, Lecture

Doel vak

General aims
1. To provide a solid basis in understanding elementary aspects of evidence- and theory-based development and planning of health promotion and disease prevention programs.
2. To write a scientific study protocol about the planned development and evaluation of a preventive health intervention.

Learning objectives
After the course, students:
- Are able to describe and apply the elementary aspects of evidence- and theory-based development and planning of health promotion and disease prevention programs using an intervention mapping approach
- Are able to apply theoretical methods that can help to change important determinants of the environment and or health behaviors (lifestyle factors)
- Have knowledge about and is able to apply strategies that provides opportunities and challenges for the development and implementation of preventive health interventions, such as:
o Environment, habits and self-regulation
o Community action
o Interventions in public space
o Evaluating effects

- Are able to describe, understand and discuss the fundamental aspects of quality of life such as measurements, types and criteria
- Are able to describe the principals and perspectives of implementation and process-, effect and economic evaluation of health promotion programs
- Are able to integrate the acquired knowledge of the course in writing a study protocol

Inhoud vak

This course, fits in the program of the specialization Prevention and Public Health. Within this specialization you are trained to become a health promotor who is able to work in a theory- & evidence-based way and is able to link research, practice and policy. The courses within this specialization are structured according to the six steps of Intervention Mapping. These steps are: 1) Needs assessment, 2) Preparing matrices of change objectives, 3) Selecting theory-informed intervention methods and practical applications, 4) Producing program components and materials, 5) Planning program adoption, implementation, and sustainability and 6) Planning for evaluation. The course Health Promotion and Disease Prevention will introduce you to the six steps of Intervention Mapping. Specific emphasize will be put on step 2 and 3 with a focus on primary prevention.

This course focuses on lifestyle/ health behaviors and environmental differences related to health and diseases among individuals and populations. The ultimate goal is to improve peoples' health status and quality of life by health promotion interventions. Some examples of the topics that will be addressed are:
• Intervention mapping; designing theory- and evidence-based health promotion programs.
• Theory-based intervention methods and strategies; theoretical methods that can help to change several of the most important determinants of health behaviors.
• Environmental influences on health. The physical environment and health interact. The importance of environmental interventions and their effect on health are postulated.
• Health-related quality of life; the role of perceived mental and physical health status in the development of interventions.
• Effect and process evaluation; principals, perspectives on process evaluation, and determining the effects of health promotion programs.

Core element in this course is writing a study protocol in English, describing the design of a health promoting or disease preventing intervention trial.

Aanvullende informatie onderwijsvormen

This course is rewarded with 6 ECTs and runs in Nov-Dec 2019. Health Promotion and Disease Prevention is a part-time course, this means that 21 hours a week are necessary to pursuit the goals of this course.

Teaching activities include: Lectures, tutorials, guest lecturers, group assignment (study protocol), peer review sessions and self study.

Toetsvorm

Grades will be based on the assignment (study protocol) and a written exam that includes multiple choice and open-ended questions. The final grade is being determined by the study protocol (30%) and written exam (70%). The study protocol as well as the written exam must have a grade 5.5 or higher.

Vereiste voorkennis

At the start of this course, we expect you to master knowledge, insight, attitude and skills at a level which is comparable to the final qualifications stated by the Bachelor Health Sciences at the VU.

Literatuur

The following book is required for students who follow the specialization Prevention and Public Health. Bartholomew, Eldredge, Parcel, Kok, Gottlieb, Fernandez (eds) Planning health promotion programs: an intervention mapping approach; fourth edition(2016). Jossey-Bass, San Fransisco. ISBN:978-1-119-03549-7 Chapters which are applicable to this course will be announced through Canvas. In addition, students will use a course manual, and additional course materials are provided via Canvas.

Aanvullende informatie doelgroep

The course ‘Health promotion and disease prevention’ is an compulsory course within the Master Health Science specialization Prevention and public health, and an elective course for students of other specializations of the master Health Sciences. Students with a Bachelor degree or pre-masters in Health Sciences with interest in the field of prevention and public health.

Overige informatie

N.A.

Afwijkende intekenprocedure

Registration for this course via VU-net. Registration for the assignment in subgroups via Canvas.

Aanbevolen voorkennis

Students are expected to comprehend the knowledge of the VU bachelor health science courses ‘Preventie’ and ‘Gezondheidscommunicatie’, or the VU premaster health science course ‘Preventie en volksgezondheid’ or similar courses on other universities.

Health Psychology

Vakcode	AM_470730
Studiepunten	6.00
Periode	P1
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	E.L. Ibouanga MSc
Examinator	prof. dr. I.H.M. Steenhuis
Betrokken Docenten	prof. dr. I.H.M. Steenhuis, B.M. van Dongen MSc
Onderwijsvormen	Study Group, Lecture

Doel vak

Knowledge:
• You have insight into the fundamental elements of coping and can explain this topic in terms of theory and research.
• You have insight into the fundamental elements of self-management and can explain this topic in terms of theory and research.
• You have insight into the fundamental elements of adherence and can explain this topic in terms of theory and research.
• You have insight into the fundamental elements of relapse and can explain this topic in terms of theory and research.
• You have insight into the fundamental elements of hospitalization and stressful medical procedures and can explain this topic in terms of theory and research.
• You have insight into the fundamental elements of doctor-patient communication and can explain this topic in terms of theory and

research.
• You have insight into the fundamental elements of health literacy and can explain this topic in terms of theory and research.

Skills:
• You are able to develop a feasible Mhealth intervention plan (tertiary prevention) based on intervention mapping. You are able to pitch an idea for a theory-based health psychology intervention (tertiary prevention) in English.
• You can write a short paper in English on the theory regarding a predetermined theme and are able to reflect if and in what way the reality of a guest lecturer (patient) is in accordance with this theory.

Inhoud vak

This course fits in the program of the specialization Prevention and Public Health. Within this specialization you are trained to become a health promoter who is able to work in a theory- & evidence-based way and is able to link research, practice and policy.

Health Psychology refers to the psychological aspects of health, illness and the health care system. In the current course ‘Health Psychology’, six different subjects regarding tertiary prevention, which are relevant in the field of Health Psychology, will be discussed. Psychological aspects which are relevant in treatment of diseases and coping with (chronic) diseases will be studied, as well as the way we can influence these aspects. Questions to be studied will be for example ‘How can we improve compliance of patients with diabetes?’, and ‘How can we improve communication between health care workers and their patients?’. These and other questions will be studied in six cases. In all cases, first underlying determinants or psychological processes of the problems have to be studied. Second, interventions to tackle the presented problems or research into the different problems will be studied.

Aanvullende informatie onderwijsvormen

This course is rewarded with 6 ECTs. Health Psychology is a part-time course, this means that 21 hours a week are necessary to pursuit the goals of this course. Attendance is mandatory for two patient-guest speakers and the pitch-presentation for the practical assignment.

During the course ‘Health Psychology’ you will obtain knowledge and understanding of:
1. Hospitalization and stressful medical procedures;
2. Coping with diseases;
3. Self-management interventions in chronic illness;
4. Adherence to advice and treatment
5. Communication processes between health care workers and their
patients;
6. Health Literacy
7. Relapse in health related behavior among patients

The course is built around these topics and every week of the course one or two
topic will be discussed and studied during two seminars. In preparation for the lectures, literature has to be studied. In addition to the lectures, you will fulfill two assignments: The objective of the first assignment is to apply Intervention Mapping to create a plan for a Mhealth (mobile health application) intervention regarding tertiary prevention. The objective of the second assignment is to get insight into the link between theory and practice. You will link theory to personal experiences of patients who suffer from chronic disease.

Toetsvorm

In order to pass for the course you must:
1. Write a plan for the systematic development of an M-health

Intervention (mobile app aimed at tertiary prevention) In addition you have to pitch your elaborated intervention plan in order to bring in funding. You will carry out this assignment in couples;
2. Hand in your PowerPoint slides (or other materials that you used for the presentation);
3. Attend the guest lectures by patients;
4. Hand in an individually written report about one of the guest lecturers before the end of the course;
5. Pass the written exam.

The pass mark for the Mhealth intervention plan and the pitch is 5.5;
The pass mark for the paper about the guest lecture is sufficient;
The pass mark for the exam is 5.5.

The final mark for the course is being determined by:
• Assignment 1 consisting of the intervention plan and the corresponding
pitch (in total 40% (80% for the intervention plan and 20% for the pitch));
• the written exam (60%) (consisting of open questions).

Information regarding the resit of the exam or the assignments will be announced
later through Canvas

Vereiste voorkennis

At the start of this course, we expect you to master knowledge, insight, attitude and skills at a level which is comparable to the final qualifications stated by the Bachelor Health Sciences at the VU. Knowledge about theories and models with respect to psycho-social determinants of behavior is necessary.

Literatuur

The following book is required for students who follow the specialization Prevention and Public Health:
• Bartholomew Eldredge, Parcel, Kok, Gottlieb, Fernandez (eds). Planning health promotion programs: an intervention mapping approach; fourth edition (2016). Jossey-Bass, San Fransisco. ISBN: 978-1-119-03549-7 (E-book also available)

Other literature, such as book chapters and articles, will be announced on Canvas.

Aanvullende informatie doelgroep

Master students Health Sciences. All other students need approval of the course coordinator and the examination committee of their own program. This course will (partly) be taught in Dutch.

Afwijkende intekenprocedure

Registration for this course via VU-net.

History of Digital Cultures

Vakcode	XM_0134
Studiepunten	6.00
Periode	P3
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. D.J. Beckers
Examinator	dr. D.J. Beckers

Betrokken Docenten	dr. D.J. Beckers
Onderwijsvormen	Lecture, Seminar

Doel vak

Students acquire a firm historical knowledge of computing in its cultural context. They will recognize the various strands in theories of “the information society”, of “digital culture”, and of "algorithmic thinking", and are aware of the strengths and limitations of such theories. ((Knowledge and understanding) (Applying knowledge and understanding) (Making judgements)
Students gain experience in teamwork in a project. (Communication) (Lifelong learning skills)
Through the experience of thinking along the lines of a different discipline (i.c. history), students of computer science get the habit of making their own discipline the subject of reflection in a systematic way. (Making judgements) (Communication) (Lifelong learning skills)

Inhoud vak

History of Digital Cultures is a hands-on reconnaissance tour through the history of the information society, from computers and software to the internet, and the present ubiquity of digital cultures.
The computer may be considered an information machine, an automatic calculator or control technology. Three traditions build up the background for the advent of the stored program computer around 1950: data processing, proces
control and scientific computation. The advent of the modern computer is treated here in its cultural context. An historical view on software is a major topic in this course. With the shaping of the internet, computers have sunk into the
background. Computing and algorithms have not. Treating the world as "data" has become second nature. History will help us recognize these aspects of today's culture.
Through history, speculations on societal impact of computing have accompanied this technology.
History of Digital Cultures addresses computing in society, and on a more abstract level theories of “the information society”, of “digital culture”, and of "algorithmic thinking"

History is concrete and local. The projects, building up the course, will be concerted efforts to explore local or national developments, possibly concerning The Netherlands, like Dutch computer- and software pioneers, contributions to software engineering, and more recent specialities like the Dutch role in the internet, "De Digitale Stad" (DDS), web design, gaming, and digital art.

In 2022/2023 we will build upon the results of previous years, by continuing archaeology and oral history of early internet culture (hacker culture) in The Netherlands and elsewhere.

I: Early internet and hacker culture
Over the past runs of HDC we have studied the digital archives of DDS, the Amsterdam Digital City, HackTic and other expression of hacker culture. There is more to explore, especially through oral history.

II: Dutch histories
Specific Dutch traditions of research into software, programming languages, theoretical computer science, AI call for further historical study. Research in archives and oral history are among our favorite approaches.

The course is an intensive, engaging and fully committing four week project in teamwork. Teams of 4 to 6 students choose their topic; the choice is open but we encourage web-archaeology of DDS, building on results of the past years, or Dutch
traditions.

Aanvullende informatie onderwijsvormen

Seminar
Fieldwork / excursion
Presentation / symposium
Working independently on e.g. a project or thesis
Supervision / feedback meeting
Lectures

Toetsvorm

Project assignments, presentations, project report

Literatuur

Digital archives of DDS are available as study material under strict confidentiality; traditional and digital archival sources are studied; oral history may be part of the research. Other material to be announced on Canvas.

