

Academic Corner

Hang Su



In this issue, we interview IEEE SMC member Domenico Lofù. Domenico is currently an Assistant Professor at Polytechnic University of Bari, Italy, since December 2024. He obtained his Ph.D. in Information Engineering from Department of Electrical and Information Engineering (DEI), Polytechnic University of Bari, Italy, in December 2022. He received his Master's degree with full marks in Computer Engineering at Politecnico di Bari, Italy. From 2019 to 2023, he worked as Security&AI Researcher at Innovation Lab (ILAB) of Exprivia S.p.A., Italy, where he was also involved in the EU H2020 ECHO Project. He also serves in the TPC of several conferences and works on several EU projects. His major research interests include artificial intelligence for Intelligent Systems for Healthcare and Information Security.

(1) What inspired you to pursue a career in Information Processing Systems and Artificial Intelligence? Were there any key events or projects that significantly shaped your research direction?

During my Master's at the Polytechnic University of Bari (Italy), in 2017, I attended a course titled "Logic and Artificial Intelligence" taught by Prof. Tommaso Di Noia. The course ignited the first spark that helped me identify the interests I wanted to pursue in my future. Indeed, after gaining foundational knowledge from the course, I began exploring how AI could assist in solving daily challenges.

I started by applying AI to a domain that had been my passion since childhood. Specifically, I became curious about how AI could become a supportive tool in fields like cybersecurity and healthcare. Cybersecurity has always been a passion, while healthcare resonated with me deeply because I grew up surrounded by medicine, with my father being a medical doctor and my mother a biologist. This upbringing inspired me to think about ways I could help them address their daily challenges using AI.

While continuing my studies during my Master, in 2018 I participated in an industrial research program, called the "Apulia-Israel Joint Accelerator". This program was a collaborative initiative between my university and the Technion University (Israel). Activities were focused on designing a Big Data Management system for handling data collected from UAVs and exploring how AI could enhance the management of such data. These experiences were pivotal in shaping my understanding that AI would soon become an enabling technology capable of addressing many of the unresolved challenges we face daily.

(2) You have applied AI techniques to the field of Information Security in various projects. What do you see as the biggest challenges in this intersection, and what methodologies or technologies show promise in addressing them?

As a child, my passion has always been cybersecurity. During my master's studies in Computer Engineering, I found the perfect opportunity to merge AI techniques with the domain of cybersecurity. Specifically, through research activities in AI and Security, I realized that data lies at the heart of an emerging ecosystem of information management and protection. This ecosystem has become a fundamental pillar in the Information Security research community. Data, beyond being generated, must be protected. This approach to data protection and security becomes increasingly critical, especially when dealing with sensitive information.

I believe that the significant use of computational resources to solve complex tasks, not only in Machine Learning (ML) but also in Deep Learning (DL), will eventually lead the scientific community to grapple with challenging questions, such as: 'How much energy will be required to solve a specific

task?’ or ‘How long can we afford to overlook energy as a critical parameter in our training and testing processes?’ Energy will become a central theme—it represents a major research challenge, and whoever wins this challenge will shape the processes that nations use to govern the world in the coming decades. For this reason, I believe the scientific community must begin to focus on designing “low-energy power” algorithms that can be run on increasingly miniaturized devices. The issue of ‘hardware resource reuse’ will also become crucial. Neuromorphic computing is starting to put out a space in this area: designing software-side algorithms that are not only highly efficient but also achieve the same objectives with reduced (and sometimes limited) energy resources, capable of being processed on embedded, miniaturized machines.

(3) Your research includes applying intelligent systems to healthcare. How do you envision the role of AI evolving in this domain over the next 5-10 years? Are there any underexplored opportunities that you find particularly exciting?

AI has become an enabling technology that is now utilized across all domains that intersect with our daily activities. I believe one of AI's most significant contributions is in the healthcare domain. It's the most critical because doctors are tasked with saving human lives and having tools that can support (and sometimes accelerate) analyses and processes—ones that might take humans days, months, or even years to complete—delivering results in just a few minutes, can truly be a game-changer. However, it's important not to make the mistake of thinking AI can completely replace humans. In my view, AI should and will serve as a -increasingly relevant- support tool.

