PERSONAL DETAILS

Family name, first name: Yu, Liuwen
Contact: liuwen.yu@uni.lu
Website: https://yuliuwen.github.io/

Research profile

I am an artificial intelligence (AI) researcher with expertise in AI reasoning, focusing on symbolic and hybrid approaches to human-level and human-centred AI in application areas like the digital transformation of law and finance.

Education and key qualifications

- **2023** Joint Doctorate in LAST-JD-RIoE-MSCA-ITN (Law, Science and Technology Joint Doctorate: Rights of Internet of Everything - funded under the EU's Marie Skłodowska-Curie Action - Innovative Training Network)

  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

PARTICIPATION IN RESEARCH GRANTS

- **11.2024 – 10.2025** 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)

- **04.2024 – 09.2024** Postdoctoral researcher, Deontic Logic for Epistemic Rights (DELIGHT), *Fonds National de la Recherche* (FNR) OPEN research, Grant No. O20/14776480

- **11.2019 – 10.2022** Doctoral researcher in Law, Science and Technology Joint Doctorate: Rights of Internet of Everything, funded under the (Horizon 2020) Marie Skłodowska-Curie Action - Innovative Training Network (LAST-JD-RIoE-MSCA-ITN), EU Grant No. 814177

FUNDING OBTAINED

- **2024** Symbolic and Explainable Regulatory AI for Finance Innovation (SERAFIN), FNR CORE (Acceptance rate: 18%, Project budget: 598K euros)

ACADEMIC SERVICE

- Program committee chair of the 5th International Workshop on Logics for New-Generation Artificial Intelligence (LNGAI 2025 Forthcoming).
- Reviewer for the 24th International Conference on Autonomous Agents and Multiagent Systems 2025 (AAMAS 2025).
- Reviewer for the 6th International Workshop on EXplainable and TRAnsparent AI and Multi-Agent Systems (EXTRAAMAS 2024).
- Program committee chair of the 2024 workshop on Causality, Agents and Large Models (CALM 2024).
- Editor of the Computer and Information Science (CCIS) post-proceedings for CALM 2024.

IMPACT

- The continuation of my work by other researchers in the field, including PhD student Vincent de Wit.

ADDITIONAL INFORMATION

Organisation of scientific meetings

- **2024** ZLAIRE workshop: vision, strategy, and research collaboration, at Zhejiang University, China
- **2024** CALM 2024 in Kyoto, Japan.
- **2023** ICR & CLAiM workshop on "Distributed Argumentation Technology"
- **2023** Zhejiang University – University of Luxembourg Joint Lab on Advanced Intelligent Systems and REasoning (ZLAIRE) kick-off workshop.

Student supervision

- **2024** Tutor for Velija Delikj's bachelor semester project on autonomous cars
- **2022 - present** Advisor for Vincent de Wit, a doctoral researcher
- **2023 - present** Advisor for master's 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 drafts and teaching core subjects in computer science such as discrete mathematics, propositional logic and first-order logic.

- **06.2025** Course on *From Logic to Argumentation in AI* at **North American Summer School in Logic, Language, and Information 2025** (NASSLI 2025 Forthcoming)
- **09.2024 – 12.2024** Master's course: *Intelligent Systems: Agents and Reasoning*

- **04.2024 – 06.2024** Doctoral course: *Introduction to Formal and Computational Argumentation*
- **04.2024 – 06.2024** Master's course: *Intelligent Agents 1*

Academic visits

- **10.2024** Department of Information Science and Media Studies, University of Bergen
- **11.2023** Computer Science Department, Cadi Ayyad University, Morocco
- **10.2023** Artificial Intelligence and Data Engineering Department, Özyeğin University, Turkey
- **07.2023** National Institute of Informatics, Tokyo, Japan
- **11.2024, 12.2023, 07.2023** Department of Informatics, Kyoto University, Japan
- **11.2024, 06.2024, 12.2023, 06.2023** Institute of Logic and Cognition, Zhejiang University, China
- **10.2022** Centre de Recherche en Informatique de Lens, France