Aanvullende informatie doelgroep

MSc Computer Science

ICT4D in the Field

Vakcode	XM_0008
Studiepunten	6.00
Periode	P6
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. A. Bon
Examinator	dr. A. Bon
Betrokken Docenten	dr. J. Gordijn, dr. A. Bon, dr. V. de Boer
Onderwijsvormen	Practicum, Hoorcollege, Werkcollege

Doel vak

De cursus is gebaseerd op de principes van "actief leren". Aan het einde van de cursus zullen de studenten
- Vertrouwd zijn met de verschillende aspecten en implicaties van het concept van de Digitale Kloof, en hoe dit mensen in omgevingen met weinig middelen beïnvloedt (Kennis en begrip).
- Inzicht hebben in technologieën, methodologieën en sociale dimensies van het ontwerp en de inzet van informatie- en communicatietechnologieën, in het bijzonder AI, in de context van internationale ontwikkeling, en dit kunnen toepassen in een echte wereldomgeving (Kennis en begrip toepassen).
- In staat zijn de afweging te maken tussen technologische kansen, bedreigingen en sociale of ethische schade, met het oog op de behoeften van mensen in omgevingen met weinig middelen (Oordeelsvorming, Onderzoeksvaardigheden, Kritisch denken).
- In staat zijn om (i) te communiceren met stakeholders over gebruikerseisen en operationele doelen; (ii) een wetenschappelijk rapport te schrijven over een belangrijk aspect van het ICT4D thema van de cursus in een groep studenten (Communicatieve en Collaboratieve vaardigheden).
- Opgeleid zijn om (i) de probleem- en oplossingsruimte te verkennen in een open, onbekende, cultureel diverse, low-tech, low-resource omgeving en (ii) een set relevante Duurzame Ontwikkelingsdoelen te identificeren en aan te pakken ("Soft" Learning skills, Creative Problem-solving).

Inhoud vak

ICT4D (informatie- en communicatietechnologieën voor ontwikkeling) houdt zich in het algemeen bezig met problemen van en oplossingen voor de "niet-aangeslotenen in de wereld". Momenteel is dit bijna de helft van de wereldbevolking, waarvan de meerderheid in arme, afgelegen, vaak rurale, regio's van de wereld woont, vaak in zogenaamde ontwikkelingslanden met een laag of middeninkomen.

In de ICT4D in het veld cursus is het centrale thema:
- Kunstmatige Intelligentie (AI) in en voor het Mondiale Zuiden
Momenteel staat AI in het middelpunt van de belangstelling als een innovatieve ICT-technologie met een geclaimd breed scala aan gunstige toepassingsmogelijkheden, hoewel anderen twijfels en zorgen uiten over diverse ontwikkelingen als ongewenst of gevaarlijk [1]. Zware investeringen om AI en Data Science te stimuleren vinden plaats in het Mondiale Noorden, met name in de grote machtsblokken van de VS, Europa en China.

De cursus ICT4D in the Field onderzoekt deze zaken in en voor het Mondiale Zuiden, met de nodige aandacht voor de specifieke contexten van de behoeften van mensen en de verschillende geografische, economische, culturele en socio-politieke contexten.

Studenten werken in groepen die zich richten op verschillende geografieën (landen/regio's) in het Zuiden en trachten een aantal kernvragen te beantwoorden:
(a) Wat is de stand van zaken met betrekking tot toepassingen van AI voor het Maatschappelijk Welzijn relevant voor mensen in het Zuiden? Hierbij kan als referentiepunt gedacht worden aan de Sustainable Development Goals (SDG's) van de VN, zoals het bestrijden van honger, het garanderen van voedselzekerheid, het verminderen van ongelijkheid, etc.
(b) Wat zijn de te verwachten negatieve of nadelige gevolgen, risico's en sociale effecten van de toepassing van AI's, en hoe kunnen deze worden beperkt?
(c) Wat zijn bijgevolg de implicaties voor de toepassing van AI, specifiek in de context van de respectieve landen of regio's van het Zuiden, in termen van beleid, regelgeving, investeringen, onderwijs, burgerlijk/civiel debat?

In het begin van de cursus wordt een open workshop gehouden met als titel "Wat is AI?". Tijdens deze workshop geven gastsprekers uit de academische wereld en het bedrijfsleven een technologische inleiding op AI en belichten ze verschillende actuele toepassingen van AI in de echte wereld.

Studenten werken dan in groepen aan essay-opdrachten met betrekking tot de hierboven vermelde vragen. Dit werk zal typisch een "mixed-methods"-benadering inhouden voor het verzamelen van empirische gegevens en bewijsmateriaal, waarbij relevante literatuur en documentatie wordt gezocht en bestudeerd, gesprekken met belanghebbenden van potentiële "gebruikers" of "begunstigden" worden gevoerd, en deskundigen en/of beleidsmakers worden geïnterviewd. De geproduceerde essays worden kritisch beoordeeld (ook door de studenten zelf), kunnen iteratief worden verbeterd, en dienen als basis voor het definitieve projectverslag van de groep, dat aan het eind tijdens een plenaire conferentie moet worden gepresenteerd en besproken.

Het individuele werk van de studenten in de cursus omvat (i) samenvattende notulen van de inleidende AI-workshop; (ii) kritische beoordeling van andere groepsessays van studenten; (iii) een afsluitende reflectie op de eindprojectrapporten als geheel met betrekking tot verschillende geografieën in het Mondiale Zuiden, en waar mogelijk een vergelijking met dominante thema's uit het Mondiale Noorden.

[1] Zie bijvoorbeeld de Public Letter on Lethal Autonomous Weapons, geïnitieerd door AI-onderzoeker Toby Walsh en collega's, cf. https://futureoflife.org/open-letter-autonomous-weapons/. Zie als ander voorbeeld een recente Digital Humanism lezing gegeven door Stuart

Russell, auteur van een veelgebruikt universitair leerboek over AI, onder de titel "How not to destroy the world with AI", zie https://informatics.tuwien.ac.at/news/1902 (lezing beschikbaar op het DigHum YouTube kanaal). Daarentegen heeft een Amerikaans panel onder leiding van voormalig Google CEO Eric Schmidt onlangs in een conceptrapport van het Congres verklaard dat de VS een "morele verplichting" hebben om AI-wapens te ontwikkelen (The Guardian, 26 jan 2021,

https://www.theguardian.com/science/2021/jan/26/us-has-moral-imperative-

Aanvullende informatie onderwijsvormen

Lezingen en workshops; het schrijven, beoordelen en bespreken van geïnformeerde argumenten; sociotechnisch projectwerk in samenwerkingsverband, presentatie van de projectresultaten tijdens een eindconferentie.

Toetsvorm

Soort en gewicht van elk onderdeel: Groep essay opdrachten (in totaal 30%), Groep Eindproject
verslag en presentatie/discussie (25%), Individuele actieve deelname (25%), Individueel reflectieverslag (20%).
Om te slagen voor de cursus moeten de scores van elk onderdeel 5,5 (55%) of hoger zijn. Compensatie: het is niet mogelijk om een onderdeel met een ander onderdeel te compenseren.
Wijze van herkansing: indien onvoldoende, kan elk onderdeel eenmaal worden herzien en opnieuw worden ingediend.

Literatuur

Benodigde materialen zullen elektronisch beschikbaar worden gesteld (bijv. via Canvas);
Voor nuttige tips, zie ook de literatuur voor VUA cursus ICT4D (X_405101).
Het is een essentieel onderdeel van de cursus dat studenten zelf recente literatuur zoeken en beoordelen die relevant is voor het centrale thema.

Aanvullende informatie doelgroep

Master Artificial Intelligence
Master Computer Science
Master Information Sciences
Master Computer Security

(Van andere universiteiten: UDS, UNIMAS, AurorA Europees universitair netwerk):
Masterstudenten of -medewerkers met een relevante achtergrond en interesse in een digitaal domein (bijvoorbeeld een bachelordiploma in CS, IS, AI, informatiesystemen, HCI, digitale geesteswetenschappen, computationele sociale wetenschappen, of andere digitale multidisciplinaire domeinen, of werkervaring in de ICT/software-industrie of de dienstensector).
Zie ook: Afwijkende intekenprocedure.

Afwijkende intekenprocedure

Gezien de intensiteit van de cursus is er een beperkt aantal plaatsen beschikbaar. Deelname vereist daarom een voorafgaande selectieprocedure die bestaat uit een motivatiebrief met een toelichting op uw achtergrondkennis, en een gesprek. Kandidaat-studenten wordt verzocht zich vóór 12 maart 2023 voor deze cursus in te schrijven, door een e-mail met motivatie en achtergrondbrief te sturen aan Dr. Anna Bon, a.bon@vu.nl .

Aanbevolen voorkennis

Bachelor-niveau of gelijkwaardige studie en/of werkervaring in een digitaal domein (cf. sectie Doelgroep)

Opmerking: de cursus vereist geen voorafgaande kennis van AI (hoewel het van pas komt)

De opleiding ICT4D (X_405101), of gelijkwaardige aantoonbare kennis. Programmeervaardigheden (Java, Python, PHP, ...).

ICT4D: Information and Communication Technology for Development

Vakcode	X_405101
Studiepunten	6.00
Periode	P5
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. A. Bon
Examinator	dr. A. Bon
Betrokken Docenten	dr. A. Bon, dr. V. de Boer
Onderwijsvormen	Seminar, Lecture

Doel vak

At the end of the course, the students will:
- be familiar with the concept of the Digital Divide, and how this affects people in low-resource environments (Knowledge and understanding).
- have an understanding of the methodologies for digital development, and the technologies and social dimension for the design and deployment of Information and Communication Technologies in the International Development context and be able to apply in practice its methodologies (Applying knowledge and understanding).
- be able to understand and balance the trade-offs between socio-economic development and the effects technologies can have on the lives of people in low-resource environments (Making judgments).
- be able to ask relevant questions and write a scientific report about a full cycle ICT4D project in a group of students (Communication skills).
- be trained to (i) explore the problem- and solution space in an unfamiliar, culturally diverse low-tech, low-resource environment, and (ii) identify and address a set of relevant development goals (Learning skills).

Inhoud vak

This course gives an introduction to the relatively new field of ICT4D and will be given jointly by the Department of Computer Science (CS) and the Center for International Cooperation (CIS) with lecturers from both backgrounds, covering different areas of expertise (social, technological, organizational) in the field of ICT4D.

In the developed world computers are ubiquitous, and ICT has rapidly grown into a critical asset for economic, technological, scientific, and societal progress.

The main objectives of this course are:

- To make the next generation of Computer Scientists aware of:
a) The importance of ICTs for the developing world and the unexpected way developing countries are leapfrogging into the information age.
b) The opportunities and challenges that exist for an information scientist in the area of 'development4development'.

c) The influence of context in a typical ICT4D project.
d) The complexity of deploying an ICT project within a development context, and how to tackle this, and d) the benefits and pitfalls of "Open Data for Development".

- To equip the students with some initial project management, technological, and programming skills specific to an ICT deployment in a developing country.

- Positioned at the heart of the VU's vision of social relevance as one of the guiding principles, the core aim of the course is to raise the awareness that we as Computer Scientists can make a significant difference by sharing our expertise according to well-established principles of international development. Furthermore, this course will give Computer Science students an opportunity to apply previously acquired knowledge and skills in a specific application environment and be able to transfer these skills to new application domains.

In the course, we will give an overview of the methodology, technology, and social dimension of the usage of Information Technology in the context of Development. We will introduce a general framework for ICT4Development, we will teach you how to analyse a development problem, and introduce the analytical methods required for an in-depth understanding of a potential development support project. Lecturers from various backgrounds will provide some initial technological knowledge required for running an ICT project in a developing country. It will give an overview of the technology already applied, such as specific networks, connection types, hardware as well as specific software environments, but also introduce basic concepts in project management for ICT projects. We will specifically focus on voice-based applications.

Aanvullende informatie onderwijsvormen

The course will be a combination of lectures (including guest lectures) and project work.

Toetsvorm

Type and Weight of each component: Group project and report (60%); Individual essay (20%) Individual portfolio (20%).
Compensation: it is not possible to compensate one component with another.
Mode of re-examination: if insufficient, each component can be revised and resubmitted once.

Literatuur

Collection of papers (to be provided during the course).

Aanvullende informatie doelgroep

MSc Artificial Intelligence
MSc Computer Science
MSc Information Sciences

Aanbevolen voorkennis

No specific pre-knowledge is formally required for this course, however, a basic level is recommended of:
- Programming skills in a language (Java, Python, PhP,...)

