

# **An interdisciplinary “Artificial Intelligence” PhD School**

Most AI research and development is conducted by interdisciplinary teams and there is also a great need for people with competency at the intersection of AI, governance, social sciences and humanities, to ensure that the AI transformation of society goes well and that AI technology is developed with societal impact in mind. To address this need, we present a concept for a PhD school on “Artificial Intelligence” that would provide students with interdisciplinary AI competency. The concept was originally developed for the AI Lund network at Lund University, Sweden ([www.ai.lu.se](http://www.ai.lu.se)) but not realized due to lack of funding. It has since been updated and some of the ideas have been implemented in the COMPUTE research school ([www.compute.lu.se](http://www.compute.lu.se)) at the same university. We publish the concept in the hope that it can serve as inspiration for other higher education organizations that want to establish such a research school.

## Main text

### Mission of the AI PhD school

The aim of the AI PhD school is to provide excellent training in interdisciplinary artificial intelligence-centred research and prepare the students to become future leaders in this domain. Students will gain a broad understanding of various aspects of artificial intelligence, including theoretical concepts, practical implementation, application areas and societal implications. The PhD school will also promote the development of cutting-edge collaborative research across fields and with outside partners.

### Students

Students are to be selected based on excellence and fit with the PhD school mission. Merits of the hosting environment, project and intended candidate should be judged by an interdisciplinary evaluation group. A maximum of 40 students is to be enrolled in each cohort.

The PhD school should have three types of students:

- 1. *Internal PhD students financed by the PhD school***  
The salary costs for these students and 10% of the supervisor salary are to be fully covered by the PhD school (including overhead costs). Ideally, at least one PhD student from each faculty should be included in each cohort.
- 2. *Affiliated PhD students from the host university***  
These students are fully financed by the respective research groups or institutions but fit in thematically with the AI PhD school. They will participate in courses and all other activities.
- 3. *Affiliated PhD students from external partners***  
These students are hosted by external partners but have a collaboration with the university hosting the AI PhD school. This could be industry PhD student or students at other universities.

In addition to the PhD students, Postdocs, senior staff and other researchers from the host university should also be permitted to participate in events and courses of the AI PhD school. This will enable PhD students to build up a network of potential collaborators and will allow them to learn and get career advice from more senior scientists.

### Learning goals

The AI PhD school learning goals are for students to

- Understand the major theoretical concepts, application areas, limitations and potential future directions of AI
- Understand the major societal, ethical and legal issues related to AI and be able to identify issues that pertain to different research fields and projects
- Be able to design, execute and lead interdisciplinary research projects involving AI
- Be able to analyse different types of data using appropriate AI approaches
- Be able to validate AI algorithms and critically evaluate the quality of input data and outcome of AI-based analyses
- Be able to assess competency and career goals in themselves and others and to identify and use appropriate training for continuous competency development

- Be able to clearly communicate and collaborate in interdisciplinary teams
- Be able to translate research strategies and knowledge from other fields to their own field and project
- Be able to reach out to stakeholders in academia, general public, industry and other sectors and to use context-appropriate language and visualization
- Understand how research findings can be translated into practical applications and innovative products
- Be able to attract funding
- Be able to engage in peer and collaborative learning

## Activities

The PhD school will comprise a broad range of training activities, typically distributed over 4 years. Students at the AI PhD school can also make use of existing activities from other actors at the host university or other partners. They can for example replace an elective course with an external course or participate in seminars/webinars/workshops elsewhere. In addition to attending the PhD school activities each PhD student will conduct research in an AI-related research group and attend the PhD education courses that are obligatory at the host institution. Depending on the customs of the host institutions students may also rotate through different research groups.

Supervisors who receive funding from the AI PhD school are expected to take part in a number of activities at a level that corresponds to their funding. Participation in the kickoff, retreat, innovation day and hackathon typically expected. The other activities can be chosen by the supervisor.

### Kickoff event

Each cohort will start with a 2-day kickoff event in which students present themselves and their projects and get to know the other students, supervisors and teachers.

### Courses

The PhD school will comprise several obligatory courses in the first two year of the PhD school. All courses will have lectures, active learning activities and online learning activities and will be taught in a project-oriented manner.

#### Obligatory courses

- General concepts and applications of artificial intelligence (2 days, year 1)
- Ethical, legal, societal and environmental implications of artificial intelligence (3 days, year 1)
- Introduction to programming and computer science (5 days, year 1, not obligatory for students with equivalent skills)
- Funding acquisition and innovation (2 days, year 2)
- Validation and visualization (2 days, year 2)
- AI project work (3 weeks, one in each year 1, 2 and 3)
  - AI and society: a project that relates to the societal transformation by AI and engages with an external stakeholder in this area, e.g. a citizen science AI project, a project on AI education, a project on AI governance, a project on AI and human rights
  - AI and business: a project that develops a business idea or is done in collaboration with a business partner
  - AI research: a project that explores an AI technology that is new to the student in a research group (internal or external) that they have not previously collaborated with

Elective courses (all courses combine theoretical and computational parts)

- Artificial Intelligence Methods and Practical Implementation - Text and Language (5 days)
- Artificial Intelligence Methods and Practical Implementation - Images (5 days)
- Artificial Intelligence Methods and Practical Implementation - Tabular big data (5 days)
- Artificial Intelligence Methods and Practical Implementation - Multivariate, temporal and other complex data (5 days)
- Reinforcement learning (5 days)
- Generative modelling (5 days)
- AI business development (5 days)
- AI in society: governance, social impact and AI sustainability (5 days)
- Elective courses at other organizations can be chosen with approval of the supervisor and the AI PhD school study director

### **Hackathons**

In these 1-week hackathons interdisciplinary groups will compete to solve real-world research problems from various fields. Hackathons will take place in year 3 and year 4.