Talks

- **12.2024** Formal and computational argumentation in AI & law (invited Talk), Ningbo University, China
- **10.2024** Three Conceptualizations of Formal Argumentation (invited Talk), at the Logic & AI Seminar, University of Bergen, Norway
- **06.2024** Weakest Link, Prioritised Default Logic, and Principles in Argumentation (invited talk), at the 4th International Workshop on Logics for New-Generation Artificial Intelligence (LNGAI 2024), Zhejiang University, China
- **03.2024** Distributed Argumentation Technology (invited talk), at the 6th Madeira Workshop on Belief Revision, Argumentation, Ontologies, and Norms in Madeira, Portugal
- **11.2023** Legal and Moral Reasoning Capabilities in Intelligent Machines (invited talk), at the Computer Science Department, Cadi Ayyad University, Morocco
- **11.2023** Law, Science, and Technology in Luxembourg (invited talk), at the Computer Science Department of Cadi Ayyad University, Morocco
- **09.2023** From Distributed Argumentation Technology (DAT) to Dialogue Technology (DT), at the ZLAIRE kick-off workshop, Zhejiang University, China
- **05.2023** Principles and Practice of Formal Argumentation: Argument Strength, Acceptance, and Storage (invited talk), at Tsinghua University, China
- **05.2022** Case-based Reasoning via Comparing the Strength Order of Features, at the 4th International Workshop on EXplainable TRAnsparent AI and Multi-Agent Systems (EXTRAAMAS2022), online
- **01.2022** Enhancing Trust in Trust Services: Towards an Intelligent Human-input-based Blockchain Oracle (IHiBO), at the 55th Hawaii International Conference on System Sciences (HICSS 2022), online

- **12.2021** A Principle-Based Analysis of Abstract Agent Argumentation Semantics (invited talk), at the 5th Institute of Electrical and Electronics Engineers International Conference on Agents (IEEE ICA 2021), online
- **11.2021** A Principle-based Analysis of Abstract Agent Argumentation Semantics, at the 18th International Conference on Principles of Knowledge Representation and Reasoning (KR 2021), Italy
- **12.2020** Interpretations of Support Among Arguments, at the 33rd International Conference on Legal Knowledge and Information Systems (JURIX 2020), online
- **09.2020** The Principle-based Approach to Bipolar Argumentation, at the 18th International Workshop on Non-Monotonic Reasoning (NMR 2020), online
- **07.2020** The Principle-Based Approach to Bipolar Argumentation, at an ICR seminar at the University of Luxembourg
- **12.2019** On the Optimized Utilization of Smart Contracts in DLTs from the Perspective of Legal Representation and Legal Reasoning, at the 32nd International Conference on Legal Knowledge and Information Systems (JURIX 2019), Madrid, Spain

PUBLICATIONS

Book

1. Textbook on Formal and Computational Argumentation (in preparation)

Journal Articles

2. Yu, Liuwen; Markovich, Réka; and 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**.
3. Pardo, Pere; Yu, Liuwen; Chen, Chen; and van der Torre, Leendert. "Weakest Link, Prioritised Default Logic and Principles in Argumentation." Journal of Logic and Computation (forthcoming).
4. Yu, Liuwen; Li, Xu; and van der Torre, Leendert. "Agent Defense in Abstract Argumentation: Semantics and Principle-based Analysis." Journal of Argument & Computation (under review).
5. Yu, Liuwen; Zichichi, Mirko; Markovich, Réka; Bhattacharya, Sukriti; and Najjar, Amro. "IHiBO: Intelligent Human-Input-Based Blockchain Oracle." IEEE Access (under review).

Conference and Workshop Papers

6. De Wit, Vincent; Yu, Liuwen; Markovich, Réka; and Najjar, Amro. "Balancing (Normative) Reasons for the Intelligent Human-Input-Based Blockchain Oracle." In the Causality, Agents and Large Models 2024 (CALM 2024) workshop proceedings of the Communications in Computer and Information Science (CCIS) post-proceedings series, 2024 (forthcoming).
7. Alcaraz, Benoît; Nourbakhsh, Aria; and Yu, Liuwen. "Assessing the Robustness of LLMs in Predicting Supports and Attacks." In the Causality, Agents and Large Models 2024 (CALM 2024) workshop proceedings of the Communications in Computer and Information Science (CCIS) post-proceedings series, 2024 (forthcoming).

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

9. Yu, Liuwen; Al Anaissy, Caren; Vesic, Srdjan; Li, Xu; van der Torre, Leendert. "A Principle-Based Analysis of Bipolar Argumentation Semantics." In the 18th European Conference on Logics in Artificial Intelligence (JELIA). Cham: Springer Nature Switzerland, 2023.

10. Chen, Chen; Pardo, Pere; van der Torre, Leendert; Yu, Liuwen. "Weakest Link in Formal Argumentation: Lookahead and Principle-Based Analysis." In the 18th International Conference on Logic and Argumentation. Cham: Springer Nature Switzerland, 2023.

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

12. Yu, Liuwen, and Gabbay, Dov. "Case-Based Reasoning via Comparing the Strength Order of Features." In the 4th International Workshop on Explainable, Transparent Autonomous Agents and Multi-Agent Systems. Cham: Springer International Publishing, 2022.