Intelligent Interactive Systems

Vakcode	XMU_418023
Studiepunten	6.00
Periode	P1

Vakniveau	400

Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	
Examinator	
Betrokken Docenten	
Onderwijsvormen	

Inhoud vak

https://studiegids.uva.nl/xmlpages/page/2022-2023/zoek-vak/vak/98347

Afwijkende intekenprocedure

This course is offered by the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Knowledge Organization

Vakcode	X_405065
Studiepunten	6.00
Periode	P1
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. T. Kuhn MSc
Examinator	dr. T. Kuhn MSc
Betrokken Docenten	dr. T. Kuhn MSc
Onderwijsvormen	Seminar

Doel vak

At the end of this course, students will:
- have gained high-level knowledge of the potentials and problems with formal knowledge organization (knowledge and understanding);
- have gained high-level knowledge of the possible solutions and applications for formal knowledge organization (knowledge and understanding);
- be able to understand concrete knowledge organization methods and practically apply them (knowledge and understanding, apply knowledge and understanding);
- be able to communicate own thoughts and reflections on the topic of knowledge organization (communication)

Inhoud vak

This course covers the general principles and methods that form the foundation of information organization and knowledge-intensive processes, as well as the contexts in which they can be applied and the interaction with users. The lecture topics include knowledge modeling, ontologies, logic, controlled natural language, Semantic Web and Linked Data, as well as knowledge maintenance and evaluation, in addition to guest lectures on specific applications and domains.

Aanvullende informatie onderwijsvormen

Lectures, which are video-recorded. These recordings are made available through Canvas afterwards.

Toetsvorm

Short paper (40%), weekly takeaways (20%), assignments (20%), flash presentation (20%). There is no exam. All parts are individual (no group work). A resit for the flash presentation is not possible.

Literatuur

20 papers to read will be announced through Canvas.

Aanvullende informatie doelgroep

MSc Artificial Intelligence
MSc Computer Science
MSc Information Sciences

Knowledge Representation

Vakcode	XM_0059
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. K.S. Schlobach
Examinator	dr. K.S. Schlobach
Betrokken Docenten	T.T.L. Ho, dr. K.S. Schlobach, A. Sauter
Onderwijsvormen	Lecture, Practical

Doel vak

Knowledge and understanding: at the end of the course the students should be acquainted with the broad principles of knowledge representation, such as the separation of representation and reasoning, the declarative nature of representations, the universal (domain independent) nature of inference mechanisms.

Apply knowledge and understanding: students will have practical experience with different representation
formalisms, and will be able to implement a reasoning tool for at least one of these formalisms. This will allow them to better understand the role of knowledge representation in the broader context of AI.

Making judgement: students be able to set up empirical experiments in order to evaluate the pros and cons of Knowledge Representation formalisms in specific application areas.

Communication skills: students will be able to write a scientific report about an original research question in a small group of students.

Learning skills: students will be trained in acquiring knowledge about a set of complex formal systems, learn how to come up with a research question and scientific hypotheses, and perform the necessary (empirical) research to prove or disprove those hypotheses.

Inhoud vak

We discuss 3 typical forms of symbolic Knowledge Representation for AI: propositional logic (SAT solvers), Description Logic and (probably) Probabilistic Graphical Models. Together, these are a typical sample of different knowledge representation techniques.

Aanvullende informatie onderwijsvormen

Lecture series, plus 2 programming assignments

Toetsvorm

-two programming assignments (2 x 30%),
-peer reviewing assignment reports (P/F)
- written exam (40%).
The peer reviewing assignment report is marked pass/fail only, but must be completed to finish the course (even for resit students).
There will be a resit of the written exam, there is no resit opportunity for practical assignments.

Literatuur

Chapters from the Handbook of Knowledge Representation will be provided online

Aanvullende informatie doelgroep

Master Artificial Intelligence

Aanbevolen voorkennis

1. Basic knowledge of logic (propositional logic and first-order logic)
2. A good working knowledge of programming (preferably) in Python is required,

Knowledge Representation on the Web

Vakcode	XM_0060
Studiepunten	6.00
Periode	P4
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. I. Tiddi
Examinator	R. Pernisch
Betrokken Docenten	dr. I. Tiddi, R. Pernisch
Onderwijsvormen	Lecture, Practical

Doel vak

- Learn the requirements of representing knowledge at Web scale (Knowledge and understanding)
- Master the RDF, RDFS, OWL and SPARQL languages, and their automatic reasoning capabilities (Apply knowledge and understanding)
- Acquire dexterity in technologies that use these languages (NoSQL databases, RDF libraries, query languages, ontology editors) (Knowledge and understanding)
- Set up a project and apply these methods and technologies to build fundamental Linked Data infrastructure (Apply knowledge and understanding, Make judgments)
- Learn to design experiments on top of the built infrastructure to make a scientific contribution to these fields (Apply knowledge and understanding, Communication)
- Obtain familiarity with the research fields of Semantic Web, Knowledge Representation, Information Extraction, and write a research paper about the identified research problems (Apply knowledge and understanding, communication, lifelong learning skills)

Inhoud vak

In this course you will learn the theory of knowledge representation languages that are used to express information on the Web, their application to real-world problems and data, and the research methods behind them.

Aanvullende informatie onderwijsvormen

Content lectures (attendance mandatory)
Practical sessions (attendance mandatory)
Invited lectures (attendance mandatory)
Project development sessions
Research Reading
Research paper writing

Toetsvorm

Exam : 30 points
Assignments : 20 points (10 points x 2 assignments)
Final project/research paper : 30 points
Research summaries : 20 points (3 x 6 papers + 2 x 1 paper)

All assignments can be repeated.
At least a passing grade in all assignments is required.
Resit for G1 is possible.

Literatuur

Handbook of Knowledge Representation (F. van Harmelen, V. Lifschitz, B. Porter)
A Semantic Web Primer (F. van Harmelen, G. Antoniou)
Linked Data: Evolving the Web into a Global Data Space (T. Heath, C. Bizer; http://linkeddatabook.com/editions/1.0/)

Aanvullende informatie doelgroep

Master Artificial Intelligence

Toelichting Canvas

All announcements and materials are made available via Canvas

Aanbevolen voorkennis

Basic knowledge of programming; basic knowledge in logic; spoken and written English. Basic knowledge in knowledge representation (SAT, constraint programming, description logics, qualitative reasoning) a plus.

Language as Data

Vakcode	L_PAMATLW001
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Geesteswetenschappen
Vakcoördinator	dr. R. Morante Vallejo
Examinator	dr. R. Morante Vallejo
Betrokken Docenten	prof. dr. P.T.J.M. Vossen, dr. R. Morante Vallejo, dr. L.M. Beinborn
Onderwijsvormen	Seminar, Lecture

Doel vak

Students learn how to transform “messy” language input full of exceptions into something that a computer can process. After this course, students are able to collect and process a dataset for a research question related to natural language processing. They can analyze the dataset computationally and reason over the computational representations. Compared to scientific data mining, texts are unstructured, complex, and ambiguous artifacts that reflect subjective human perspectives and biases. Students learn to cautiously interpret quantitative text mining analyses and combine them with qualitative

insights.

Inhoud vak

Natural language is a means of communication that connects form to meaning. It is powerful and creative, it follows rules only to make exceptions, and it evolves over time and from domain to domain. It is highly ambiguous and information can only be interpreted in context. By applying text mining techniques, we try to collect information on language use and to derive meaning from language input. Digital communication is abundant and can be a valuable source of information. Text mining methods provide tools for resolving ambiguities and detecting variation. In Language as Data, we study how information is encoded in texts across different genres, topics, and languages.

Aanvullende informatie onderwijsvormen

The course consists of two sessions per week. In the lectures, the relevant linguistic theory and NLP methods are introduced and in the practical sessions students learn to write code to apply the theoretical concepts and represent language as data. Students are expected to show an interactive attitude.

Toetsvorm

The course is evaluated by practical assignments (60%) and an exam (40%). Both components need to be graded at least with a 5.5.

Vereiste voorkennis

Students must have acquired programming skills in Python on the level that is taught in the course "Programming in Python for Text Analysis" and should have background knowledge in natural language processing on the level that is taught in the course "Introduction Human Language Technology".

Aanvullende informatie doelgroep

The course is optimized for MA students in Linguistics (specialisation Text Mining). Students from other masters with sufficient Python programming skills and NLP background knowledge are also welcome.

Toelichting Canvas

Details about the course will be published on Canvas.

Learning Machines

Vakcode	XM_0061
Studiepunten	6.00
Periode	P3
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. K. da Silva Miras de Araujo
Examinator	dr. K. da Silva Miras de Araujo
Betrokken Docenten	dr. K. da Silva Miras de Araujo
Onderwijsvormen	Seminar, Lecture

Doel vak

At the end of the course, we expect students to:

- understand the difference between machine learning and learning machines, and the concept of embodied intelligence, as well as being

able to conduct experiments with simulated and real robots. (Knowledge and insight)

- to be able to apply the learned concepts to the development of different types of adaptive robots. (Applying knowledge and insight)

- practice awareness of the societal implications of developing adaptable robots. (Judgements)

- to be able to write formal scientific reports describing experimental results, analyzing the obtained findings and their limitations. (Communication)

- acquire investigative independence but also the ability to take in feedback and guidance. (Learning skills)

Inhoud vak

This course concerns developing robots that can adapt and improve their behavior. Most of the course encompasses practical assignments with only a few lectures. Two tasks should be delivered, and students have the freedom to choose different learning and optimization methods to work with:

- Task I: Robobos - will be done in simulation AND in hardware. The Robobos are wheeled robots with fixed bodies that possess infrared sensors and a camera. The controllers (brains) of the robots are expected to be optimized for a chosen task.

- Task II: Robogen modular robots - will be done only in simulation. The modular robots have optimizable brains AND bodies. Both controllers (brains) and bodies of the robots are expected to be optimized for a chosen task.

Ps: For the simulations, we have our own software frameworks, which will be provided to students.

Aanvullende informatie onderwijsvormen

The course is short and requires intensive work!

The course happens over a period of four weeks - each week contains one lecture, two practical sessions, and one presentation & evaluation session.

Toetsvorm

Students will work in teams of three, four, or five (depending on total the number of students).

1) Task I (50%: 25% presentations and live demos + 25% report)
2) Task II (50%: 25% presentations and live demos + 25% report)

Tasks scores range from 0 to 10, and both tasks must be above 5.5 to pass the course.

Vereiste voorkennis

Prerequisites: Python.

Aanvullende informatie doelgroep

Master Artificial Intelligence

Aanbevolen voorkennis

Artificial Neural Networks

Machine Learning and Reasoning for Health

Vakcode	XM_0102
Studiepunten	6.00
Periode	P2
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. A.C.M. ten Teije
Examinator	prof. dr. A.C.M. ten Teije
Betrokken Docenten	prof. dr. A.C.M. ten Teije, prof. dr. M. Hoogendoorn
Onderwijsvormen	Lecture, Practical

Doel vak

The main aim of this course is to make the student familiar with the combination of machine learning and reasoning techniques applied in healthcare. We will focus on machine learning with prior knowledge ("informed machine learning"), machine learning with symbolic output, and explainable learning systems. We apply each approach to some of the important tasks in healthcare, namely diagnosis, prediction, treatment and prevention using patient data (electronic health record data or trial data).

The course is focused on the following Dublin descriptors:
Knowledge and understanding: learning new relevant learning and reasoning techniques.
- Applying Knowledge and Understanding: the aim is to apply algorithms in
practice in a project.
- Making judgements: deciding which domain knowledge and learning and reasoning techniques are appropriate.
- Communication skills: how to report on your approach, choices and your results

Inhoud vak

Machine learning with prior knowledge: The input of informed machine learning consists of usual training data and additional prior knowledge. The prior knowledge is independently of the learning task and can be in the form of logic rules, simulation results, knowledge graphs, etc.
Topics:
Prediction with machine learning techniques (i.e., CART, LR, RF) enriched with domain knowledge (ontologies). For example predictive modeling of colorectal cancer using a dedicated pre-processing pipeline on routine electronic medical records.
Reinforcement learning with initial policies based on domain knowledge and/or constraints. Reinforcement learning can be used to select sequences of interventions. This should however be done safely, and one should not ignore existing knowledge on suitable intervention strategies. For example, limiting the actions space per situation based on rules and regulations and starting from the current treatments regimes, and refining them based on data.

Machine learning with symbolic output: machine learning techniques can be applied to symbolic structures (eg. Electronic Health Record) that results in symbolic output (e.g. discovery of possible causes of rare diseases, or simple guidelines).
Topics:
inductive logic programming (application eg. discovering possible causes of diseases)
probabilistic logic (application in diagnosis)

Explainable learning systems: Machine learning algorithms are usually black boxes, however physicians would like an explanation for the decisions of machine learning algorithms.
Topics:
SHAPE and LIME algorithms for providing an explanation. Those algorithms can be used for instance for explaining predictions of breast cancer survival.
using background knowledge for deductively reconstructing an explanation for the results of machine learning algorithms.

