PERSONAL DETAILS

Family name, First name: Yu, Liuwen
Contact: liuwen.yu@uni.lu
URL for website: https://yuliuwen.github.io/

Research Profile

I am an AI researcher focusing on symbolic and hybrid approaches for new-generation AI — human-level and human-centered AI, with a focus on applications in the digital transformation of law and finance.

Education and key qualifications

- **2023** PhD in Law, Science, and Technology Joint Doctorate - MSCA grant for the project Rights of Internet of Everything.

  Dissertation: *Distributed Argumentation Technology*

- **2018** MSc in Philosophy, at Zhejiang University

- **2016** BSc in Information Systems and Information Management, at Jiaxing University

Current position

- **2023 – Present** Postdoctoral Researcher at the Computational Law and Machine Ethics (CLAiM) group led by Dr. Réka Markovich, Department of Computer Science, University of Luxembourg

PARTICIPATING IN RESEARCH GRANTS

- **2024.11 – 2025.10** Postdoctoral researcher, DISCREASON (Formal Analysis of Discretionary Reasoning – Deontic Logic and Formal Argumentation for Modeling Discretionary Decision-making in Legal Cases), Marie Speyer Excellence grant project (PI: Dr. Réka Markovich)

- **2024.04 – 2024.09** Postdoctoral researcher, DELIGHT (Deontic Logic for Epistemic Rights), FNR OPEN research grant Nr. O20/14776480

- **2019.11 – 2022.10** Doctoral researcher, LAST-JD-RIoE (Law, Science and Technology, Rights of Internet of Everything) MSCA ITN (Marie Skłodowska-Curie actions European Joint Doctorates) Horizon 2020 EU project 814177

OBTAINED FUNDING

- **2024** SERAFIN - Symbolic and Explainable Regulatory AI for Finance Innovation, FNR CORE (Project budget: 598K Euros)

ACADEMIC SERVICE

- Reviewer of AAMAS2025 (International Conference on Autonomous Agents and Multiagent Systems).

- Reviewer of EXTRAAMAS 2024 (The International Workshop on EXplainable and TRAnsparent AI and Multi-Agent Systems).
- Chair of CALM 2024 (Workshop on Causality, Agents and Large Models 2024).
- Editor of CALM 2024 (Workshop on Causality, Agents and Large Models 2024), Communications in Computer and Information Science (CCIS) post-proceedings volume.

IMPACT

- Work being continued by other researchers in the field, including PhD student Vincent de Wit.

ADDITIONAL INFORMATION

Organisation of scientific meetings

- **2024** CALM 2024 (Workshop on Causality, Agents, and Large Models) in Kyoto, Japan.
- **2023** ICR & CLAiM workshop after my PhD defense
- **2023** ZLAIRE Kickoff (Zhejiang University – University of Luxembourg Joint Lab on Advanced Intelligent Systems and REasoning).

Supervision of students

- **2024** Tutor of a bachelor semester project of Velija Delikj on autonomous cars
- **2022 - present** Advisor of the doctoral researcher Vincent de Wit
- **2023 - present** Advisor of master and PhD students from Zhejiang University through ZLAIRE

Teaching Profile and Activities

I enjoy both **research-based teaching and foundational teaching**. My research-based teaching focuses on advanced topics in knowledge representation and reasoning, including logic and formal argumentation in AI. Additionally, I contribute to foundational education by coordinating textbook drafting and teaching core subjects in computer science, such as discrete mathematics, propositional logic, and first-order logic.

- **2024.09 – 2024.12** Master Course on *Intelligent Systems: Agents and Reasoning*
- **2024.04 – 2024.06** Doctoral Course on *Introduction to Formal and Computational Argumentation*
- **2024.04 – 2024.06** Master Course on *Intelligent Agents 1*

Academic Visits

- **2024.10** Department of Information Science and Media Studies, University of Bergen
- **2023.11** Computer Science Department, Cadi Ayyad University, Morocco
- **2023.10** Artificial Intelligence and Data Engineering Department, Özyeğin University, Turkey

- **2023.07** National Institute of Informatics, Tokyo, Japan
- **2022.10** Centre de Recherche en Informatique de Lens, France
- **2023.12, 2023.07** Department of Informatics, Kyoto University, Japan
- **2024.06, 2023.12, 2023.06** Institute of Logic and Cognition, Zhejiang University, China

