

As a child, Meeyoung “Mia” Cha had a dream: she wanted to be an astrophysicist. But her path took a different turn. After a challenging time at school, she decided not to reach for the stars, but to pursue computer science instead. Today, as a Director at the Max Planck Institute for Security and Privacy she studies how artificial intelligence and social media are changing society.

TEXT: FINN BROCKERHOFF

Appointments like today’s have become an increasingly significant part of Mia Cha’s schedule for a little over a year: a conference room; Cha at the podium; surrounded by dozens of political and business leaders. This time, it is for the annual German-Korean Forum, with delegations from Germany and South Korea gathered in the futuristic setting of the Transparent Factory, a Volkswagen electric car plant in Dresden. They want to discuss future cooperation between the two countries. “I think the cooperation between Germany and Korea in the field of artificial intelligence holds immense potential for both countries,” says Cha, Director at the Max Planck Institute for Security and Privacy in Bochum since December 2023.

Cha, who investigates social science questions using big data, was invited by the forum organizers to give an overview of the possibilities and importance of cross-border cooperation in the field of AI. As a Korean computer scientist at a German research institute, she can offer insights into the research infrastructures of both countries and sees herself as a mediator in scientific cooperation.

“Germany has a strong industrial sector and offers unparalleled research opportunities, such as those at the Max Planck Institutes,” says Cha. Korea, for its part, has a lot of young talent in AI research, partly because a select number of young people are introduced to science at an early age in Korean science high schools. “I, myself, received such specialized education in high school and subsequently at university in Korea. I know from personal experience how extensive and thorough the scientific education is in Korea,” says Cha.

Cha credits her father for her decision to pursue a career in science. As they walked to her elementary school through the thick fog that enveloped their hometown of Chuncheon in the northern province of Gangwon almost every morning, her fa- →

VISIT TO

MEEYOUNG
CHA



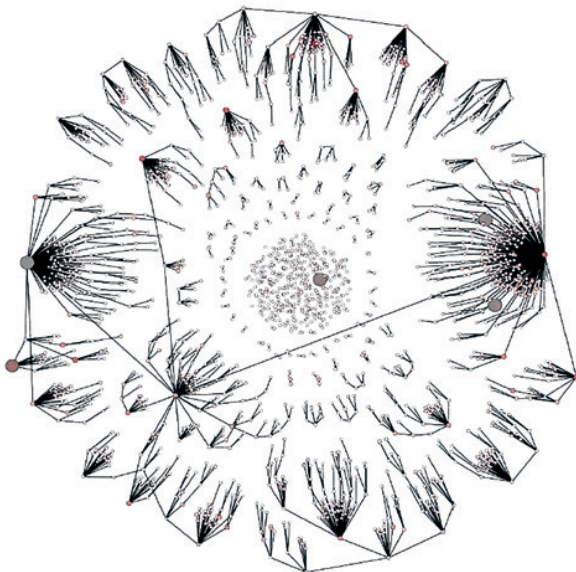
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41

At the intersection of computer science and society: Mia Cha's research interests include how people connect through the Internet and how information spreads through social media.



Each dot represents a Twitter account post about a particular rumor (top) or fact (bottom), and each line represents a retweet or reply. Both rumor and fact are popular (resulting in a large number of dots), but users are more likely to interact with the factual posts. These graphs, analyzed using computer algorithms, help fact checkers quickly review large amounts of data.



42

ther told her about his work. “As a professor of nuclear physics, his duties included taking water samples from rivers near the North Korean border and determining from the radioactive contamination whether North Korea was conducting nuclear tests. “He taught me a lot about nuclear reactions, including those in space. He explained how stars are born and how they die. That totally fascinated me back then.” A detailed picture of the universe quickly formed in her mind – and with it, the desire to become an astrophysicist.

When Cha’s parents suggested that she continue her education at a newly established science high school in the nearby city of Wonju, she agreed. “These Korean science high schools are exclusive institutions with a very difficult entrance exam and almost guaranteed professional prospects. You spend practically all of your school time in the dormitory, studying from 8 in the morning until 11 at night,” explains Cha. For many, this career path is very demanding, but it is also a positive and enriching experience. Unfortunately, for her it was quite different: with no time for preparatory courses, young Mia Cha barely passed the entrance exam: “I was at the bottom of the class. And unlike today, there were very few girls at the science high school, and I had almost no friends there. After a few weeks, I hated everything there and just wanted to leave.” She decided to escape by taking a leap forward: a gifted and talented program. In fact, she became one of the top students and completed the degree program in two years instead of three. But the price was high: “It took me several years to mentally recover from the stress.”