Project: exploiting a combination of reasoning and learning in health care along the lines of the above themes (machine learning with prior knowledge, machine learning with symbolic output, explainable learning systems). For instance using several machine learning techniques and knowledge sources to predict the occurrence of a particular disease based on medical records.

Aanvullende informatie onderwijsvormen

Lecture series, plus workgroup sessions for the assignment. In the first part of the period the emphasis is on the theory (lectures), the second part of the period is a practical assignment in the form of a project.
The course ends with an exam.
Furthermore we aim to have one or two guest lectures by medical experts (physicians).

Toetsvorm

Written exam (E) (50%) and practical assignment (A) (50%). For both parts the grade needs to be sufficient to obtain a final grade.
No resist is possible for the practical assignment.

Literatuur

Collection of research papers.

Aanvullende informatie doelgroep

Master students Artificial Intelligence (track AI for Health)
Master students Medical Informatics (UvA) (track AI for Health)

Afwijkende intekenprocedure

Registration for medical informatics (UvA) students: Please check the following document

https://www.dropbox.com/s/a2kd7xacuxt5y8e/AI%20for%20Health%202022-2023.
and
then register for secondary courses via

https://vu.nl/en/student/information-about-registration-and-enrolment/in

Machine Learning for Graphs

Vakcode	XM_0119
Studiepunten	6.00
Periode	P3
Vakniveau	600
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. M. Cochez
Examinator	dr. M. Cochez
Betrokken Docenten	dr. P. Bloem, dr. M. Cochez
Onderwijsvormen	Study Group, Lecture

Doel vak

Upon completion of this course, students will:
Be acquainted with several modern approaches to apply machine learning to problems explicitly or implicitly involving graphs. (Knowledge and understanding)
Have deep knowledge of a selected method, down to the details of the primary research. (Knowledge and understanding)
Are able to implement, extend and evaluate a selected method, for example GCN, RGCN or GAT. (Apply knowledge and understanding, make judgements)

Inhoud vak

Graphs are one of the most powerful ways of representing data. They can naturally describe social connections, ways of moving through a city, or interactions between molecules in a cell. Relational data, like that found in a relational database system can be described as a knowledge graph, and multimodal data such as images or natural language can be integrated with graphs in a very natural way.

This has led to a fast growing interest in machine learning models for graphs. In recent years, new deep learning techniques enable us to learn on, from and with graphs directly, opening up a lot of possibilities.

In this course, we will focus on the bleeding edge of research on the intersection between machine learning and graphs. At the start we will recap the basics of graph theory as it pertains to machine learning. Then we will discuss specific machine learning techniques for graphs and move our focus to reading and discussing recent research papers.

The precise topics and papers under discussion will be chosen at the start of the course, and driven to a large extent by the interests of the students. Possible domains include:

- Embedding methods (Node2Vec, RDF2Vec, Distmult, RESCAL, translational methods, etc)
- Message passing methods and Graph networks (GCNs, GATs, RGCNs)
- Rule-based methods (AIMIE, AnyBURL)
- Link prediction, node classification, query and question answering.

Aanvullende informatie onderwijsvormen

There are several sessions per week, consisting of either a lecture, a guest lecture or presentations from students. Students are assumed to not have other concurrent courses.

At the start we will have more lectures to recap needed concepts from graph theory and machine learning. Near the middle this will shift more towards very recent techniques, with lectures and research papers to be read. Near the end the format will change to be a research seminar for which you need to read some of the latest literature in the field and work on a related practical project.

The course is taught in English.

Toetsvorm

The course evaluation consists of two parts:

1) An extended presentation of a research article.
2) A research report, based on the implementation and extension of a published model.

The presentation and report are both graded, with the presentation counting for one-third of the final grade and the report for two thirds. Both parts must be passed with a minimum of 5.5 to pass the course.

There is no resit option for this course.

Literatuur

There is no textbook. Reading material will be provided digitally.

Most likely we will make use of parts of these books
* Graph Representation Learning Book - William L. Hamilton, McGill University https://www.cs.mcgill.ca/~wlh/grl_book/
* Knowledge Graphs - Aidan Hogan, et al. https://arxiv.org/abs/2003.02320
* Geometric Deep Learning: Grids, Groups, Graphs, Geodesics, and Gauges - Michael M. Bronstein, et al. https://arxiv.org/abs/2104.13478

There are many possible papers for the seminar part of the course, these will be selected jointly with the lecturers from various related conferences and journals: e.g, NIPS, AAAI, ICML, ICLR, IJCLR, ISWC, ESWC, ACL, and EMNLP.

Aanvullende informatie doelgroep

This course is targeted at MSc. AI students with a research ambition.

Afwijkende intekenprocedure

Because of this intensive, participatory and interactive seminar format, this course is limited to 20 students.

Only a registration for the main course itself is required to take part in all parts of the course.

Toelichting Canvas

All course material will be made available through canvas.

Aanbevolen voorkennis

We require a strong background in machine learning and all topics that implies, such as linear algebra, calculus and probability.

Practical experience with programming deep learning models is a hard requirement. Ideally students have taken the Deep Learning course (XM_0083), but this is not a hard requirement. In the course we will use python, and experience with pytorch is recommended.

At the start of the course we cover the basic aspects of graphs needed during the course. If you want to get more background, a useful resource for getting to know the area is the freely available book Graph Theory and Complex Networks by Maarten van Steen https://www.distributed-systems.net/index.php/books/gtcn/

Machine Learning for NLP

Vakcode	L_AAMPLIN024
Studiepunten	6.00
Periode	P2
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Geesteswetenschappen
Vakcoördinator	prof. dr. A.S. Fokkens
Examinator	prof. dr. A.S. Fokkens
Betrokken Docenten	prof. dr. A.S. Fokkens
Onderwijsvormen	Seminar

Doel vak

This course provides students with the means to conduct NLP research using machine learning. Students will learn: a) what the main machine learning technologies used in Natural Language Processing are b) how they work and how they can be used c) the methodologies for using these technologies in NLP research and d) how to represent linguistic data and what the impact is of choices in data representation. By the end of this course, students will be able to (1) name and describe the (working of) main machine learning technologies in NLP, (2) apply these technologies to specific NLP tasks (3) design a research environment where machine learning is used to solve an NLP problem, and (4) interpret and analyze evaluation results from machine learning experiments.

Inhoud vak

Machine learning is a dynamic and active research field. The main goal of machine learning is to develop systems which can automatically solve different problems without being specifically programmed, i.e. by learning from the data. In this course, we will focus on the use of machine learning as a methodology for solving NLP tasks (e.g. pos-tagging, syntactic parsing, information extraction). We cover both `traditional' machine learning methods as the latest deep learning approaches. Representation of language as data plays a prominent role in this course.
This course distinguishes itself from other ML courses taught at this university, in its focus on analysing tasks and data representation. We will cover the experimental setup, running
existing packages on new tasks and evaluation of overall results as well as error analysis. The course covers practical skills that can be useful in industry as well as in academia.
The course can be followed by any student with sufficient linguistic and programming knowledge. Note however that this course is explicitly not meant as an introduction to NLP or linguistics: knowledge of basic linguistic concepts is an explicit prerequisite.

Aanvullende informatie onderwijsvormen

2 lectures of 2 hours. One focuses on machine learning algorithms, the other on linguistic properties and practical aspects.

Toetsvorm

Students hand in a portfolio of exercises carried out during the course and take a final exam. Both components need to receive a passing grade in order to pass the course (at least 5.5).

Vereiste voorkennis

Programming (Python, corresponding to the end level of `Programming Python for Text Analysis') and Linguistics

Literatuur

TBA

Aanvullende informatie doelgroep

This course is specifically designed for students in the Text Mining 1-year master. It can also be followed by Computer Science students (among others Business Analytics and AI) if they have sufficient knowledge of linguistics or are willing to invest (independent) research time to obtain this (materials are provided).

Aanbevolen voorkennis

See required prerequisites.

Machine Learning for the Quantified Self

Vakcode	XM_40012
Studiepunten	6.00
Periode	P6
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. M. Hoogendoorn
Examinator	prof. dr. M. Hoogendoorn
Betrokken Docenten	prof. dr. M. Hoogendoorn
Onderwijsvormen	Lecture, Practical

Doel vak

The main aims of this course are to make the student familiar with specific machine learning techniques for quantified self and sensory data. Both the theory as well as the practical side of matters will be addressed. More specifically, the following aims are distinguished:
1. Understanding the domain of the quantified self and sensory data
2. Knowing and being able to apply techniques for outlier detection on sensory data.
3. Knowing and being able to apply techniques for feature engineering on sensory data.
4. Knowing and being able to apply clustering techniques related to sensory data.
5. Understanding the theory of supervised learning and its implications.
6. Learning how to apply non-temporal machine learning techniques to sensory data.
7. Knowing and being able to apply temporal machine learning techniques to sensory data.
8. Knowing and being able to apply reinforcement learning in the application of the quantified self.

The course if focused on the Dublin descriptors Knowledge and understanding (learning new relevant algorithm in this domain); Applying Knowledge and Understanding (since the aim is also to apply the algorithms in practice); Making judgements (which technique is appropriate, how to best apply the techniques for a specific case); Communication skills (how to report on your approach, choices and your results), and Learning skills (able to find new relevant techniques, assess their suitability, etc.).

Inhoud vak

The quantified-self refers to large-scale data collection of a user's behavior and context via a range of sensory devices, including smart phones, smart watches, ambient sensors, etc. These measurements contain a wealth of information that can be extracted by means of machine learning techniques, for instance for the purpose of predictive modeling. In addition, machine learning techniques can be a driver for adaptive systems to support users in a personalized way based on the aforementioned measurements. The type of data does however require specialized machine learning techniques to fully exploit the information contained in the data. Examples of challenges include the temporal nature of the data, the variety in the type of data, the different granularity of various sensors, noise, etcetera.

In this course specific techniques to handle quantified self (or broader sensory data) will be treated. More in specific, it will address:
• Feature engineering (how do we come from raw data to usable features):
* Removing noise from data
* Handling missing data
* Identifying (temporal) features
• Learning of user patterns:
* Temporal machine learning approaches such as recurrent neural networks, time series analysis
* Clustering approaches with dedicated distance metrics (including

dynamic time warping)
• Adaptive feedback and support
* Reinforcement learning
• Integration of the various components.

In addition, a number of real-life applications will be discussed. Next to lectures, there will be an extensive practical part, where students will learn to work with various algorithms and data sets. As a final assignment, the students will work on a project they propose themselves.

Aanvullende informatie onderwijsvormen

The course will be taught in four weeks. Both regular lectures (l, first two weeks) and practical sessions (p) will be organized. During the first two weeks the emphasis will be on the lectures and assignments related to their content. In the third week a larger practical assignment (in the form a project) will be done which. The course ends with an exam.

Toetsvorm

Written exam (E) (50%) and practical assignments (A) (50%). For both parts the grade needs to be sufficient to obtain a final grade. For the practical assignments the final assignment counts for 60% while assignment 1 and 2 each count for 20%.

The written exam will have a resit. On top, in case your assignment grade average is insufficient you are allowed to redo one of the assignments by improving it based on the feedback you received. The maximum grade for this resubmitted assignment is set to a 6.

Literatuur

Hoogendoorn, M. and Funk, B. Machine Learning for the Quantified Self -On the Art of Learning from Sensory Data, ISBN 978-3-319-66308-1, Springer Verlag 2018. The book can be downloaded free of charge through the UBVU, just follow the link to the book: http://dx.doi.org/10.1007/978-3-319-66308-1

Aanvullende informatie doelgroep

Master Artificial Intelligence, Master Business Analytics, Matser Computer Science

Overige informatie

Lecturer:
Dr.M. Hoogendoorn

Afwijkende intekenprocedure

Registration for medical informatics (UvA) students: Please check the following document

https://www.dropbox.com/s/a2kd7xacuxt5y8e/AI%20for%20Health%202022-2023.
and
then register for secondary courses via
https://vu.nl/en/student/information-about-registration-and-enrolment/in

Aanbevolen voorkennis

Programming experience. Knowledge of basic machine learning algorithms.