13. Yu, Liuwen; Zichichi, Mirko; Markovich, Réka; and 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.

14. Yu, Liuwen; Zichichi, Mirko; Markovich, Réka; and 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.

15. Yu, Liuwen; Zichichi, Mirko; Markovich, Réka; and Najjar, Amro. "Argumentation in Trust Services within a Blockchain Environment." In the 33rd Benelux Conference on Artificial Intelligence and the 30th Belgian Dutch Conference on Machine Learning (BNAIC/BENELEARN 2021), 2021.

16. Yu, Liuwen; Chen, Dongheng; Qiao, Lisha; Shen, Yiqi; and van der Torre, Leendert. "A Principle-Based Analysis of Abstract Agent Argumentation Semantics." In the proceedings of the 18th International Conference on Principles of Knowledge Representation and Reasoning (KR 2021), 2021.

17. Qiao, Lisha; Shen, Yiqi; Yu, Liuwen; Liao, Beishui; and van der Torre, Leendert. "Arguing Coalitions in Abstract Argumentation." In Logics for New-Generation AI 2021, pp. 93-106. College Publications, 2021.

18. Yu, Liuwen, Réka Markovich, and Leendert Van Der Torre. "Interpretations of support among arguments." Legal Knowledge and Information Systems. IOS Press, 2020. 194-203.

19. 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 with expertise in AI reasoning, focusing on **symbolic and hybrid approaches** to **human-level and human-centred AI** in application areas like the **digital transformation of law and finance**. With an interdisciplinary background — having graduated from the EU programme Law, Science and Technology Joint Doctorate - Rights of Internet of Everything funded by Marie Skłodowska-Curie Action - Innovative Training Network (LAST-JD-RIoE-MSCA-ITN) — I am working towards bridging the gap between technological innovation and upholding societal values.

AI encompasses sub-symbolic AI, including data-driven models such as **large language models (LLMs)** and symbolic AI, which is rooted in **knowledge representation and reasoning (KRR)**. Their strengths are complementary, and both are widespread due to their applicability in so many different application domains. With a solid background in KRR, my interests lie 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 human-level and human-centred AI by integrating symbolic and sub-symbolic approaches to overcome the **limitations of data-driven methods**. For example, argumentation schemes can be used to enable **critical thinking** in chatbots, while speech act and formal dialogue guide meaningful interactions and reasoning about individual agents' mental states with **empathy and understanding**. Integrating LLMs with formal models for **ethics** like balancing, which is essential and a key focus of my work.

The second long-term goal is rooted in the LAST-JD European doctoral programme, which has had a strong network of over **100** graduates with different expertise since 2011. Our aim is not only to address challenges posed by emerging technologies like financial technology (FinTech) from a 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 the law regulates AI, and how the law governs AI systems used in legal contexts, which creates a circular relationship. Through the resources and network of LAST-JD, I have collaborated with legal experts, gained better access to real-world cases, and studied them through the lens of KRR. Beyond legal experts, I also engage with professionals from the diverse fields of computer science, ethics, philosophy, finance, and engineering. These experiences have deepened my understanding of the interactions between these domains, shaping my proposals for a CORE Junior project and, subsequently, an European Research Council (ERC) grant to explore interdisciplinary challenges.

PERSONAL DETAILS – INDIVIDUAL NARRATIVE PROFILE

I did my bachelor's degree in Information Systems and Information Management and I did my master's degree in Philosophy at **Zhejiang University**, which is one of the **top 3** universities in China. I obtained my PhD from the LAST-JD-RIoE-MSCA-INT programme and a PhD in Computer Science from the University of Luxembourg. **Marie Skłodowska-Curie Actions**, the European Union's prestigious and highly sought-after flagship funding programme, have been recognised 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 programme 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, both those that have immediate practical applications and those that have visionary potential. During my PhD studies, I used formal argumentation to represent, manage, and resolve conflicts in open and dynamic environments, to provide effective explanations for humans, and to promote ethical and legal behaviour. For example, I used **argumentation as balancing** to model **child custody cases** [18]. I also

integrated **multi-agent argumentation with blockchain**, envisioning its applications in **financial systems requiring regulatory compliance** [13, 14].