While Cha looks back on her high school years as an empowering experience that made her tougher for the rest of her life, she wouldn’t wish such an unpleasant school experience on her children. Since Cha moved with her family from Korea to Bochum in the spring of 2024, she has paid a lot of attention to how her two children are doing in their new schools in Germany. “My daughter is 12 and attends a public high school (Gymnasium), and my 6-year-old son started elementary school last summer. Apart from two extra German lessons a week, they are attending regular classes and doing well,” says Cha. “They already speak much better German than me. And when I ask them how school is going, they both just tell me not to worry so much.”

Although Cha will never forget the hardships she endured during her high school years, her excellent academic performance at least gave her the opportu-

nity to study at the prestigious Korea Advanced Institute of Science and Technology (Kaist) without the usual admission requirements. She would have loved to finally realize her dream of becoming an astrophysicist. But there was no astrophysics degree program at Kaist.

On the recommendation of her father, she began studying computer science in 1998. “He said that more and more people were needed in astrophysics to analyze the large amounts of data, and programming skills were the most important foundation for this.” But she had gained little real programming experience to that point. “However, my father was one of the first in my hometown to have Internet access at the office. When I had two weeks of school vacation in the summer of 1995, I was allowed to try it out for myself. There were only a few dozen websites, but they fascinated me immediately.”

discipline – be it economics, environmental sciences, or social sciences – because computer science methods are now used in research everywhere. “Especially with big data, deep learning, and artificial intelligence, the possibilities have expanded drastically again,” says Cha. “It’s not so much about being a good programmer.” What’s much more important is thinking and questioning. “I was never a programming guru myself. But because I spent a lot of time alone in my childhood, I was frequently wrapped up in my own thoughts and could visualize things very clearly in my mind. And I think that helps me in my research today.” This became clear to Cha, for example, when she was working on her dissertation.

In the mid-2000s, IPTV, the transmission of television programs and movies via the Internet Protocol, was booming. But the networks of the time were not up

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43

Cha instantly had the desire to program her own website. But since she didn’t have access to any manuals or books on the subject, she instead set about reading the source code of the existing websites and reverse-engineering them. “I spent a few days developing my own website and taught myself a rudimentary understanding of programming.” Later, at the university, she quickly built on this technical foundation with the same motivation. “It was while studying computer science that I really blossomed for the first time – and started to enjoy life.” During this time, she finally took the time for personal things that had been denied in her youth due to endless studying. “For example, I drove a fancy sports car at the time,” the scientist says with a laugh.

What Cha likes most about computer science is the variety of possibilities. “Some subfields are quite abstract and mathematical, others are very concrete and application oriented.” In addition, computer science can be linked to almost any other scientific

to the task. Often, data packets would not reach their destination on the way from the IPTV provider to the end user because certain paths were congested. This caused interruptions and errors in the transmission. “In my dissertation, I looked at how to increase the reliability of data transmission.” To do this, Cha searched for an algorithm that would calculate the best alternatives and detours for each “congested” route. In essence, this problem was purely mathematical. “But when I visualized the complex transmission paths of the data, I immediately realized that the problem was multifaceted. In practice, the choice of the best route depends heavily on the customer’s usage patterns.” She concluded that there must be a predictable pattern for the use of certain routes, which was dependent on socio-demographic factors such as population density, age distribution or political orientation. “Where do people live? What is the composition of their household? What topics are they interested in? All of this affects network use.” Cha analyzed the viewing habits of a

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quarter of a million IPTV users and applied the results to optimize the distribution algorithm.

