Xi'an Jiaotong-Liverpool University
西交利物浦大學

School of Advanced Technology

MODULE HANDBOOK

SAT301
Bio-Computation

Rui Yang

Semester 1

2021-2022

SECTION A: Basic Information

- **Brief Introduction to the Module**

This module introduces the concepts of artificial neural networks and covers some of the contemporary topics including perceptron, MLP and CNN. Students can understand the ANN models for specific applications including regression, prediction and classification, and get familiarized with MATLAB for realization of ANNs for practical applications.

- **Key Module Information**

Module name: Bio-Computation
Module code: INT301
Credit value: 5
Semester in which the module is taught: 1
Pre-requisites needed for the module:
CSE105 OR CPT105
AND
MTH013 OR MTH019 OR MTH023
AND
MTH007 OR MTH015
Programmes on which the module is shared:
BSc Bioinformatics
BEng Computer Science and Technology
BSc Information and Computing Science

- **Delivery Schedule**

Lecture room: SA169 or Online via Zhumu
Lecture time: Tuesday 9:00-11:00

Lab room: SD546/554/319 or Online via Zhumu
Lab time: Tuesday 15:00-16:00

Tutorial room: EE101 or Online via Zhumu
Tutorial time: Friday 11:00-12:00

- **Module Leader and Contact Details**

Name: Rui Yang
Email address: r.yang@xjtlu.edu.cn
Office telephone number: 0512-88161502
Room number and office hours: SD529 Thursday 11:00-13:00
Preferred means of contact: email

SECTION B: What you can expect from the module

- **Educational Aims of the Module**

1. To introduce students to a range of topics in the field of artificial neural networks, and to provide them with hands-on familiarity some of the established works.
2. To highlight some contemporary issues within the domain of neural computation with regard to biologically-motivated computing, particularly in relation to multidisciplinary research.
3. To emphasize the need to keep up-to-date in developing areas of science and technology and provide some skills necessary to achieve this.
4. To enable students to make reasoned decisions about the engineering of machine learning systems

- **Learning Outcomes**

A. Account for biological and historical developments of neural computation. Describe the nature and operation of Perceptron, MLP, Convolutional Neural Network (CNN), Competitive learning, Oja learning, and SOM networks, and when they are used assess the appropriate applications and limitations of ANNs;
B. Apply their knowledge to some emerging research issues in the field;
C. Understand how ANN models work in general terms and with respect to specific applications, e.g., regression, prediction and classification. The understanding will be reinforced by first-hand experiences in problem solving and assessed by course works and assessment;
D. Understand some of the contemporary topics of artificial neural networks, and deep neural networks in particular, including CNN, with awareness of their advantages and applications,
E. Awareness of some of the modern machine learning concepts;
F. Familiarity with the essentials of MATLAB and relevant toolboxes so as to enable exploration of the above in practical applications of ANNs.

- **Assessment Details**

Assessment 1: In-class Test 1 (Learning Outcomes A-C)
The objective of this assessment is for the student to demonstrate understanding of artificial neural network concepts focusing on topics to be specified by the module leader. This will be in a time-constrained format in week 8. This assessment contributes **10%** of the overall module grade. **Re-sitting of this assessment is not available**.

Assessment 2: In-class Test 2 (Learning Outcomes D-F)
The objective of this assessment is for the student to demonstrate understanding of artificial neural network concepts focusing on topics to be specified by the module leader. This will be in a time-constrained format in week 14. This assessment

contributes **10%** of the overall module grade. **Re-sitting of this assessment is not available**.

Assessment 3: Final Written Examination (Learning Outcomes A-F)
The objective of this assessment is for the student to demonstrate understanding of artificial neural network concepts focusing on the topics covered by the whole module. The exam duration is 2-hours and the exact date and location will be arranged by the university. This assessment contributes **80%** of the overall module grade. **Re-sitting of this assessment is not available**.

- **Methods of Learning and Teaching**

1. Didactic component - the core of the teaching is lecture-based with Q/A and feedback. Lectures are supported by tutorials and labs/practices.
2. Self-learning component - students are encouraged to read around the subject materials.
3. Comprehension/review exercise - supervised discussion and Q/A sessions in the tutorials.
4. Case studies will be supplied to help students place the course material in context.

