COS30018 – Intelligent Systems

Week 1 tutorial

This week we will cover the following items:

- Subject overview and nature of tutorials
- Assignment requirements
- Forming of groups for your assignment
- Java & Python environment setup
- JADE framework installation

1. Subject overview & nature of tutorials

This subject is designed to give you a general understanding of how intelligent systems are created today and how they may be created in the future. Your primary assessment besides a verbal examination will be a group project. Given the large volume of material covered we do not expect you to implement a software system covering all the concepts discussed in class, but we do want you to get as much hands-on experience as possible.

The purpose of these tutorials is to assist you in your project! Depending on the project you select you may be required to build a multi-agent system, utilize constraint problem solvers, or train deep learning models — or even a system of these things. These tutorials will provide resources for learning one framework for implementing each of these things. You are not required to understand all the tutorial materials. Your project will dictate what materials you need to understand, the provided resources will get you started and if you have more detailed questions you can ask your tutor.

In the first 8 weeks of tutorials, we will cover:

- Building multi-agent systems with JADE (in Java)
- Solving constraint problems using the library Choco (in Java)
- Python introduction
- Machine learning & Deep learning using TensorFlow & PyTorch framework (in Python)
- Building Genetic Algorithm (Evolutionary Algorithm) using library PyGAD (in Python) In the

last 4 weeks of tutorials we will focus on:

- Group project

You *do not* need to learn all the languages used in the lab or all the frameworks we introduce, just whatever is relevant to the project you choose with your group.

2. Assignment requirements

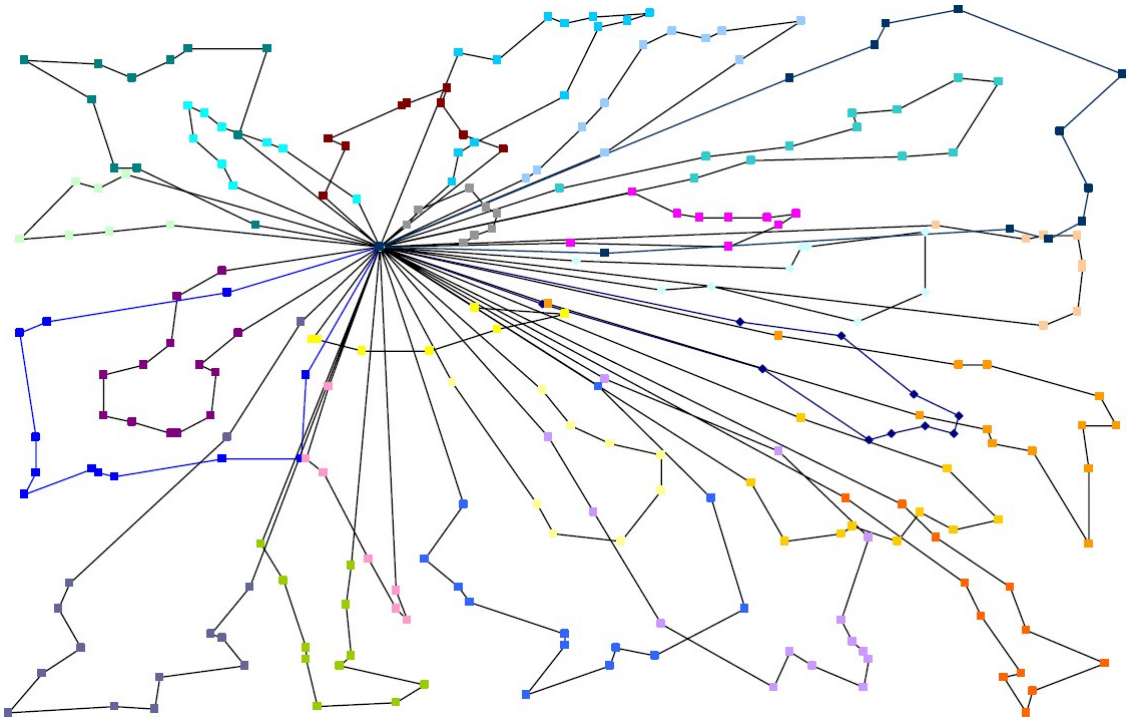
Assignment description: Design and implement a simple intelligent system to solve a practical problem

- Agent-based or Machine Learning system – built using IS principles/algorithms
- Working software – demonstration
- Short project report (summary of work, architecture, interaction, algorithms, result analysis, example)
- Video if applicable (s/w demo)
- Assignment Release: on Canvas

- **Assignment Progress**: will be checked by your tutor starting Week 3! It's very important that you attend the weekly tutorials to provide your tutor with updates of your assignment progress. Failing to do this may result in failing the assignment and failing the unit.
    - If you choose Option C, you will have Weekly Tasks starting Week 3!