“It became clear to me that the combination of computer science and social science could change things for the better in society,” says the scientist. After completing her Ph.D., she spent two years as a post-doc at the Max Planck Institute for Software Systems (MPI-SWS) in Saarbrücken, where her research increasingly focused on questions of social

Covid-19 pandemic, my research team and I tracked how misinformation about the virus spread on social networks,” Cha says. “When we saw that, we felt the responsibility to do something about it. That’s why we launched the Facts Before Rumors campaign to effectively combat fake news. Thanks to our research, we were familiar with the distribution patterns of fake news and were able to systematically disseminate fact checks around the world before the misinformation arrived in those areas.”

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science. “I was interested in how people connect through the Internet and how they are connected to each other through social media.” In 2010, she published the paper “Measuring User Influence in Twitter: The Million Follower Fallacy”, analyzing 54 million Twitter accounts to show that users with large numbers of followers do not necessarily have significant social influence. The paper received considerable attention at the time and has been cited nearly 5000 times to date.

In 2010, Cha returned to Kaist, where she spent the following years as an assistant professor in various areas of applied computer science. From 2015 to 2016, she was also a visiting professor at Facebook (now Meta). “It was very exciting to gain a deep insight into how the platform works. Having access to the platform’s incredible datasets was like being a kid in a candy shop. But I longed to delve deeper into basic scientific research.” So, when the opportunity arose in 2019 to establish the Pioneer Research Center for Mathematical and Computational Sciences as the lead scientist at the Institute for Basic Science (IBS) in South Korea, she immediately agreed. “Interestingly, the IBS was modeled on Germany’s Max Planck Institutes and also offers the freedom to conduct high-risk, long-term basic research. So, I was able to do research there with much greater freedom and autonomy.” Since then, Cha’s research has focused on how information spreads through social media. Her current focus is on AI-based fake news detection: “During the

According to Cha, whether social media has a positive or negative impact on society depends largely on the underlying algorithms of the platforms. Currently, these are designed to keep users on the platform as long as possible and maximize operator profits. Conversely, Cha believes that algorithms could just as easily be tweaked to show users content that truly enriches their lives. She and her research group in Bochum will continue to study how this can be achieved. “My team is still in the process of moving. But soon we’ll really get started here,” she says, visibly excited. She plans to collaborate with the Max Planck Society’s social and neuroscience institutes to study how people process social media content in the brain. “Understanding how people respond to certain content and why they use platforms in certain ways will help us better address issues like fake news, hate speech, or psychological harm in the future.

As Cha emphasized at the German-Korean Forum in Dresden, the expansion of applied AI research offers great potential to positively impact the safety, health, and general



well-being of society. “The goal is to do data science for humanity,” she explains, summarizing the idea at the end of her presentation to delegates from Germany and Korea. This includes not only social media but, more recently, satellite data. “Our AI algorithms identify features in the images that correlate with poverty, for example.” Damage from the impacts of climate change can also be easily and cost-effectively monitored using AI analytics.

This practical and solution-oriented approach to research has made Cha a sought-after scientific advisor. Just days after the forum, she was invited to speak at the United Nations World Health Summit in October 2024, where she participated in a panel discussion titled “Can AI improve public trust in science?” She is also part of a committee advising UN Secretary-General António Guterres on the ethical issues of artificial intelligence. Despite her many new responsibilities, she finds time for her personal life – even more than before: “In Korea, work was all I had, and my children had a nanny.”

But since moving to Bochum, her family has become more of a focal point, Cha says. “It’s very important to me that they are happy here in Germany.” The next thing she really needs to do is learn German, Cha says with a laugh: “During my postdoc time in Saarbrücken, I always managed quite well with English.”

In whatever free time she has, Cha likes to read: “My goal is to read 60 books a year.” So far, she has only gotten through 30, but she isn’t stressed about it. “I just love being alone with my thoughts over a cup of coffee.” During these moments, she often thinks about her future. “I have a whole list of ideas and wishes.” Recently, she imagined what her farewell party at the Max Planck Institute might look like more than 20 years from now: “I imagine thanking all my colleagues and friends in perfect German. And I hope to feel that I’ve made a difference with my work. Not only for research and scientific cooperation between Germany and Korea, but also for society.” ←

Can AI increase public trust in science? Max Planck Society President Patrick Cramer (center) discusses this question with Mia Cha (second from right) and experts in global health management at the World Health Summit 2024.



PHOTO: MPI FOR SECURITY AND PRIVACY (MPI-SP)