- **Syllabus & Teaching Plan**

Week Number	Lecture
Week 1	Introduction; M-P Neuron & Hebb Learning
Week 2	Supervised Learning and Perceptron
Week 3	Supervised Learning and Perceptron
Week 4	Multi-layer Perceptron
Week 5	Multi-layer Perceptron
Week 6	Multi-layer Perceptron
Week 7	Midterm
Week 8	Introduction to Convolutional Neural Network
Week 9	Radial-Basis Function Network
Week 10	Time-series Prediction and Elman Network
Week 11	Unsupervised Learning
Week 12	Unsupervised Learning
Week 13	Associative Memories
Week 14	Associative Memories; Review

- **Tutorial Schedule**

Student Group	Time	Day	Venue	Lecturer/Instructor
Group 1	11:00-12:00	Friday	EE101 or Online	Rui Yang

- **Reading Materials**

Reference Textbooks

Title	Author	ISBN/Publisher
Introduction to Artificial Neural Systems	Jacek M. Zurada	9780314933911 / West Group; 1st Edition
Neural Networks. A Comprehensive Foundation	Simon Haykin	9780132733502 / Prentice Hall; 2nd Edition
Handbook of Neural Computation	Ed. E. Fiesler and R. Beale	9780128113189 / Academic Press; 1st Edition
From Computer to Brain: Foundations of Computational Neuroscience.	William W. Lytton	9780387955261 / Springer
Neural Network Architectures	Judith Dayhoff	9780442207441 / Van Nostrand Reinhold; 1st Edition
Neural Networks. A Systematic Introduction	Paul Rojas	9783540605058 / Springer; 1st Edition

SECTION C: Additional Information

- **Attendance**
- Students who are able to be on campus are reminded of the Academic Policy requiring no less than 80% attendance at classes. Failure to observe this requirement may lead to failure or exclusion from retake examinations in the following year.

- **Student Feedback**

  The University is keen to elicit student feedback to make improvements for each module in every session. It is the University policy that the preferred way of achieving this is by means of an Online Module Evaluation Questionnaire Survey. Students will be invited to complete the questionnaire survey for this module at the end of the semester.

  You are strongly advised to read the policies mentioned below very carefully, which will help you better perform in your academic studies. All the policies and regulations related to your academic study can be found in 'Student Academic Services' section under the heading "Policies and Regulations" on E-bridge.

- **Plagiarism, Cheating, and Fabrication of Data.**

  Offences of this type can result in attendance at a University-level committee and penalties being imposed. You need to be familiar with the rules. Please see the

"Academic Integrity Policy" available on e-Bridge in the 'Student Academic Services' section under the heading 'Policies and Regulations'.

- **Rules of submission for assessed coursework**

  The University has detailed rules and procedures governing the submission of assessed coursework. You need to be familiar with them. Details can be found in the "Code of Practice for Assessment" available on e-Bridge in the 'Student Academic Services' section under the heading 'Policies and Regulations'.

- **Late Submission of Assessed Coursework**

  The University attaches penalties to the late submission of assessed coursework. You need to be familiar with the University's rules. Details can be found in the "Code of Practice for Assessment" available on e-Bridge in the 'Student Academic Services' section under the heading 'Policies and Regulations'.

- **Mitigating Circumstances**

  The University is able to take into account mitigating circumstances, such as illness or personal circumstances which may have adversely affected student performance on a module. It is the student's responsibility to keep their Academic Advisor, Programme Director, or Head of Department informed of illness and other factors affecting their progress during the year and especially during the examination period. Students who believe that their performance on an examination or assessed coursework may have been impaired by illness, or other exceptional circumstances should follow the procedures set out in the "Mitigating Circumstances Policy", which can be found on e-Bridge in the 'Student Academic Services' section under the heading 'Policies and Regulations'.

- **Viewing Exam Scripts**

  Students are permitted to see their answer sheets for final and resit exams under the stated conditions. A student must apply to review their answer sheet within two weeks of the results being published on e-bridge. If a request is received before this deadline the relevant departmental administrative support staff will arrange a time for the student to view their script in the company of an appointed staff member.

  The following conditions apply for students to view their exam scripts.

  1. Students will be afforded a set time period in which they are allowed to view their exam script (e.g. a limit of 5 minutes).
  2. Students have *no* right to discuss their mark, ask for their marks to be adjusted, or demand more marks.
  3. Students are only allowed to see their own script individually and cannot be accompanied by another party other than the appointed staff member.

4. Students are not allowed to write notes or take photos during the appointment.
5. There is no requirement to provide students with access to the exam paper or solutions.
6. The module leader may request an additional staff member to be on-site during review so as to avoid any potential conflict.

Please note that the purpose of viewing exam scripts is to check for mistakes in your submission and gauge the quality of your work, not to discuss the grading or question your mark.

- **Learning Mall**

  Copies of lecture notes and other materials are available electronically through Learning Mall, the University's virtual learning environment.