Project Option A: Delivery Vehicle Routing System (Team of 3-4 students)

Design and implementation of a simple delivery vehicle routing system involving delivery agents and a master routing agent whose job is to find the optimal routes for the delivery vehicle agents to get their parcels to the receivers.

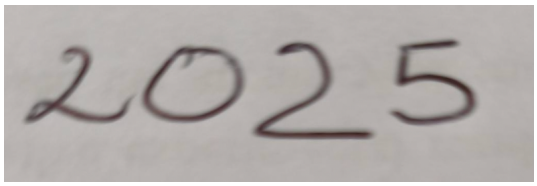


Involved domains:

- Interaction Protocols
- Search/optimization
- Dynamic adaptation

Project Option B: Handwritten Number Recognition System (Team of 3-4 students)

This project requires your group to implement and demonstrate a system that can recognize handwritten numbers. This is a problem that is simpler than the more complex and practical problem of handwritten text recognition. On the other hand, the problem is more challenging than the typical problem of Handwritten Digit Recognition.



Involved domains:

- Machine learning
- Deep learning
- Image recognition/computer vision

Project Option C – Stock Price Prediction System (Individual student to work directly with a teaching staff)

Design and implementation of a simple machine learning system for predicting stock price of companies on the stock market using real-world datasets.

You are going to work in a project led by a teaching staff. The project leader will give you starting code for this project. It is quite poor (in terms of programming and performance). We will give you weekly tasks to do to improve this code base (and in the process, you will learn about things such as data processing and deep learning).

Involved domains:

- Machine learning
- Deep learning
- Stock price prediction

Project Option D – Large Language Model (LLM)-powered Autonomous Agents and Multiagent systems (Team of 3-5 students)

To do Option D, you will need to apply with the unit convenor by presenting your suitability to do this research-oriented project: Your current average from your academic transcript has to be at least D (>=70%) AND you are aiming to achieve D/HD in Intelligent Systems AND you are well equipped to do this project by having a strong capability to do Python programming.

This project requires you to work in a team led by a teaching staff aiming to implement and demonstrate the capabilities of autonomous agents powered by large language models (LLMs) such as GPTs, Llama's, or Gemini's.

Requirement: Python programming, Git, UI implementation.

Involved domains:

- Machine Learning
- Deep learning (NLP focus)
- Large Language Models (LLMs)

3. Forming of groups for your assignment:

Form a team of 3-4 (if you choose **Option A** or **Option B**):

- Team members can be from different tutorials.
- To help your tutor easily recognise the members of the team, please fill in the Team Page on Canvas.
- If you can't find a team for yourself, please talk to us ASAP.
- Feel free to use the Discussion Board on Canvas.
- Discuss within your team to choose a topic.
- Teams are to be finalised next week (or Week 3 the latest).
- Topic is to be finalised in Week 3 (with your tutor's approval)!

If you choose **Option C**, you do not need to form a team as you will work with your tutor.

If you choose **Option D**, you need to contact and get approval from Unit Convenor Bao Vo (bvo@swin.edu.au).

4. Java & Python environment setup

Using Java:

If you are new to Java, then consider using an IDE. Two popular ones are IntelliJ and Eclipse (we recommend IntelliJ, as the tutorials are demonstrated using this IDE). Also, you may want to learn the basics of Maven (http://maven.apache.org/guides/getting-started/maven-in-five-minutes.html) which can manage your dependencies and builds.

In this week tutorial, we will walk through an installation and setup of the Java environment (using IntelliJ) and make the first "hello world" program!

Using Python:

If you are new to Python then consider using an IDE. The most popular one is PyCharm. Or you can also use text editor such as Sublime Text, Notepad++, or Atom (we recommend Sublime Text, as the tutorials are demonstrated using this text editor). Also, you may want to learn the basics of pip which manages all the dependencies and building of your Python programs. The projects supplied use Python 3.

This useful resource provides a walkthrough on the installation and setup of the Python environment (using Sublime Text) and implement the first Python program:

https://www.youtube.com/watch?v=VC13MkENVoY

5. JADE framework installation:

JADE (Java Agent Development Framework) is a software framework to develop agent-based applications in compliance with the FIPA specifications for interoperable intelligent multi-agent systems. The goal is to simplify the development while ensuring standard compliance through a comprehensive set of system services and agents.

JADE can then be considered an agent middleware that implements an Agent Platform and a development framework. It deals with all those aspects that are not peculiar of the agent internals and that are independent of the applications, such as message transport, encoding and parsing, or agent life-cycle.

You can read more about JADE here: https://jade.tilab.com/

Please read the file named "JADE installation" on Canvas and follow the instruction to install JADE framework on your machine.