### **Retreat**

Annual gathering of students, supervisors and teachers of the PhD school with research presentations, poster session and networking/social activities.

### **Student seminars**

Seminar series in which students present their research and/or exciting applications of AI in their field (2 students per seminar).

### **Research seminars**

Series of monthly seminars with international and national researchers.

### **Career seminars**

Series of quarterly seminars on soft skill and career development topics (e.g. project and time management, Agile software development, building an online career profile).

### **Student symposium**

Annual scientific symposium on interdisciplinary AI research organized by the students.

### **Buddy program**

Each student will be paired with a buddy from another discipline who gives input for their research project. Each pair will have at least one student with some experience in computation/AI.

### **Study groups**

Students should be supported in the creation of study groups where they meet without teachers to develop specific skills or discuss topics of interests. This could also be in the form of a journal club. Not all students will participate in the same study groups. Instead, small groups can be formed to bring together students with related interests.

### **Call4Help Sessions and online forum**

Call4Help Sessions will be short pitching events in which students can present issues they are struggling with in their projects and get input from other students, supervisors and teachers. In between, students will also have an online forum to discuss questions and connect for social activities.

**Mentor program**

Every year students will be assigned a new senior mentor recruited from host organization researchers and/or external partner organizations. Students will also be grouped into peer mentoring groups.

**Study visits**

The PhD school will organize visits to industry, public sector and other organizations.

**Individual training program**

Each student will have an individual training program through which they develop scientific and transferable skills that match their research topic and career goals. This will cover several training areas: research, teaching, communication, leadership, internationalization, cooperation, outreach and innovation. Training activities will be chosen among those on offer at the host institution and elsewhere (e.g. courses, conferences, study visits).

**Popular science day**

Annual day with activities for the general public and local schools organized by students

**Innovation day**

In each of the last two years, a day for interaction with partners from industry and other outside organizations will be organized. At these events, students will present their business ideas and get advice from mentors, supervisors and business representatives.

**Career fair**

In the last year of graduating cohort, external partners will be invited to present their career opportunities and network with students and supervisors.

**Innovation and grant support**

Students with ideas for innovation projects will be supported by connecting them to relevant partners such as LU Innovation and local business accelerators and mentors with innovation experience. In addition, the school will have a small funding program for students with grants for innovation and travel. Supervisors are expected to contribute with advice and grant review.

**Travel grants**

Each student should receive a travel grant that enables them to participate in two conferences of their choice, one national and one international, or a research visit at another institution.

**Individual career development plan and portfolio**

Together with their supervisors and mentors, students will write a career development plan and use it to set up an individual training program consisting of courses and other activities they want to participate in. By this, students, will develop the technical and general skills that match their research and individual career goals in different areas of expertise: research, teaching, communication, leadership, internationalization, cooperation. Training activities will be chosen among those on offer at the host institution and elsewhere e.g. courses, conferences, lab visits. Activities will be documented in a portfolio that should be reflected on annually with mentors and supervisors. Based on the outcome of the reflections, the study plan will be updated.

## Example schedule for a 4-year PhD education

### Year 1

## **Courses**

- General concepts and applications of artificial intelligence (2 days)
- Ethical, legal, societal and environmental implications of artificial intelligence (3 days)
- Introduction to programming and computer science (5 days, not obligatory for students with equivalent skills)
- AI project 1
- Elective courses (at least 1 week)

## **Other activities**

Intro day - info about PhD school and mingling with students and teachers; meeting of buddies

PhD student conference (posters and short talks)

Study groups

Mentor meetings

Industry visit

Research seminars/workshops

Hackathon/Call4Help events

## **Year 2**

### **Courses**

- Funding acquisition and innovation (2 days)
- Validation and visualization (2 days)
- AI project 2
- Elective courses (at least 1 week)

### **Other activities**

PhD student conference (posters and short talks)

Study groups (beginners and advanced)

Mentor meetings

Industry visit

Research seminars/workshops

Hackathon/Call4Help events

Career seminars

Retreat

PhD half-time review (at end of year 2)

## **Year 3**

### **Courses**

- AI project 3
- Elective AI course (at least 1 week)

### **Other activities**

PhD student conference (posters and short talks)

Innovation day

Study groups (beginners and advanced)

Mentor meetings

Industry visit

Research seminars/workshops

Hackathon/Call4Help events

Career seminars

Retreat

## Year 4

### Courses

- Elective AI course (at least 1 week)

### Other activities

PhD student and alumni conference (posters and short talks)

Innovation day

Study groups (beginners and advanced)

Mentor meetings

Industry visit

Research seminars/workshops

Hackathon/Call4Help events

Career seminars

Retreat

Thesis writing group

PhD defence training

Individual career counselling

PhD defence (at end of year 4)

## Budget

The operation of the research school will require the following items to be covered, with modifications based on the conditions of the host institution:

| Types of costs that need to be covered   |
|--|
| PhD student salaries (approximately 6-8 new funded PhD students per year)                |
| Supervisor (compensation corresponding to 10% employment)                                |
| Courses (incl teacher salary, rooms, catering, etc) (3 courses/year, 1 week each)        |
| Admin/economy support staff salary (4 hours/week)  |
| Events (e.g. seminars incl travel for external speakers, poster day, Call4help, retreat) |
| School coordinator salaries (2 persons, 25% employment each)                             |
| Travel and innovation grants   |

The exact costs depend on the specific implementation of the PhD school concept and can therefore not be given.