Talks

- **2024.10** Three Conceptualizations of Formal Argumentation (Invited Talk), at Logic & AI Seminar, University of Bergen, Norway
- **2024.06** Weakest Link, Prioritised Default Logic, and Principles in Argumentation (Invited Talk), at The Fourth International Workshop on Logics for New-Generation Artificial Intelligence (LNGAI 2024), Zhejiang University, China
- **2024.03** Distributed Argumentation Technology, at 6th Madeira Workshop on Belief Revision, Argumentation, Ontologies, and Norms, Madeira, Portugal
- **2023.11** Legal and Moral Reasoning Capabilities in Intelligent Machines (Invited Talk), at Computer Science Department, Cadi Ayyad University, Morocco
- **2023.11** Law, Science, and Technology in Luxembourg (Invited Talk), at Computer Science Department, Cadi Ayyad University, Morocco
- **2023.09** From Distributed Argumentation Technology (DAT) to Dialogue Technology (DT), at ZLAIRE Kickoff, Zhejiang University, China
- **2023.05** Principles and Practice of Formal Argumentation: Argument Strength, Acceptance, and Storage (Invited Talk), at Tsinghua University, China
- **2022.05** Case-based Reasoning via Comparing the Strength Order of Features, at 4th International Workshop on EXplainable TRAnsparent AI and Multi-Agent Systems (EXTRAAMAS2022), Virtual
- **2022.01** Enhancing Trust in Trust Services: Towards an Intelligent Human-input-based Blockchain Oracle (IHiBO), at 55th Hawaii International Conference on System Sciences (HICSS2022), Virtual
- **2021.12** A Principle-based Analysis of Abstract Agent Argumentation Semantics (Invited Talk), at The 5th IEEE International Conference on Agents (IEEE ICA2021), Virtual
- **2021.11** A Principle-based Analysis of Abstract Agent Argumentation Semantics, at 18th International Conference on Principles of Knowledge Representation and Reasoning (KR2021), Italy
- **2020.12** Interpretations of Support Among Arguments, at 33rd International Conference on Legal Knowledge and Information Systems (JURIX2020), Virtual
- **2020.09** The Principle-based Approach to Bipolar Argumentation, at International Workshop on Non-Monotonic Reasoning (NMR2020), Virtual
- **2020.07** The Principle-based Approach to Bipolar Argumentation, at ICR Seminar, University of Luxembourg

- **2019.12** On the Optimized Utilization of Smart Contracts in DLTs from the Perspective of Legal Representation and Legal Reasoning, at 32nd International Conference on Legal Knowledge and Information Systems (JURIX2019), Madrid, Spain

PUBLICATIONS

Book

- Textbook on Formal and Computational Argumentation (in Preparation)

Journal Articles

- Yu, Liuwen; Markovich, Réka; van der Torre, Leendert. "Thirteen Challenges in Formal and Computational Argumentation." Journal of Applied Logics (Forthcoming). **Also appears in Handbook of Formal Argumentation, Vol. 3**.

- Pardo, Pere; Yu, Liuwen; Chen, Chen; van der Torre, Leendert. "Weakest Link, Prioritised Default Logic and Principles in Argumentation. "Journal of Logic and Computation (Forthcoming).

- Yu, Liuwen; Li, Xu; van der Torre, Leendert. "Agent Defense in Abstract Argumentation: Semantics and Principle-based Analysis." Journal of Argument & Computation (Under Submission).

- Yu, Liuwen; Zichichi, Mirko; Markovich, Réka; Bhattacharya, Sukriti; Najjar, Amro. "IHiBO: Intelligent Human-Input-Based Blockchain Oracle." IEEE Access (Under Submission).

Conference and Workshop Papers

- De Wit, Vincent, Liuwen Yu, Réka Markovich, and Amro Najjar. "Balancing (Normative) Reasons for the Intelligent Human-Input-Based Blockchain Oracle." In Causality, Agents and Large Models 2024 (CALM 2024) Proceedings, Communications in Computer and Information Science (CCIS) post-proceedings volume, 2024 (forthcoming).

- Alcarazi, Benoît; Nourbakhsh, Aria; Yu, Liuwen. "Assessing the Robustness of LLMs in Predicting Supports and Attacks." In Causality, Agents and Large Models 2024 (CALM 2024) Proceedings, Communications in Computer and Information Science (CCIS) post-proceedings volume, 2024 (forthcoming).

- Knoks, Aleks; Shao, Muyun; van der Torre, Leendert; De Wit, Vincent; Yu, Liuwen. "A Principle-Based Analysis for Numerical Balancing." Logics for New-Generation Artificial Intelligence (LNGAI2024). College Publications, United Kingdom, 2024.