In this regard, I recommend reading Paolo Benanti's book, ‘Human in the Loop, Human Decisions and Artificial Intelligences,’ which explores the major ethical questions surrounding AI. The book aims to make the impact of this technological revolution visible and comprehensible while addressing what actions are needed to manage it and how to ensure humans remain central to decision-making. Paolo Benanti, a Franciscan monk, leads the Italian government's task force on AI.

I believe that research in the health domain over the next decade will solve very complex tasks, such as the early identification of potential cancerous pathologies. This will be a turning point, not only in terms of pure scientific research but also because early detection of cancer reduces hospitalizations and, consequently, lowers healthcare system management costs. In short, investing in scientific research, particularly in this field, benefits everyone—especially those in governance.

(4) Having worked as a Security & AI Researcher at Exprivia S.p.A. and participated in several EU H2020 projects, how has your transition from industry to academia influenced your research approach and perspective?

The second year of my master's degree program was packed with activities. During that year, in addition to working on a research project in partnership with the Technion, I also began working in the private sector, where I stayed for about five years. I was recruited by Exprivia S.p.A. as a researcher, an international IT company located in Puglia (IT), where I was involved in the research area. A few months after my master's thesis, I pursued an industrial PhD, applying AI techniques I studied at university to real-world applications in the company. During my time at Exprivia, I had the opportunity to contribute to the H2020 ECHO project. ECHO was one of the four pilot projects (ECHO, CyberSec4Europe, Sparta, and Concordia) funded by the EU in the field of cybersecurity.

This period confirmed my desire to teach and train in research. Furthermore, these years of industrial research allowed me to develop skills that, due to differing priorities, are not typically acquired in a purely academic research environment. Moreover, I came to understand that research in and of itself has its limitations. For research outcomes to have a future, they must be transformed into industrial products—a process that requires excellence not only in research but also in industrial production.

When I completed my PhD, I found myself increasingly drawn to academic research, particularly the work conducted at the SisInflab laboratory of Polytechnic University of Bari. It has over 45 members and develops activities around artificial intelligence systems. What stood out to me was the lab's focus on aligning research investigations with tangible industrial products. This motivated me to apply for a researcher position, which I successfully secured.

I believe that the background I gained during my time in the private sector serves as a guiding light in my current activities. It taught me that research should always be approached with a vision for what comes next. This forward-looking mindset is critical for anticipating the potential industrial impact of the research we conduct daily with our colleagues.

(5) What advice would you give to young researchers who are interested in pursuing careers in Artificial Intelligence or Information Security? How can they identify and develop their interests in interdisciplinary fields?

To anyone considering a research path in AI or Security, my advice is first of all to study diligently as the old advice about the ratio between perspiration and inspiration stays true. Both AI and Security are incredibly promising fields from a research perspective, and I believe they will revolutionize the research landscape for at least the next 10 years.

AI is now being used across all domains to address their challenges, from automotive to healthcare, manufacturing, management systems, and beyond. I strongly believe we should introduce AI as a core subject in the early years of undergraduate programs because it has become such a disruptive tool that it is essential for solving virtually any kind of problem.

At the same time, it's critical to safeguard the data we use to train and test our AI models, the results of computations, and the communication channels over which connections are established. In short, the intersection of these two domains will undoubtedly be a driving force for research innovation in the coming years.

(6) You've been involved in international research projects like the EU H2020 initiatives. What is your view on the importance of international collaboration in advancing research? What advice would you give to young academics seeking to engage in global research networks?

Participating in the ECHO project was my first opportunity to be part of an international initiative that required daily collaboration with multidisciplinary research teams from across Europe. This experience allowed me to engage with teams conducting research in AI and Security from various European countries. Working on tasks that necessitated collaboration among diverse teams helped me truly appreciate the value of EU cooperation. Scientific communities sometimes have different visions, even when it comes to solving the same research problem.

Through this experience, I was exposed to new technologies, studied innovative algorithms, and, most importantly, learned how research teams operate in other parts of Europe. Research achieves its goals more effectively when it becomes universal—when more people collaborate, and the research objectives become shared goals.

A piece of advice for young researchers eager to pursue a career in research: strive to expand your team and network. When you solve a problem, don't consider it the final goal; instead, start envisioning the next step. Work with individuals from different nationalities. Share your knowledge in multidisciplinary teams where there is a rich exchange of experiences and expertise. We achieve greatness when our knowledge reaches someone on the other side of the world. I believe this concept embodies one of the most beautiful and essential aspects of the world of research.