Master Project AI

Vakcode	X_400285
Studiepunten	30.00

Periode	Ac. Year (sept)

Vakniveau	600
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. F.A. Kunneman
Examinator	S.M.A. Zaghow
Betrokken Docenten	prof. dr. A.C.M. ten Teije
Onderwijsvormen	Lecture

Doel vak

The Master program in Artificial Intelligence is a scientific program that aims to provide the student with the knowledge, experience and insights in AI needed to autonomously carry out his/her professional duties. It is designed to prepare the student for further education as scientific researcher (Ph. D. studies) as well as to offer a solid basis for a career in business at an academic level. Moreover, the program aims at educating students to acquire a practical understanding of the position of the field of Artificial Intelligence within a broad scientific, philosophic and societal context. The Master Project AI marks the end of the Master program in Artificial Intelligence and aims to cover all its intended final learning outcomes.

The learning outcomes of the course (based on the Dublin descriptors) are as follows:
1) Knowledge and Understanding (reading up on relevant AI techniques for the project at hand);
2) Applying Knowledge and Understanding (applying the AI techniques within the project);
3) Making judgements (finding an appropriate technique, applying the technique for a specific case);
4) Communication skills (reporting on your approach, choices and your results and how to present your work)
5) Learning skills (e.g. finding new relevant techniques, assessing their suitability, etc.).

Inhoud vak

The Master Project AI marks the end of the Master programme in Artificial Intelligence. Information about possible projects (incl. internships) can be found on the Master Projects Canvas site. Internships proposed by
students need prior approval by a staff member, who will also be involved in the project supervision.

The graduation project lasts between 5 and 6 months, and (typically) involves implementation of an artificially intelligent system and conducting experiments to evaluate performance. Deliverables include a project plan written in the first month, a written thesis and a final presentation.

For more details, see Canvas.

Aanvullende informatie onderwijsvormen

Your master project is typically supervised by a staff member with a PhD title and (general) expertise in the topic of your research. Postdocs and (assistant/associate) Professors are hence qualified. Persons outside of the VU AI staff may also be asked as supervisor. A PhD candidate may still be your daily supervisor, in which case the main supervision should be in the hands of someone who does have a PhD title. The grading is performed by two examiners who hold a PhD degree, of which at least one should be a VU staff member (typically the supervisor). The second examiner needs to comply with the VU's formal requirements for second examiners as well, even in the case that (s)he

is not a staff member at the VU or a collaborating University.

Toetsvorm

The final grade will be based on the quality of the research, the written thesis, and the final presentation.
For detailed information on grading see the grading rubric on Master Project AI Canvas page.

Vereiste voorkennis

The student needs to have completed at least 84 EC (all but one of the courses) to start with the master thesis, which marks the final part of the master AI.

Aanvullende informatie doelgroep

Master Artificial Intelligence

Overige informatie

For all rules, assessment criteria, contact persons, and many practical tips for your master project, see the Master project page on Canvas.

Master Thesis: Research Project Cognitive Science

Vakcode	P_MTHRCSC
Studiepunten	30.00
Periode	Ac. Year (sept)
Vakniveau	600
Onderwijstaal	Engels
Faculteit	Faculteit der Gedrags- en Bewegingswetenschappen
Vakcoördinator	prof. dr. H.A. Slagter
Examinator	prof. dr. H.A. Slagter
Betrokken Docenten	
Onderwijsvormen	

Doel vak

To learn how to perform research in cognitive psychology / cognitive (neuro)science and report its results in a Master thesis. Projects involve basic research, applied research, research concerning modeling, or a combination of these.

Inhoud vak

Students participate in a research project concerning cognitive psychology / cognitive (neuro)science. The project will be supervised by a member of the section Cognitive Psychology (part of the Department of Experimental and Applied Psychology at the Faculty of Behavioral and Movement Sciences).
Before starting, a written research plan (half a page outlining the research question and the methods indicating how you intend to address that question) should be submitted to the coordinator of this course. Participation in a research
project can only start after approval of the research plan. The research performed by the student forms the basis for the thesis. The thesis should be written in journal article style at a level appropriate for submission to an academic journal. Students will be supervised by a person from the academic staff of the section Cognitive Psychology. There will be at least one meeting a week between the student and the supervisor.

Aanvullende informatie onderwijsvormen

Individual meetings with supervisor.

Toetsvorm

The final grade for the Master Thesis will be based on the quality of both the student's performance during the research and the quality of the written thesis. Grading will be done by the supervisor and a second assessor. It is required that students present their research in the form of a talk during one of the KIM meetings organized by the Department of Artificial Intelligence.

Medical AI

Vakcode	XMU_0038
Studiepunten	6.00
Periode	P1
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	S.M.A. Zaghow
Examinator	
Betrokken Docenten	
Onderwijsvormen	

Inhoud vak

https://studiegids.uva.nl/xmlpages/page/2022-2023/zoek-vak/vak/102817

Medical Informatics Basics

Vakcode	XMU_0037
Studiepunten	6.00
Periode	P5+6
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	S.M.A. Zaghow
Examinator	
Betrokken Docenten	
Onderwijsvormen	

Inhoud vak

https://studiegids.uva.nl/xmlpages/page/2022-2023/zoek-opleiding/opleiding/7297/251526

Memory and Memory Disorders

Vakcode	P_MMEMORY
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Gedrags- en Bewegingswetenschappen
Vakcoördinator	dr. R.J. Godijn
Examinator	dr. R.J. Godijn
Betrokken Docenten	
Onderwijsvormen	Lecture

Doel vak

The course aims to give students an overview of memory at the cognitive and neurophysiological level, and to give students the background to interpret memory disorders in patients with brain damage.

Inhoud vak

The course focuses on various approaches in the study of human memory and memory disorders. We will discuss different memory systems, retrieval, forgetting, eyewitness testimony, memory in childhood and aging and the brain substrate of memory. We will also discuss memory loss after local brain damage.

Aanvullende informatie onderwijsvormen

Short background lectures followed by paper discussions

Toetsvorm

Exam (50 %), presentation (20%) and research proposal (30 %).

Literatuur

papers on canvas

Overige informatie

This course is taught every two years. Will be taught in 2022-23, but not in 2023-24

Mini-Master Project AI

Vakcode	XM_400428
Studiepunten	6.00
Periode	Ac. Year (sept)
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. M. Hoogendoorn
Examinator	prof. dr. M. Hoogendoorn
Betrokken Docenten	
Onderwijsvormen	

Doel vak

Gaining deeper insight into a specific topic in AI. (mainly Knowledge and Understanding, and Applying Knowledge and Understanding)

Inhoud vak

This course consists of a small project on a specific topic in AI, selected in agreement with your supervisor. The project may have various forms, such as a literature study, the design of a piece of software, or exploring a research question. The results of the project are described in a brief report. To start, students can contact one of the staff members that can act as a supervisor directly or contact the coordinator of the projects: Mark Hoogendoorn (m.hoogendoorn@vu.nl).

Aanvullende informatie onderwijsvormen

Individual project and written report.

Toetsvorm

The end grade is based on both the project and the written report.

Aanvullende informatie doelgroep

Master Artifical Intelligence

Overige informatie

Depending on the interest of the student, a specific topic is selected and an individual supervisor is assigned.

Multi-Agent Systems

Vakcode	XM_0052
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. E.J.E. Pauwels
Examinator	dr. E.J.E. Pauwels
Betrokken Docenten	dr. E.J.E. Pauwels
Onderwijsvormen	Lecture, Seminar

Doel vak

After successfully completing this course, the student

- Has a solid understanding of concepts from elementary and intermediate game theory, such as Nash equilibria for simultaneous games, backward induction and subgame perfect equilibria for sequential games and the Shapley value in cooperative games.
- Understands various principled approaches to balance exploration and exploitation;
- Has a solid understanding of the tabular solution methods for (single agent) reinforcement learning;
- Is able to explore and digest current research on deep reinforcement learning and multi-agent reinforcement learning.

Dublin descriptors:
1 Knowledge and Understanding,
2. Applying Knowledge and Understanding:

Inhoud vak

In Multi-agent systems (MAS) one studies collections of interacting, strategic and intelligent agents.
These agents typically can sense both other agents and their environment, reason about what they perceive, and plan and carry out actions to achieve specific goals. In this course we introduce a number of fundamental scientific and engineering concepts that underpin the theoretical study of such multi-agent systems. In particular, we will cover the following topics:

- Beliefs, desires, and intentions (BDI)
- Introduction to non-cooperative game theory
- Introduction to coalitional game theory for teams of selfish agents
- Principles of Mechanism Design
- Exploration versus Exploitation
- Markov Decision Processes
- Reinforcement learning for a single agent
- Introduction to multi-agent reinforcement learning

Aanvullende informatie onderwijsvormen

Two lectures (1h45) and one recitation class (1h45) per week.

Toetsvorm

There will be weekly homework assignments that will be graded. In addition, there will be a final exam that will test the student's ability to apply the course material to new and concrete problems. The final grade will be a weighted average of the grades for the homeworks (50%) and the final exam (50%).

Literatuur

Recommended reading:

Yoav Shoham, Kevin Leyton-Brown: Multiagent Systems
Publisher: Cambridge University Press (15 Dec. 2008)
ISBN-10: 0521899435
ISBN-13: 978-0521899437

R.S. Sutton, A.G. Barto, F. Bach: Reinforcement Learning: An Introduction
Publisher: MIT Press; second edition edition (23 Nov. 2018)
Language: English
ISBN-10: 0262039249
ISBN-13: 978-0262039246

Aanvullende informatie doelgroep

Master Artificial Intelligence

Aanbevolen voorkennis

Basic calculus, probability theory and linear algebra. Fluency in a programming
language.

Natural Language Processing

Vakcode	XM_0121
Studiepunten	6.00
Periode	P5
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. L.E. Donatelli
Examinator	dr. L.E. Donatelli
Betrokken Docenten	dr. L.E. Donatelli
Onderwijsvormen	Seminar, Lecture

Doel vak

Natural language processing (NLP) is a highly dynamic research field that aims at analyzing natural language using computational models and methods. This course provides an introduction to the principles of the field and has two main objectives:

1) Students learn the fundamentals for developing a system for a common NLP task.
- They can analyze and interpret the linguistic information provided by common pre-processing pipelines and are familiar with the core NLP terminology. (Knowledge & Understanding)
- They can describe a common NLP classification setup and evaluate the results. (Making Judgements)
- They can explain the functionality of neural networks and their use in NLP. (Communication)

- They can explain the role of pre-trained language models in NLP and apply them to a task. (Applying knowledge and understanding)

2) Students learn to systematically analyze and interpret NLP models for a specific task.
- They can describe the linguistic challenges associated with the task. (Making judgments)
- They can describe how the task is approached by a state-of-the-art model. (Knowledge and understanding)
- They are able to understand, evaluate, and interpret the output of a model. (Applying knowledge and understanding)
- They can compare the output of different models and analyze their strengths and weaknesses. (Lifelong learning skills)

Inhoud vak

Natural Language Processing operates on the interface between linguistics and computer science. In order to get computers to deal well with natural language, it is important to understand both how language works and how computational methods work. Computational linguists work on this interface and have developed methods and technologies for language analysis.
This course covers technologies and computational models for core domains of natural language processing. Students are trained to find, process, and understand the latest developments in this rapidly advancing field. The course includes practical components that require students to work with Python code to explore NLP models. They learn to apply them to new data and reflect on the effect of modeling decisions on the performance.

Aanvullende informatie onderwijsvormen

The course consists of two sessions per week. We generally alternate between more theoretical lectures and interactive practical classes in smaller groups.

Toetsvorm

The course is evaluated by practical assignments (50%) and an exam (50%). Both components need to be graded at least with a 5.5. Retakes of practical assignments to improve the grade are not allowed. Practical assignments might be organized as a mix of group projects and individual contributions.

Literatuur

TBA

Aanvullende informatie doelgroep

Master Artificial Intelligence, also suitable for Master Business Analytics and other Master students in Computer Science

Aanbevolen voorkennis

Students must have acquired programming skills in Python. For students with no background knowledge of machine learning, additional reading might be required as the fundamental concepts will only be briefly introduced in the course.

Neural Models of Cognitive Processes for AI

Vakcode	P_NEUMOD_AI
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels

Faculteit	Faculteit der Gedrags- en Bewegingswetenschappen
Vakcoördinator	dr. T.H.J. Knapen
Examinator	dr. T.H.J. Knapen
Betrokken Docenten	dr. T.H.J. Knapen
Onderwijsvormen	Lecture, Computer lab

Doel vak

Computational modeling is an important tool for cognitive neuroscience, but the majority of modeling work requires quite some background knowledge on the core principles being applied.
The course is intended to offer insight(s) into what different types of models exist in in cognitive neuroscience, how they can be (and are) used to enrich the field, and it explores what questions arise when evaluating modeling work in this field.
We will work our way towards direct comparisons between current topics in computational cognitive neuroscience and open questions in AI.