- Yu, Liuwen; Al Anaissy, Caren; Vesic, Srdjan; Li, Xu; van der Torre, Leendert. "A Principle-Based Analysis of Bipolar Argumentation Semantics." In European Conference on Logics in Artificial Intelligence. Cham: Springer Nature Switzerland, 2023.

- Chen, Chen; Pardo, Pere; van der Torre, Leendert; Yu, Liuwen. "Weakest Link in Formal Argumentation: Lookahead and Principle-Based Analysis." In International Conference on Logic and Argumentation. Cham: Springer Nature Switzerland, 2023.

- Pardo, Pere; van der Torre, Leendert; Yu, Liuwen. "Advanced Intelligent Systems and Reasoning: Standardization, Experimentation, Explanation." In Logics for New Generation AI (LNGAI2023). College Publications, London, United Kingdom, 2023.

- Yu, Liuwen, and Dov Gabbay. "Case-Based Reasoning via Comparing the Strength Order of Features." International Workshop on Explainable, Transparent Autonomous Agents and Multi-Agent Systems. Cham: Springer International Publishing, 2022.
- Yu, Liuwen; Zichichi, Mirko; Markovich, Réka; Najjar, Amro. "Intelligent Human-Input-Based Blockchain Oracle (IHiBO)." In Proceedings of the 14th International Conference on Agents and Artificial Intelligence (ICAART 2022), pp. 1-12. SCITEPRESS, 2022.
- Yu, Liuwen; Zichichi, Mirko; Markovich, Réka; Najjar, Amro. "Enhancing Trust in Trust Services: Towards an Intelligent Human-Input-Based Blockchain Oracle (IHiBO)." In The 55th Annual Hawaii International Conference on System Sciences (HICSS 2022), 2022.
- Yu, Liuwen; Zichichi, Mirko; Markovich, Réka; Najjar, Amro. "Argumentation in Trust Services within a Blockchain Environment." In 33rd Benelux Conference on Artificial Intelligence and the 30th Belgian Dutch Conference on Machine Learning (BNAIC/BENELEARN 2021), 2021.
- Yu, Liuwen; Chen, Dongheng; Qiao, Lisha; Shen, Yiqi; van der Torre, Leendert. "A Principle-Based Analysis of Abstract Agent Argumentation Semantics." In Proceedings of the 18th International Conference on Principles of Knowledge Representation and Reasoning (KR 2021), 2021.
- Qiao, Lisha; Shen, Yiqi; Yu, Liuwen; Liao, Beishui; van der Torre, Leendert. "Arguing Coalitions in Abstract Argumentation." In Logics for New-Generation AI 2021, pp. 93-106. College Publications, 2021.
- Yu, Liuwen, Réka Markovich, and Leendert Van Der Torre. "Interpretations of support among arguments." Legal Knowledge and Information Systems. IOS Press, 2020. 194-203.
- Yu, Liuwen, and Leendert Van der Torre. "A principle-based approach to bipolar argumentation." NMR 2020 Workshop Notes. Vol. 227. 2020.

PERSONAL STATEMENT

I am an AI researcher focusing on **symbolic and hybrid approaches** for **human-level and human-centered AI** in application areas like **digital transformation of law and finance**. With an interdisciplinary background—having graduated from the **Law, Science, and Technology - joint doctoral program (LAST-JD)**—I am working towards bridging the gap between technological innovation and societal values.

AI encompasses **sub-symbolic AI that is data-driven models like Large Language Models (LLMs)**, and **symbolic AI, rooted in knowledge representation and reasoning (KRR)**. They offer complementary strengths, and both of them are transversal due to their applicability in so many different application domains. Rooted in KRR, my interests are in the **foundations of AI** and **general concerns about the use of AI**, particularly in the digital transformation of law and finance.

My first long-term goal is to **develop next-generation AI—human-level and human-centered**—by integrating symbolic and sub-symbolic AI to overcome the **limitations of data-driven methods**. For example, using **argumentation schemes** to enable **critical thinking** in chatbots, while **speech act and formal dialogue** guide meaningful interactions and reasoning about **individual agent's mental states** with **empathy and understanding**. Integrating LLMs with formal models for **ethics**, such as **balancing**—a key focus of my work—is essential.