After my PhD, I was selected to join 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 Deontic Logic for Epistemic Rights (DELIGHT) FNR-OPEN project, 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 a Marie Speyer Excellence grant project called Formal Analysis of Discretionary Reasoning – Deontic Logic and Formal Argumentation for Modeling Discretionary Decision-making in Legal Cases (DISCREASON), led by Dr. Réka Markovich. DISCREASON addresses the limitations of current KRR techniques in capturing discretion in legal decision-making—a critical challenge for the digital transformation of law. By applying formal argumentation to selected legal cases, I aim to develop frameworks that model discretionary legal decision-making. At the same time, I have been further developing and using my PhD ideas. I was **one of the main authors of the recently CORE-funded project Symbolic and Explainable Regulatory AI for Finance Innovation (SERAFIN)**, with the acceptance rate being **18%**. The project investigates deploying LLMs in multi-agent systems to assist in the resolution of complex intersections of financial regulatory provisions by providing reliable, relevant, and customised 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 on the topic of the **handbook project**. Upon invitation, I contributed to the third volume of the **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 new-generation AI. In my thesis and several conference papers, I proposed **Distributed Argumentation Technology**, a computational approach that incorporates argumentation reasoning mechanisms within multi-agent systems. In particular, I explored the integration of argumentation theories with distributed ledger technologies like blockchain. For the implementation, I proposed **IHiBO (Intelligent Human-Input-Based Blockchain Oracle)**, an AI tool for storing argumentation reasoning. IHiBO offers a decentralised and secure architecture for decision-making, addressing key concerns such as legal compliance, trust, transparency, and auditability. This work is being **continued by other researchers in the field**, including the PhD student Vincent de Wit, who is working on an extension of IHiBO at the University of Luxembourg.

Attracting funding in a competitive CORE round. Following on from my thesis, I was one of the main authors of a recently **CORE-funded project** called Symbolic and Explainable Regulatory AI for Finance Innovation **(SERAFIN)**. The funding is **598K euros**. Within SERAFIN, I aim to deploy LLMs in multi-agent systems to help resolve complex financial regulatory provisions by providing reliable, relevant, and customised explanations. This approach enhances transparency and accountability in automated decision-making processes, which is essential for upholding fundamental rights and societal values.

Contribution to the foundations and applications of formal argumentation. I have worked intensively on the foundations of formal and computational argumentation and its application to legal reasoning, where argumentation is central, so this is vital for the digital transformation of law. In relation to the results of my thesis, I have had research papers published at top conferences like **KR, JELIA, HICSS** as well as **JURIX**, one of the main AI & law conferences. For example, I have conducted an axiomatic analysis of various conceptualisations of formal argumentation such as argumentation as inference, dialogue, and balancing. It provides systematic methodologies for comparing and guiding the choices of formal methods in accordance with particular applications, laying the groundwork for advancements in formal argumentation across different domains.

TEACHING EXPERIENCE AND VISION

I have taught master's courses like **Intelligent Systems: Agents and Reasoning** (which covers the basics of logic, including propositional logic and first-order logic) and **Intelligent Agents 1** (including modal logic and formal argumentation) as well as 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 out **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 organised the **ZLAIRE kick-off** seminar, bringing together researchers from China and Luxembourg. I also organised the workshop of **CALM 2024** (Causality, Agents, and Large Models) in Kyoto, Japan. I am also the reviewer of the top conference **AAMAS** and the workshop **EXTRAAMAS**.

I enjoy collaborative research as it allows me to work with and learn from experts in different fields. For example, I visited Zhejiang University in China to lead research collaborations and teaching activities. It resulted in several (top) conference papers and a journal article through ZLAIRE. Invited by Prof. Marie Bonnin, **an expert in environmental law**, to Cadi Ayyad University in Morocco, we discussed topics related to AI and environmental law. I also gave talks on **"Legal and Moral Reasoning Capabilities in Intelligent Machines"** and **"Law, Science, and Technology in Luxembourg"**. Additionally, my visit to collaborate with Prof. Marija Slavkovik at the University of Bergen in Norway involved investigating **explainable AI and fairness in AI applications**. Another example is my visit to collaborate with Dr. Srdjan Vesic, at Centre National de la Recherche Scientifique (CNRS) researcher affiliated with Centre de Recherche en Informatique de Lens (CRIL), France. We collaborated on KRR, resulting in publications at top conferences. I also visited **Tsinghua University** (ranked no.

1 in China), **Kyoto University** (ranked no. 2 in Japan), and others. These engagements have connected me with scholars across **Asia, Europe, and North Africa**. I have actively pursued collaborations by participating in conferences, workshops, and summer schools such as European Summer School in Logic, Language, and Information (ESSLLI) 2020, KR 2021, JURIX 2020, and International Conference on Computational Models of Argument (COMMA) 2022 and 2024. Moreover, I have been invited to give talks on several occasions, including the two in Morocco mentioned above, at IEEE ICA 2021, seminars at the University of Bergen, Tsinghua University, and Kyoto University, as well as workshops such as LNGAI, among others.