Inhoud vak

Computational models are an important tool in cognitive neuroscience. A large branch of research focuses on an experimental approach, testing predictions by means of carefully designed experiments. Models, on the other hand, can integrate experimental results into complete and detailed theories that produce testable predictions. As such, they form a critical step in the empirical cycle by generating predictions for future experiments.
When used appropriately, a model allows for the integration of findings from a wide range of experiments. Rather than merely verbal theories, computational models are rich in detail and allow for a mechanistic view on how the brain produces its behavior.

An old adage from statistics is that ``all models are wrong, but some models are useful''. They are wrong because a model by definition is a simplification of reality, but they are useful when they generate testable predictions. However, it can be difficult to assess whether a model is too much of a simplification, and whether its predictions actually are useful. What makes a model good or bad? To what extent do models need to fit the data? And if multiple models fit the data, how do we choose which is the `better one'?
In addition, modeling papers can at times seem rather enigmatic, and for the untrained reader it is all too easy to get lost in the mathematical equations that make up computational models.

This course takes a learn-by-example approach to give an overview of different modeling approaches that are common in neuroscience. We will start at a high level of abstraction, with models that are used to mathematically describe experimental data, with relatively little regard for their implementation in the brain. By means of practical sessions, you will get hands-on experience with some of these models and see how they are implemented. By means of `debates', you will learn how to assess different models in terms of their strengths and weaknesses.

Aanvullende informatie onderwijsvormen

Lectures and discussion, computer tutorial and practicals.

Toetsvorm

Grades are based on a weighted average of performance on a final exam (65%), the practical sessions (25%), and class participation in the debate (Perusall) sessions (10%)

Vereiste voorkennis

As the practicals work with Python code, is required to familiarize oneself
with the language. The 'programming for psychologists' course should suffice, and https://www.codecademy.com/learn/python offers a wonderful free online tutorial

Literatuur

Literature (articles, tutorials) will be provided through Canvas.

Prevention of Mental Health Problems

Vakcode	AM_470840
Studiepunten	6.00
Periode	P3
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. A.M. Kleiboer
Examinator	dr. A.M. Kleiboer
Betrokken Docenten	dr. B.L. Slawinski, dr. A.M. Kleiboer
Onderwijsvormen	Study Group, Computer lab, Lecture

Doel vak

You can explain the most important theoretical and scientific concepts in the field of prevention of mental health problems.
You can demonstrate a basic understanding of methods to identify who is at risk for developing mental health problems.
You can discuss the relevance of different risk and protective factors for mental health problems.
You can describe relevant prevention programs for different mental health problems and the evidence for its effectiveness.
You can conduct a systematic and critical review of the scientific literature in the field of mental health prevention programs and report on it.
You can integrate gained knowledge on mental health prevention to make recommendations for further research and practice.

Inhoud vak

For Health Science students this course fits in the program of the specialization Prevention and Public Health. Within this specialization you are trained to become a health promotor who is able to work in a theory- & evidence-based way and is able to link research, practice and policy.
The courses within this specialisation are structured according to the six steps of Intervention Mapping. These steps are: 1) Needs assessment, 2) Preparing matrices of change objectives, 3) Selecting theory-informed intervention methods and practical applications, 4) Producing program components and materials, 5) Planning program adoption, implementation, and sustainability and 6) Planning for evaluation.

For Psychology students this fits in the program of the Clinical Psychology specialization. Within this specialization you are trained to become a psychologist specialising in either the research, policy or practice of mental health care. Most courses in this specialization can be freely chosen and are all specific subtopics in mental healthcare, usually aimed at specific disorders or types of treatment.

Theoretical backgrounds of the prevention of mental health problems will be discussed, as well as currently used methods in preventive mental health care. Guest lecturers who work in the field of preventive mental health care will discuss current programs aimed at preventing

several psychological symptoms and disorders. Also, the most important results of research conducted in the field of preventive mental health care will be presented. There will also be a focus on the implementation and evaluation of mental illness prevention programs.

In the practicals students will tackle a self-chosen problem within the field of preventive mental healthcare, writing a report on it and presenting their most important recommendations.

All lectures and work group meetings will be taught in English. All examination will be done in English as well.

Aanvullende informatie onderwijsvormen

This course is rewarded with 6 ECTs and runs in January 2017.

Prevention of Mental Health Problems is a full-time course, this means that 40 hours a week are necessary to pursuit the goals of this course. Regular attendance during the weeks is mandatory.

Teaching activities include: lectures, work group meetings, consultation hours, feedback on assignments, answers to questions via the Discussion forum on BB.

Toetsvorm

An individual written examination that accounts for 60% of the final grade of this course.

A written assignment and presentation of the written assignment that together account for 40% of the final grade of this course.

To pass this course you have to have at least a 5.5 for the individual exam, the presentation and the assignment.

Vereiste voorkennis

At the start of this course, we expect you to have mastered knowledge, insight, attitude and skills at a level which is comparable to the final qualifications stated by the Bachelor of either Health Sciences, Psychology or Artificial Intelligence at the VU.

Literatuur

A list of scientific papers to study will be listed on canvas.

Aanvullende informatie doelgroep

Health Science, Psychology and AI students.

Overige informatie

Registration for this course via VU-net.

Afwijkende intekenprocedure

Post-placement for this course is not possible.

Aanbevolen voorkennis

• Basic knowledge of psychopathology (symptoms of the most common psychiatric disorders).
• Basic knowledge on what prevention programs are and how they are Developed

Programming in Python for Text Analysis

Vakcode	L_AAMPLIN021
Studiepunten	6.00
Periode	P1
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Geesteswetenschappen
Vakcoördinator	prof. dr. A.S. Fokkens
Examinator	prof. dr. A.S. Fokkens
Betrokken Docenten	prof. dr. A.S. Fokkens, J.A. Daza Arevalo
Onderwijsvormen	Seminar

Doel vak

Goals of this course:
• Get to know the basics of the Python programming language
• Make a start with becoming an independent programmer, who is able to find solutions to new problems

Skills you will acquire during this course:
- Learn how to develop Python code using Jupyter notebooks as well as Python modules (.py files)
- Learn how to create readable code that can be understood by others
- Learn how to debug your code
- Learn how to write pseudo code
- Learn how to make your own code project
- Learn how to deal with unstructured textual data
- Learn how to perform linguistic processing with established NLP pipelines

Inhoud vak

During this course, you will learn how to analyze text data using the Python programming language. No programming knowledge is required; we believe that anyone can learn how to program.

You will learn how to extract information from text corpora; deal with different file types (plain text, CSV, JSON, xml). We will focus on readability and understandability of your code so that you will be able to share it with others, and reuse your code in the future.

Aanvullende informatie onderwijsvormen

The course is organized in blocks. Blocks typically follow this routine:
-Lecture 1: introduction of concepts in the form of an (interactive) lecture. Students are expected to have worked through preparatory exercises and ask questions in class.
-Lecture 2: The lecturer focuses on dedicating time to more difficult concepts from the block. If there is enough time, students can already start working on the assignment.
-Lecture 3: the lecture is mostly dedicated to working on the assignment. Students will have the opportunity to ask for help and clarification. The deadline for an assignment is typically soon after this lecture.
-Lecture 4: this lecture is a feedback session. The lecturer provides general feedback about the submitted assignments.

Toetsvorm

Individual bi-weekly assignments (60%): The assignments are designed to practice your programming and problem-solving skills. Moreover, they allow us to keep track of your progress, and identify topics that require more attention in class. To pass this course, you need a passing grade (at least 5.5) for the total grade for the assignments and at least a 5 for the last assignment. For students who submitted serious attempts for all graded assignments, but do not reach a passing grade, there will be an option to submit a retake assignment (which can make up

for one of the bi-weekly assignments).

Final exam (40%): The final exam is designed to test your knowledge of Python. To pass this course, you need a passing grade (at least 5.5).

Literatuur

To be announced on Canvas. All materials are freely available online.

Aanvullende informatie doelgroep

Master students

Overige informatie

We advise against using Netbooks or Tablets for this course since you will need to use the command line and execute Python code.

Project Reinforcement Learning

Vakcode	XM_0120
Studiepunten	6.00
Periode	P3
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	V.G.M. Francois Lavet
Examinator	V.G.M. Francois Lavet
Betrokken Docenten	V.G.M. Francois Lavet
Onderwijsvormen	Study Group, Lecture

Doel vak

Knowledge and understanding: students will be familiar with basic knowledge of (deep) reinforcement learning and they will be able to apply them to sequential decision-making tasks under uncertainty, including in the context of relatively high-dimensional inputs (e.g. time series).

Applying knowledge and understanding: students will be able to understand how to implement deep RL algorithms, how to compare them and how to apply them in real life problems.

Making judgements: students will have an understanding of the key learning techniques for sequential decision-making tasks used in RL, as well as an overview of a few key AI applications for such techniques along with a short discussion on societal impacts.

Communication skills: students will be able to write a scientific report about their project (in a group of 2-3 students).

Learning skills: students will be trained in acquiring a set of complex AI and programming skills in a restricted period of time. They will also be trained in applying those techniques on a given problem and report adequately the results.

Inhoud vak

Reinforcement Learning is a set of techniques that can be used to solve sequential decision-making tasks. When combined with deep learning as a function approximator, these algorithms are referred to as deep RL and they have been able to solve a variety of tasks that were previously out of reach for a machine (e.g. the game of Go). Thus, deep RL opens up many new applications in domains such as healthcare, robotics, smart grids, finance, and many more.

This course will provide an introduction to how real-world problems can be formalized as sequential decision-making problems (MDP, POMDPs, meta RL) as well as how (deep) reinforcement learning techniques such as deep Q-networks and actor-critic methods can be useful. The course will provide the theoretical foundations as well as an introduction to the practical skills necessary to apply (deep) RL techniques. Students will also develop their coding skills by developing (deep) RL agents.

Aanvullende informatie onderwijsvormen

The course will be centered on the practical task of designing intelligent agents that can solve a sequential decision-making problem close to real-life (e.g. optimizing the use of a damp by storing/releasing energy on the electricity grid, given some past time series of the daily electricity price).

- For the first week, there will be the equivalent of 4 hours of online pre-recorded lectures, one/two practical sessions (1h30 each), one or two Q&A sessions in a flipped classroom style (1h30 each). All students should know the basic elements of RL and deep learning by the end of the first week.

- During the second week, there will be 4 lectures (each 1h30) covering specific topics of (deep) reinforcement learning as well as one/two practical session(s) and a test for the theory part.

- The last two weeks will focus on implementing RL algorithms to solve the project and write a scientific report describing the results obtained. This part also encompasses a significant amount of self-study to familiarise oneself with the (deep) RL algorithms and their implementations.

Toetsvorm

There will be one test and a project assignment (the test counts for 20% of the grade if it is higher than the project, and does not count otherwise). The project will be graded based on the quality of the RL agent obtained on unseen time series, the quality of the ablation study and the quality of the report.

Literatuur

- Sutton, Richard S., and Andrew G. Barto. Introduction to reinforcement learning. Vol. 135. Cambridge: MIT press, 1998. Recommended, but not compulsory. There will be a reader.

- François-Lavet, Vincent, et al. "An Introduction to Deep Reinforcement Learning." Foundations and Trends® in Machine Learning 11.3-4 (2018): 219-354.

Aanbevolen voorkennis

The minimal required background is basic machine learning concepts (supervised learning, the concept of loss function, etc.). Some practical knowledge of deep learning and notions about Markov Decision Processes (MDPs) is an additional asset but not a hard requirement, as all concepts will be recalled during the first week.

Seminar Cognitive Neurosciences

Vakcode	P_MSEMCNS_AI
Studiepunten	6.00
Periode	P1
Vakniveau	500
Onderwijstaal	Engels

Faculteit	Faculteit der Gedrags- en Bewegingswetenschappen
Vakcoördinator	prof. dr. H.A. Slagter
Examinator	prof. dr. H.A. Slagter
Betrokken Docenten	dr. A.V. Belopolskiy, prof. dr. H.A. Slagter
Onderwijsvormen	Lecture

Doel vak

After this course, the student
• can describe central contemporary debates in cognitive neuroscience
• can explain, critically evaluate, and present the main ideas in these debates, their strengths and weaknesses, methodological implications and empirical support
• can apply these ideas to research findings and clinical conditions and to design new
experiments
• can formulate ideas about, and discuss how the field of cognitive neuroscience should progress

Inhoud vak

This is an advanced course that presents recent developments in the field of cognitive neuroscience, with a focus on overarching ideas. Why do we have a brain to begin with? What is the relationship between cognition and action? Can psychiatric disorders be reduced to brain dysfunction? And can artificial systems ever truly think and learn like humans? The course provides an overview of important cognitive and neuroscientific debates with a focus on influential theories, their strengths and weaknesses, their methodological implications and their empirical support. We will also explore what are important future directions for the field of cognitive neuroscience.