The second long-term goal is rooted in my doctoral program LAST-JD, with over **100** graduates. Our aim is not only to address **challenges posed by emerging technologies like FinTech from legal and socio-ethical perspective** but also to **develop AI tools for legal applications**. AI, law, and finance are **complex systems**, and their interplay creates a **second-level complexity**. For instance, the interaction between AI and law involves **how AI is applied in law**, **how law regulates AI**, and **how law governs AI systems used in legal contexts**, creating a circular relationship. However, people in one field often **overlook the complexity** of another. For example, the complexity of the law is often overlooked by outsiders, leading to an oversimplified view of autonomy that risks undermining societal order by compromising justice and fundamental rights. Analogously, there is a distinction between AI ethics (regulating AI) and machine ethics (building AI to behave ethically), with the increasing complexity of their interaction.

Given these complex, interdisciplinary challenges, my research is conducted in collaboration with researchers from various disciplines, such as computer science, law, ethics, philosophy, finance, and engineering.

PERSONAL DETAILS – INDIVIDUAL NARRATIVE PROFILE

I did my bachelor's degree in Information Systems and Information Management, and I did my master's in Philosophy at **Zhejiang University**, which is the **top 3** university in China. I obtained my PhD in **Law, Science and Technology funded by Marie Skłodowska-Curie Action (LAST-JD-RIoE MSCA ITN)** from the University of Bologna and in Computer Science from the University of Luxembourg. Over 100 PhD have graduated from the LAST-JD program, creating a collaborative EU-wide network of experts, who fight together to seek the balance between AI and law. Marie Skłodowska-Curie Actions, the European Union's prestigious and highly sought-after flagship funding program, have been recognized under the **HORIZON EUROPE Strategy Plan** for fostering collaboration among top researchers worldwide and equipping them with advanced skills. My experience in the LAST-JD program not only enabled me to become an expert in AI but also broadened my study in applying AI to the digital transformation of law and Finance.

I am interested in **innovative formal techniques** that have **immediate practical applications** or **visionary potential**. During my PhD, I used formal argumentation to represent,

manage, and resolve conflicts in open and dynamic environments, providing effective explanations to humans and promoting ethical and legal behavior. For example, I use **argumentation as balancing** to model **child custody cases**. I also integrated **multi-agent argumentation with blockchain** envisioning applications in **financial systems requiring regulatory compliance**.

Following my Ph.D., I joined the **Computational Law and Machine Ethics (CLAiM)** group led by **Dr. Réka Markovich** at the University of Luxembourg as a postdoctoral researcher. I was involved in the **FNR-OPEN project DELIGHT (Deontic Logic for Epistemic Rights)**, developing formal frameworks and computational tools for reasoning about epistemic rights in normative systems. My role involved comparing various formal approaches and validating them with real-world use cases.

Currently, I am the sole postdoctoral researcher in the **Marie Speyer Excellence grant project DISCREASON** (Formal Analysis of Discretionary Reasoning – Deontic Logic and Formal Argumentation for Modeling Discretionary Decision-making in Legal Cases) of Dr. Réka Markovich. DISCREASON addresses the limitations of current KRR techniques in capturing discretion in legal decision-making—a critical challenge in the digital transformation of law. By applying formal approaches to selected legal cases, I aim to develop frameworks that model discretionary legal decision-making. In the meanwhile, I have been developing further my PhD ideas, and using them, I was **one of the main authors of the recently funded CORE project SERAFIN** (Symbolic and Explainable Regulatory AI for Finance Innovation). It is going to investigate deploying LLMs in multi-agent systems to assist in the resolution of complex intersections of financial regulatory provisions by providing reliable, relevant, and customized explanations.

KEY OUTPUTS, CONTRIBUTIONS, AND ACHIEVEMENTS

Contribution to community handbook The body of seminal work in the community of KRR is collected by leading authors of the field in the **handbook project**. I have been invited and contributed to the third volume of **Handbook of Formal Argumentation**. My PhD work led me to be the first author of the chapter **"Thirteen Challenges in Formal and Computational Argumentation"**. This chapter not only illustrates the breadth of argumentation research—spanning machine ethics, AI & law, and decision-making—but also provides a forward-looking vision that inspires the research community to tackle open questions and shape future directions.

Impact on the new-generation AI In my thesis, also witnessed in several conference papers, I proposed **Distributed Argumentation Technology**, a computational approach that incorporates argumentation reasoning mechanisms within multi-agent systems. Particularly, I explored the integration of argumentation theories with distributed ledger technologies like blockchain. As an instantiation, I proposed **IHiBO (Intelligent Human-input-based Blockchain Oracle)**, an AI tool for storing argumentation reasoning. IHiBO offers a decentralized and secure architecture for decision-making, addressing key concerns such as legal compliance, trust, transparency, and auditability. This is **taken over by other researchers in the field**, like the PhD student Vincent de Wit at the University of Luxembourg.

