

Julita Vassileva & Ralph Deters

# MADMUC LAB



## Research Focus:

Human-Centered AI Applications:  
Social, Personalized,  
Adaptive Educational  
and  
Behavior Change Systems.



## Approach:

Integrating AI into Existing  
Software Systems  
Decentralized systems,  
Middleware

## Multi-Agent Distributed Mobile And Ubiquitous Computing (MADMUC) Lab

The MADMUC lab opened in May 2000, funded by \$895,687 "new opportunities" grant from the Canadian Foundation for Innovation (CFI), the provincial government of Saskatchewan and by the University of Saskatchewan. The research in the lab currently focuses on:

- 1) middleware infrastructures for decentralized software systems: mobile, ubiquitous, cloud-based or fog-based, that have better performance, consistency and security;
- 2) social software infrastructures that enable and encourage sustainable participation and collaboration between users;
- 3) decentralized trust-based approaches for storing and accessing user data, preserving privacy and user ownership of data;
- 4) personalized persuasive technologies for user behaviour change to improve: healthy living, physical activity, productive work, social support and more engaging learning experiences.

Since its inception, 152 students and researchers have worked in our lab. Of these, 120 graduate students (17 PhD and 103 MSc) have graduated, including two Vanier Scholars, 5 Post Doctoral Fellows and 22 undergraduate summer students. MADMUC is vibrant place with students who actively publish, win awards and prestigious scholarships. It also has many tropical plants to make the long winters greener.



Ralph Deters, PhD

Professor

Lab Director



Julita Vassileva, PhD

Professor, Graduate Chair

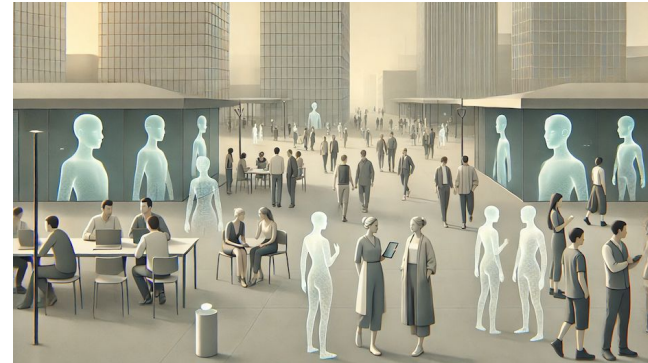
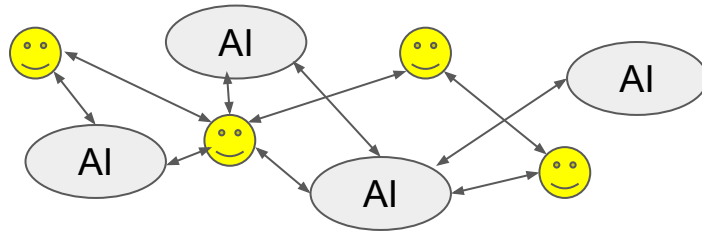
Lab Director

# Research Direction: Towards Social Generative AI

**Vision:** The next major step in AI development is likely to be **social generative AI** where humans and GenAI agents engage in a broad range of social interactions.

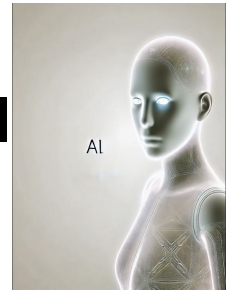
## Social Conversational Learning Systems

- GenAI as a component in an social educational system where humans and AI agents converse within a pervasive computational medium
- Techniques from multi-agent systems and reinforcement learning used to enable collaboration between conversational genAI systems and human learners.
- Applications: educational systems and behaviour change (in health, environment, sustainability)





# Research Direction: Trustworthy and Ethical AI



## Human Side:

### Trustworthy and Explainable AI

- Ethical balanced explanations in recommenders and decision support systems.
- Design of effective warnings regarding risks.
- Scrutability: visualizations and user controls.

### AI to Support Human Learning and Behaviour Change

- Ethical personalized persuasive technology.
- Personalized educational systems.
- Learner motivation, engagement, participation.

## System Side:

### Privacy and Intellectual Property Protection:

- Distributed ledgers (blockchain, NFTs).
- Federated learning.
- Digital twins.

### Creating Trusted Middleware for AI Applications

- Preserving privacy and user ownership of data - Data Trusts, Data Communities.
- Compatibility with legal frameworks.
- Ensuring OCAP (Ownership, Control, Accessibility, and Possession) principles.