Aanvullende informatie onderwijsvormen

Lectures, literature study, group assignments, and discussions.

Toetsvorm

Group assignments (30%) and a final exam (70%).

Vereiste voorkennis

The requirement to participate is the completion of the basic Cognitive Neuroscience and Neuropsychology course.
Alternatively, students may study the required literature by self-study.

Literatuur

Scientific articles. The list of articles will be announced on canvas (annually
updated).

Skills for AI

Vakcode	XM_0077
Studiepunten	6.00
Periode	P1
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. S.M. van Otterloo
Examinator	dr. S.M. van Otterloo
Betrokken Docenten	dr. S.M. van Otterloo

Onderwijsvormen	Study Group, Partial Exam, Lecture

Doel vak

Skills for AI is a brush up course for students with limited background in mathematical skills necessary for understanding Artificial Intelligence: linear algebra, logic and probability.

The goals are:

Familiarise students with logical and mathematical language (Knowledge and understanding)

Let students use logic and linear algebra to express AI applications (Knowledge and understanding)

Let students solve mathematical exercises, both manually and with the help of the computer in Python (Applying knowledge and understanding)

Inhoud vak

This brush up course contains the following topics: logic, linear algebra, probability theory, and gradients and derivatives.

Logic-part:
The logic part focuses on propositional logic and first order predicate logic:

For propositional logic, the following is covered: truth tables, boolean operators, semantic equivalence, rewriting rules, functional completeness.

For first order logic, students will learn predicates, quantifiers, logic models, reasoning rules and converting natural language to first order logic.

Linear algebra:
The main topics are: systems of linear equations, linear (in)dependence, linear transformations and matrices, matrix operations, determinants and eigen vectors. The theory will be used to model computer science and AI problems such as computer graphics, language recognition, path finding and neural networks.

For probability theory: events, probability, conditional probability and Bayes' Theorem will be covered.

Gradients and derivative: Definition and interpretation of the derivative as a gradient, computing derivatives for basic polynomial functions.

Aanvullende informatie onderwijsvormen

Lectures, and practical sessions

Toetsvorm

The course will be examined in the following way:
- Quizzes after each lecture on canvas. These determines 20% of the grade
- Assignments (making report using a given dataset and open questions. mostly python based): These determines 30% of the grade
- A final written exam at the end of the course. This determines 50% of the grade

A resit option for the final written exam will be offered. If a student misses of fails one project assignment, one assignment can be

resubmitted in the week after the final written exam.

Vereiste voorkennis

Students must be familiar with the python programming language.

Literatuur

Part 1 Logic: All course materials will be provided via Canvas.

Part 2 Linear algebra: All course materials will be provided via Canvas.
Optionally, students can use the book: (Linear Algebra and its Applications, by David C. Lay, Steven R. Lay en Judi J. McDonald, global edition (fifth edition), Pearson.)

Students may wish to consult: (How to Think Like a Computer Scientist, Learning with Python, 2nd Edition, by Jeffrey Elkner, Allen B. Downey, and Chris Meyers) see the URL: http://openbookproject.net/thinkcs/python/english3e/index.html

Aanvullende informatie doelgroep

Only first year master Artificial Intelligence students without an Artificial Intelligence/Computer Science bachelor degree can attend this course.

Aanbevolen voorkennis

Some programming experience with python and jupyter notebooks is recommended.

Social Robotics

Vakcode	S_SR
Studiepunten	6.00
Periode	P4
Vakniveau	600
Onderwijstaal	Engels
Faculteit	Faculteit der Sociale Wetenschappen
Vakcoördinator	dr. D.F. Preciado Vanegas
Examinator	dr. J.F. Hoorn
Betrokken Docenten	dr. J.F. Hoorn, dr. D.F. Preciado Vanegas
Onderwijsvormen	Study Group, Lecture

Doel vak

After completion of this course, the student is able to:
• Understand and discuss current thematic and research issues in social robotics;
• Critically discuss the role of theory building (i.e. formal modeling) within social robotics, and reflect on ethical and normative issues in robot research and design;
• Apply a critical-reflective attitude about up-to-date and interdisciplinary scientific research in the field of social robotics;
• Develop a design proposal and related research to tackle a communication problem in social robotics.

Inhoud vak

The future is now and we are designing it. Certain layers of society already work with social robots on a day-to-day basis. Until recently, robots seemed to be the realm of engineering but with the rise of Big Data analysis and embedded software in the Internet of Things,

Communication Science has a new role to play in understanding how digital communications (i.e. patterns, trends, read-outs) should be translated back into human-digestible forms. Social robots seem to be the ultimate interface between the digital and analogue world but in what way are robots different from humans? Do the same rules of conduct and communication apply as to human-human interactions? Will Computer-Mediated Communication branch off into robot-mediated communication? Will Media Psychology have found a new field to explore human bonding with machines?
This course consists of 12 lectures that describe the study and creation of social robots. Learning the ingredients is one thing, combining them in practice is another. Therefore, lectures are flanked by practical exercises during the work groups, where you will learn how to formally model a theory but also how to draw on your own creativity to design a robot or a robot application. If possible (but this is dependent on the availability of participants), we will let your design be tested by real users. While working, we will have plenty of discussions about the societal impact of robots on work, privacy, security, ethical behavior, our self-image as humans, and the like.
Theoretical explorations will not be limited to communication science but will stretch to science philosophy (i.e. epistemics) and the theory of creativity and innovation as well. In practice, we will work with Nao/Zora robots, Pepper, DARwIn-OP, Autonomous TurtleBot 2, and many toy robots (Hasbro's monkey, Roboraptor). Mindstorms, Makey-Makey, LittleBits, and Fischertechnik are available for design challenges.

Aanvullende informatie onderwijsvormen

Lectures and work groups. Lectures are partly done by robot tutors. Work groups are directed at robot-communication design in relation to electro-mechanical and industrial design engineering (equipment is available). Students will be trained to access their individual creativity and ingenuity.

Toetsvorm

1) Individual paper-pencil examination ('tentamen') (50% final grade)
2) Short graded assignments (group-based) (40% final grade)
3) Individual participation in the work groups (10% final grade)
Examination, assignment, and participation should minimally be 'passable' ('voldoende').

Literatuur

Hyperlinks to scientific articles from different disciplines (humanities, communication, and computer science) are available on Canvas. Purchase of two (e-)books is recommended but not obligatory. The third book is open access and free of charge. Individual literature searches are expected with respect to assignments.

Aanvullende informatie doelgroep

Elective for Master students Communication Science
Master students Linguistics (i.e. CIW), Computer Science (i.e. AI and CHI), Health Science, Industrial Design Engineering (i.e. interaction design), and foreign exchange students are welcome.

Overige informatie

This course will be taught in English. Part of the teaching will be done by robot tutors. We welcome international exchange students and students outside the Social Sciences. Programming skills are appreciated but not required. Certain work groups are held off campus at the relevant industries. Presence is mandatory for all plenary sessions and work groups.

Aanbevolen voorkennis

BA level cognitive theory (whether acquired in linguistics, communication, artificial intelligence, industrial design engineering, education, or health intervention). BA level knowledge of empirical testing and/or formal modeling. Recommended but not obligatory: structured questionnaire design, statistics, coding (any language), electronics, mechanics.

Socially Intelligent Robotics

Vakcode	XM_0074
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. K.V. Hindriks
Examinator	prof. dr. K.V. Hindriks
Betrokken Docenten	prof. dr. K.V. Hindriks, dr. ir. K. Baraka
Onderwijsvormen	Study Group, Lecture

Doel vak

The overall objective of this course is that students will be able to apply basic design skills to create interaction designs for a social robot and develop key skills of the social robot using AI techniques.

Students will gain an understanding about social robotics and related AI techniques to control such a robot (e.g., conversational AI, computer vision aimed at interacting with people, expressing gestures, etc.) and apply this knowledge for designing a social robotics use case with the Nao robot (Applying Knowledge and Understanding)
Students will be asked to evaluate their use case prototype on a social robot by piloting their user study design with peers that take part in the course
(Making Judgments)
Students will need to present their use case ideas and design in the course (during lectures) and (outside lectures) work in groups to design a use case and will need to define and communicate about their individual roles within their group (Communication).
Students will be challenged to take the initiative and direct their own learning by designing a specific use case for a social robot, where their design is grounded in existing (multi-disciplinary) literature (Learning Skills).

Inhoud vak

In this course we will take a user-centered approach to the design of social robots and look into AI techniques for developing a social robot that can interact with human users. We will look at the basic cognitive skills we expect a social robot to have, including visual perception (e.g. face recognition), speech recognition and dialogue, emotional expression through body language, and the architecture for integrating these various skills to execute them on the robot.

Aanvullende informatie onderwijsvormen

Lectures, and practical work (to be done by students in groups).

Toetsvorm

Practical assignment.

It will not be possible to redo the practical assignment (no resit).

Vereiste voorkennis

Students should have the programming skills (Python) and ability to learn to use a programming framework for social robots that will be made available in the course.

Literatuur

A brief course manual will be made available. The main literature used will consist of existing literature (papers and other materials) on social robotics and related AI techniques.

Aanvullende informatie doelgroep

Master Artificial Intelligence

Overige informatie

Important: Students who cannot attend the practical sessions on campus cannot join this course (because these practical sessions are crucial for
the learning goals).

Afwijkende intekenprocedure

The capacity for this course is 100 students.

Socially Intelligent Robotics Project

Vakcode	XM_0076
Studiepunten	6.00
Periode	P3
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	prof. dr. K.V. Hindriks
Examinator	prof. dr. K.V. Hindriks
Betrokken Docenten	prof. dr. K.V. Hindriks, dr. ir. K. Baraka
Onderwijsvormen	Study Group, Lecture

Doel vak

Students will be able to apply AI techniques to enable social capabilities on a
social robot. (Applying Knowledge and Understanding)
Students will collaborate in groups and discuss their project with peers and instructors (Communication)
Students will learn how to identify and collect data to evaluate success metrics for the capability(ies) they developed for a social robot (Making Judgements)

Inhoud vak

Robots in human environments are expected to interact socially with the people in those environments. In contrast the Socially Intelligent Course which focused on use case design for social robots, this project will focus on adding new social skills to the repertoire of a social robot. Students will program capabilities for the social robot Pepper and evaluate its performance in an interactive setting involving one or more human(s). Examples of such capabilities would be social cue detection algorithms, e.g. emotion, gaze, or similar, or behavioral capabilities for generating expressions, e.g., learnt from human users. The specific group project topic will be specified at the start of the project.

Aanvullende informatie onderwijsvormen

Discussion sessions and practical work

Toetsvorm

Report about project outcomes. There is no resit. The practical (programming) work is mandatory.

Vereiste voorkennis

The project requires (Python) programming and basic debugging skills.

Aanvullende informatie doelgroep

Master Artificial Intelligence. There is a maximum of 50 students that can participate in this project course.

Overige informatie

Important: Students who cannot attend the practical sessions on campus cannot join this course (because these practical sessions are crucial for the learning goals).

Aanbevolen voorkennis

The project requires Python programming skills, and basic debugging skills.
It is recommended to have attended the course Socially Intelligent Robotics.

Structural Bioinformatics

Vakcode	X_405019
Studiepunten	6.00
Periode	P4
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	L. Hoekstra
Examinator	dr. ir. K.A. Feenstra
Betrokken Docenten	dr. ir. K.A. Feenstra, dr. S. Abeln, L. Hoekstra, D. Muysken, J.H.M. van Gils MSc, dr. H. Mouhib
Onderwijsvormen	Lecture, Computer lab

Doel vak

Why Structural Bioinformatics?
The function of a protein is determined by its three-dimensional structure, and therefore structural information is crucial for understanding the working of proteins. However, experiments, prediction and simulation of protein structures remain difficult. This course will provide you with an overview of existing computational techniques, to validate, simulate, predict and analyse protein structures. More importantly, it will provide practical knowledge about how and when to use such techniques.