Attract funding in Competitive CORE round As a follow-up of my thesis, I was one of the main authors of the recently funded **CORE project SERAFIN** (Symbolic and Explainable Regulatory AI for Finance Innovation). The funding is **598K Euros**. Within SERAFIN, I aim to deploy LLMs in multi-agent systems to assist in resolving complex financial regulatory provisions by providing reliable, relevant, and customized explanations.

This approach enhances transparency and accountability in automated decision-making processes, which is essential for upholding fundamental rights and societal values.

Contribution to Foundations and Applications of Argumentation-based Reasoning I have worked intensively on the foundations of formal and computational argumentation and its application to legal reasoning, where argumentation is central. It is thus vital for the digital transformation of law. Next to the results of my thesis, I have research papers published at top conferences, like KR, JELIA, HICSS, and the main AI and law conference JURIX. For example, I have conducted an axiomatic analysis of various conceptualizations of formal argumentation—such as argumentation as inference, dialogue, and balancing. It provides systematic methodologies for comparing and guiding the choices of formal methods according to particular applications, laying the groundwork for advancements in formal argumentation across diverse domains.

TEACHING EXPERIENCE AND VISION

I have taught master courses like **Intelligent Systems: Agents and Reasoning**, which covers the basics of logic, including propositional logic and first-order logic; **Intelligent Agents 1**, including modal logic and formal argumentation; and the doctoral course **Introduction to Formal and Computational Argumentation**.

My teaching vision focuses on integrating **research-based methodologies** to build a dynamic and cutting-edge learning environment. I aim to connect my teaching with my ongoing research so that students can learn about the latest developments and ideas directly from recent studies. At the same time, I place significant emphasis on **foundational teaching**, particularly in core subjects such as discrete mathematics.

Currently, as part of a group teaching initiative, we are **drafting a comprehensive textbook encompassing four courses**. Our goal is to align terminologies and create a cohesive narrative for computer science students at our university, enabling them to gain a clear and coherent understanding of AI. This structured approach not only enhances their grasp of fundamental concepts but also aims to spark their interest in research.

Lastly, I enjoy trying **creative teaching methods**. For instance, in all my courses, I use Wooclap, an online interactive platform, to actively engage students and enhance their learning experience.

INTERNATIONAL RESEARCH NETWORK AND ACADEMIC SERVICE

I am the coordinator of **ZLAIRE (Zhejiang University – University of Luxembourg Joint Lab on Advanced Intelligent Systems and REasoning)**. I coordinate exchanges and joint activities. In 2023, I organized **ZALIRE kickoff**, bringing together researchers from China and Luxembourg. I also organized the workshop of **CALM 2024** (Causality, Agents, and Large Models) in Kyoto, Japan. I am also the reviews of top conference **AAMAS** and workshop **EXTRAAMAS**.

I enjoy collaborative research as it allows me to work together with and learn from experts from different fields. For example, I have visits **Zhejiang University** in China to lead research collaborations and teaching activities. It has resulted in several (top) conference papers and a journal article through ZLAIRE. Invited by Prof. Marie Bonnin, **a lawyer in environmental law**, to Cadi Ayyad University in Morocco, we have discussed topics on AI and environmental law. And I gave the talk on **Legal and Moral Reasoning Capabilities in Intelligent Machine**, and **Law, and Science, and Technology in Luxembourg**. Additionally, my visit to Prof. Marija Slavkovik at the University of Bergen in Norway, involves investigating **explainable AI and fairness in AI applications**. Another example is the visit to Dr. Srdjan Vesic in **CNRS researcher affiliated with CRIL (Lens)** in France, we collaborate

to work on KRR leads to top conference papers. I have also visited **Tsinghua University** which is top 1 in China, **Kyoto University** which is top 2 university in Japan, etc. These engagements have connected me with scholars across **Asia, Europe, and north Africa**. I pursue collaborations also by participating actively in conferences, workshops and summer schools, such as **ESSLLI2020, KR2021, JURIX2020, COMMA2022/2024**. I have also been invited to give talks at different occasions, such as the above-mentioned two in Morocco, in the conference **IEEE ICA2021**, seminar in University of Bergen, Tsinghua University, Kyoto University, and workshop **LNGAI**, etc.