Course objectives:
• To understand the basics of protein structure, evolution and function [Knowledge and understanding]
• To understand the basics of statistical thermodynamics and the relation to protein structures, and structure and function prediction [Knowledge and understanding]
• To be able to evaluate protein structures with knowledge of their experimental source and validation techniques [Applying knowledge and understanding]
• To be able to compare different protein structures, and evaluate

similarity [Applying knowledge and understanding]
• To learn how and when to use structure prediction methods [Making judgements; Applying knowledge and understanding]
• To be able to create scripts that connect different Structural Bioinformatics methods [Applying knowledge and understanding]
• To be able to compare different simulation techniques for biological macro-molecules, and be able to analyse the simulated data computationally [Applying knowledge and understanding]
• To be able to read and understand scientific papers in the field of Structural Bioinformatics [Communication; Learning skills]

Inhoud vak

Theory:
• Protein and DNA structure sources
• Experimental methods
• Structure validation
• Protein fold prediction (from homology modelling to ab initio prediction)
• Structural classification and structural alignment
• Protein folding and energetics
• Molecular Dynamics & Monte Carlo simulation
• Function from structure

Practical:
• Obtaining geometric features from PDB files
• Homology modelling with Modeller
• Protein interaction as a 'computational experiment' (simulation)

Aanvullende informatie onderwijsvormen

• 13 lectures (2 two-hour lectures per week)
• exercises during/in between lectures
• 12 computer practicals (2 two-hour sessions per week)
Feedback (theoretical and practical) will be given during the computer practical sessions.

Toetsvorm

The final grade for this course will consist of 50% practical work and 50% theoretical assessment.

Practical Assignments: (50%)

Theoretical: (50%)
• Oral, written or digital exam (depending on number of course students) to assess lecture topics.
• As part of the exam research papers on Structural Bioinformatics topics need to be analysed in detail.
• You will be prepared for your exam through exercises and paper discussions during the lectures, as well as through the practical assignments.

Assessment and grading details will be posted on Canvas.

Vereiste voorkennis

Bachelor in any science discipline (including medicine), with an interest in molecular biology and applying algorithmic approaches to protein structures.
Experience with programming (preferably python). Basic understanding of calculus and of organic chemistry. When in doubt
please contact the coordinator.

Literatuur

- course material on canvas.vu.nl
- book: Marketa Zvelebil and Jeremy O. Baum. Understanding

Bioinformatics. Garland Science 2008 ISBN-10: 0-8153-4024-9
- book "Introduction to Structural Bioinformatics": The intro and two chapters are published on ArXiv
- https://arxiv.org/abs/1801.09442
- https://arxiv.org/abs/1712.00407
- https://arxiv.org/abs/1712.00407
- The other chapters will be made available during the course via Canvas.

Aanvullende informatie doelgroep

M Bioinformatics and Systems Biology
M Biomolecular Sciences
M Artificial Intelligence
M Computational Science

Overige informatie

BYOD policy (Bring Your Own Device)
We expect students in this course to use their own laptop. This laptop should at the very least support an SSH client, for remote shell access to the VU Linux servers. We will provide some help in setting this up at the start of the course.
Lectures may be recorded; these recordings will only be used within the course, including possibly in subsequent years as background information.

Aanbevolen voorkennis

Some experience with the linux command line is preferred.

Subjectivity Mining

Vakcode	L_AAMPLIN018
Studiepunten	6.00
Periode	P1
Vakniveau	500
Onderwijstaal	Engels
Faculteit	Faculteit der Geesteswetenschappen
Vakcoördinator	dr. E. Maks
Examinator	dr. E. Maks
Betrokken Docenten	dr. E. Maks
Onderwijsvormen	Seminar

Doel vak

The overarching objective of the course is that students are able to design and conduct an automatic hate speech detection (AHSD) experiment as a specific instance of subjectivity mining using a dedicated ML-pipeline, justify key choices that they made and indicate their potential impact, interpret the results, indicate their validity, generalisability and relevance, and report about methods, results and interpretation both orally and in writing.

To achieve this objective, students learn to:
* Be familiar with the concepts of opinion mining, sentiment analysis, subjectivity mining and hate speech;
* Understand that the validity of any AHSD critically depends on the availability of reliably annotated texts and other resources, which in turn critically depends on the definition and opera- tionalization of hate speech;
* Be able to make a realistic planning of the various sub-tasks of AHSD, such as the selection of appropriate digital texts, experimenting with various definitions of hate speech, methods and set- tings of machine

learning, pre-processing of texts, word representations, use of external resources, and reporting.
* Be able to draw an evaluation report based on an error analysis while using standard evaluation metrics such as Precision and Recall (PRF report);
* Be able to critically appraise literature on hate speech and its automated detection, and interpret their own methodology and findings in the context of this wider literature;

Inhoud vak

In recent decades, the number of digital texts that have been produced and become publicly available has increased exponentially. As such, a vast volume of texts now exists that can -in principle- be ‘read’ (that is, processed, analysed and interpreted) by appropriately instructed and programmed computers. The purposes for which such text mining can be used are enormous, ranging form the development of voting aids, stock market prediction and opinion mining (e.g., opinions toward contentious issues such as vaccination).
Many of these texts are subjective: they contain sentiments, opinions, stances, beliefs, speculations and emotions (also called private states). Automated analysis of these private states starts with iden tifying the intentions of the speaker or writer of the message and its associated functions and syntactic structures, not to mention the choice of vocabulary and associated connotations.
The topic of the 2022 edition of the Subjectivity Mining course is online hate speech and its automated detection. With the growth of online content the spread of hate speech has expanded, too. Hate speech, offensive language, cyber bullying, etc. create important societal problems as they can cause serious harm to the victims. A strong desire to control this spread has stirred increased interest in the potential for automated hate speech detection (AHSD). The automated detection of hate speech in digital texts is, however, associated with significant challenges These challenges derive from different sources:
• There are many different variants of hate speech, varying in terms of degree of harmfullness, target, immediate threat, etc. Relatedly, hate speech has been differently defined and operationalized.
• The context of the hate speech (e.g., Facebook, Twitter, blogs, etc).
• The possibilities for creating manually annotated gold standards, to be used for assessing performance and training of AHSD. - The sort of method and settings used for AHSD (using rule-based or machine learning algorithms)

The overall objective of the course is not only to introduce students to the theory and methods of subjectivity mining. We also aim at improving their understanding of the factors that affect detection performance, help them to develop their skills in critically appraising specific instances of subjectivity mining (in this case AHSD) and in designing and implementing strategies for automated identification, taking into account the various relevant contextual factors. In other words: tools always produce results; the challenge is to develop the ability to critically interpret such results. We believe that, more than the technicalities, this will help students to become life-long learners in this rapidly expanding field of computational linguistics.

The course combines theoretical linguistic notions used in techniques such as sentiment analysis and opinion mining with hands-on work on real language data. Moving between theory, discussions, practical data annotation, using and modifying existing tools and computer code you focus on one of some of the following linguistic phenomena: modality, sentiment, emotions (hate!), opinions and stance.

Aanvullende informatie onderwijsvormen

Lectures and working groups (2 * 1,5 hour per week)

Toetsvorm

Weekly assignments and a final course paper

Vereiste voorkennis

1. Programming Skills (Python); AND
2. at least one machine learning course AND
3. (L_AAMPALG016)Introduction to Human Language Technology
(L_AAMPALG016) OR (Natural Language Processing Technology) L_AAMAALG005

Literatuur

To be announced

Aanvullende informatie doelgroep

Students of the Research Master's Humanities, in particular Linguistics (Human Language Technology) and master-students of Artificial Intelligence and Computer science and master-students of Business Analytics

The Social Web

Vakcode	X_405086
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	dr. J.R. van Ossenbruggen
Examinator	dr. J.R. van Ossenbruggen
Betrokken Docenten	dr. J.R. van Ossenbruggen
Onderwijsvormen	Computer lab, Lecture

Doel vak

In this course, students will:

- Learn theory and methods concerning communication and interaction in a Web context (Knowledge and Understanding).
- Understand how user data is represented and distributed across devices in the context of the Social Web (Knowledge and Understanding).
- Apply the above skills in practical assignments (Apply Knowledge and Understanding).
- Reflect on social and ethical responsibilities linked to the application of these methods (Making Judgements).
- Communicate their knowledge and judgements in a final paper (Communication).

Inhoud vak

This course will cover theory, methods and techniques for:
- personalization for Web applications;
- Web user & context modeling;
- user-generated content and metadata;
- multi-device interaction;
- usage of social-web data.

The course takes a data science approach, using Jupyter notebooks to collect and analyse data, with a research paper describing the data science study as the main outcome of the course.

Aanvullende informatie onderwijsvormen

Lectures (1x week)
Practical sessions (1x week)

Presentation seminars (1x week)

Toetsvorm

The weighted average of:
- 70% research paper (group assignment A),
- 10% group presentation (P),
- and 20% individual contribution to the research paper (R).

A minimum grade of 5.5 for each component is required.
Compensation: it is not possible to compensate one component with another.
Mode of re-examination: if insufficient, each component may be revised and resubmitted once.

Literatuur

- Course lecture slides;
- Selected articles, videos and Web links

All materials for each lecture will be provided through Canvas.

Aanvullende informatie doelgroep

Master Artificial Intelligence
Master Computer Science
Master Information Sciences
Master Computer Security

Aanbevolen voorkennis

Basic Python programming skills.

Web Data Processing Systems

Vakcode	XM_40020
Studiepunten	6.00
Periode	P2
Vakniveau	400
Onderwijstaal	Engels
Faculteit	Faculteit der Bètawetenschappen
Vakcoördinator	J. Urbani
Examinator	J. Urbani
Betrokken Docenten	J. Urbani
Onderwijsvormen	Lecture

Doel vak

After taking this course, students will be able to:
- Extract useful knowledge from raw data available on the Web using state-of-the-art techniques from NLP;
- Apply advanced AI techniques to further process Web data and knowledge;
- Adapt or reuse techniques used on the Web to other fields (e.g. Data Mining, Databases) where similar problems might occur.

This course has seven learning goals:
G1: Learning to store and retrieve information from large repositories of knowledge (Knowledge and understanding) (Applying knowledge and understanding)
G2: Represent and extract knowledge on the Web (Knowledge and understanding) (Applying knowledge and understanding)
G3: Connect unstructured and unstructured data (Knowledge and understanding) (Applying knowledge and understanding) (Making judgements)

G4: Infer new knowledge from existing knowledge bases (Applying knowledge and understanding) (Making judgements)
G5: Process large amounts of Web data efficiently using state-of-the-art tools (Applying knowledge and understanding) (Making judgements) (Lifelong learning skills)
G6: Implement efficient prototypes that work with Web data (Applying knowledge and understanding) (Making judgements) (Lifelong learning skills)
G7: Adapt or reuse techniques used on the Web to other fields (Applying knowledge and understanding) (Lifelong learning skills)

Inhoud vak

The Web constitutes the largest repository of knowledge that is available to mankind, and its impact on modern society is unprecedented at many levels. Many Web companies are valued with billion-dollar quotations and are now central to our modern life.

The key players in the Web industry must face numerous challenges that are concerned with the size, distribution, heterogeneity, and the uncontrolled nature of the Web. Systems to process Web data require the application of a combination of techniques spanning databases, distributed systems, data mining, and artificial intelligence.

The goal of this course is to introduce the student to the most advanced systems and techniques which deal with the extraction of knowledge from Web data. Important classes of problems concern:

- the storage and retrieval of Web data (How can we store and retrieve information from large social networks, graphs, or large volumes of text?)
- efficient entity disambiguation (What is a particular web page talking about?)
- large-scale knowledge extraction (What sort of knowledge can we extract from web documents -- e.g. Wikipedia?)
- effective link prediction (Is there a connection between two users/events/concepts?)
- expressive ontological inference (Can current knowledge lead to more implicit knowledge?)
- trust (Can we trust the content on a certain blog post?)

This course will describe techniques to perform these tasks with a particular emphasis on systems and scalability. In order to better understand the challenges and effectiveness of current solutions, the student will be called to implement a practical assignment on realistic Web data. The assignment will be part of the final evaluation of the course.

Aanvullende informatie onderwijsvormen

The course takes the form of lectures (either online or at the VU) and practical assignments.

Toetsvorm

The final grade is determined by a final written exam (60%) and one or more practical group assignments (40%).

Literatuur

A collection of scientific publications and other online material available on the Web.

Aanvullende informatie doelgroep

MSc Artificial Intelligence
MSc Business Analytics
MSc Computer Science

MSc Econometrics and Operations Research

Aanbevolen voorkennis

To successfully complete the practical assignment, students should have a good knowledge of programming languages like Python or Java. Although knowledge of basic machine learning techniques is not strictly required, it will be helpful since many of the covered techniques use statistical based classifiers or deep neural networks.