

- [01] Artificial intelligence: Bosch presents AI Young Researcher Award**
- [02] Machine learning: Bosch sends sensor system to ISS**
- [03] Artificial intelligence: Bosch is expanding its involvement in Cyber Valley**
- [04] Cyber Valley: top researcher Matthias Hein appointed Bosch-endowed chair**
- [05] Cyber Valley: Bosch establishes an endowed chair for machine learning**
- [06] Keeping tomatoes healthy**
- [07] Artificial intelligence: Bosch and University of Amsterdam to cooperate closely**
- [08] Artificial intelligence: Germans see no reason to fear robot coworkers**
- [09] Research on artificial intelligence**
- [10] Bosch AI mission-bound to the ISS**

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Artificial intelligence: Bosch presents AI Young Researcher Award Award-winner teaches algorithms to learn

October 29, 2019
PI 9446 RB Cwi/BT

- ▶ Junior researcher Gergely Neu receives 50,000 euros in prize money
- ▶ Neu praised for his research in the domain of reinforcement learning
- ▶ Bosch CDO/CTO Dr. Michael Bolle: “Neu’s work is helping to make artificial intelligence more robust, more reliable, and more understandable.”

Stuttgart, Germany – Bosch has presented the Bosch AI Young Researcher Award, endowed with 50,000 euros, for the first time. Dr. Gergely Neu, scientist at Pompeu Fabra University in Barcelona, won the jury over with his basic research in reinforcement learning (RL), an area of artificial intelligence (AI). Dr. Michael Bolle, management board member, Chief Digital Officer and Chief Technology Officer at Bosch, congratulated the 34-year-old honoree on his excellent achievements as he presented him with the Bosch AI Young Researcher Award at Bosch AI CON 2019 in Renningen. “This award is a way for the Bosch Center for Artificial Intelligence to recognize the exceptional achievements of young researchers in artificial intelligence,” Bolle says. “Gergely Neu’s research plays a major role in making AI more robust, more reliable, and more understandable.” The five-person jury of researchers from academia and industry reviewed submissions from across Europe and honored Neu’s application as the most promising, not least due to his research on probability theory. Neu’s work focuses on known “multi-armed bandit problems” through which algorithms learn to find their way through countless situations that can be combined in myriad ways.

Award winner Dr. Neu aims to bring AI theory and practice closer together

Neu considers a two-way exchange between academic and industry AI research to be essential, as mutual benefitting is the only way for each area to expand its knowledge. “I am very honored to accept this award, and I’m especially pleased to see Bosch’s commitment to supporting academic research,” Neu says. “In recent years, many talented AI researchers have been leaving academia for lucrative jobs in industry, so prizes like the Bosch AI Young Researcher Award

play an important part in increasing the prestige of traditional academic careers.” Neu plans to invest the 50,000 euro prize money towards amplifying his group’s current collaborations and creating new ones by inviting guest researchers to his laboratory and by enabling his own team to be visiting researchers at other laboratories and to attend conferences.

Reinforcement learning: when machines learn the way children do

For more than ten years, the Hungarian scientist has been conducting research in the field of reinforcement learning, or RL. RL is an area of machine learning in which algorithms learn, intuitively and through experimenting, how their surroundings are constructed and what rules apply – much the same way a child explores the world and discovers what works and what doesn’t. Neu investigates at what point existing RL algorithms reach their limits and why, using his findings to develop robust algorithms that perform reliably. In AI applications such as highly automated vehicles, automated financial trading systems, or intelligent power grids, reliability and stable performance are essential. Together with his team, Neu develops algorithms under conditions that are as realistic as possible: he exposes them to new environments and unknown situations, asks them to make vast numbers of decisions, and then examines the factors that led to success or failure. Unlike most empirical research in RL, Neu has decided to try to understand RL’s underlying logic and functions in order to pave the way for robust generalizing methods. Solving this would ultimately advance all fields of application. With his basic research, the passionate scientist is improving the performance and reliability of algorithms – which he believes are one of the main obstacles to a more frequent use of AI solutions.

About Dr. Gergely Neu

As an expert and speaker at the most prominent scientific AI conferences and workshops (e.g. ICML, DALI, ALT, NeurIPS, ICLR), Neu is not an unknown name in the community. Before joining the Artificial Intelligence Group at Pompeu Fabra University in Barcelona in 2015, the AI researcher was already doing excellent work in Lille as a postdoc on the SequeL Team at the world-renowned INRIA institute (French research institute for digital sciences). He earned his doctorate from the Budapest University of Technology and Economics in 2013. His most recent appointment was as a visiting researcher at Google Brain in Zurich, where he focused on industry-relevant science, and he is already looking forward to spending the second half of 2020 at the Simons Institute at the University of California, Berkeley.

About the Bosch AI Young Researcher Award

With the annual Bosch AI Young Researcher Award, Bosch supports scientists whose outstanding achievements help make artificial intelligence increasingly robust, reliable, and easier to interpret. The jury, made up of researchers from academia and industry, evaluate the submissions according to criteria such as relevance, scientific quality, and innovativeness.

Applications for the Bosch AI Young Researcher Award 2020 will open in the spring of next year.

More information about the Bosch AI Young Researcher Award 2019 is available at www.bosch-ai.com/young-researcher-award.

Press photo: #535824

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The Bosch Group is a leading global supplier of technology and services. It employs roughly 410,000 associates worldwide (as of December 31, 2018). In the business year 2018, the company generated sales of 78.5 billion euros. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected manufacturing. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "Invented for life." The Bosch Group comprises Robert Bosch GmbH and its roughly 460 subsidiary and regional companies in over 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company's future growth is its innovative strength. At nearly 130 locations across the globe, Bosch employs some 68,700 associates in research and development.

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Machine learning: Bosch sends sensor system to ISS Bosch in North America enters space technology research partnership

November 19, 2018
PI10804 RB LB/BT

- ▶ Bosch sensor system will help with maintenance work on the ISS
- ▶ Space mission is planned for May 2019
- ▶ Aim is to test technologies in extreme conditions

Pittsburg, USA – Bosch in North America and Astrobotic Technology Inc. today announced a research partnership to send experimental sensor technology to the International Space Station (ISS) as early as May 2019. Bosch’s SoundSee technology is a deep audio analytics capability that uses a custom array of microphones and machine learning to analyze information contained in emitted noises. SoundSee’s analytics will investigate whether audio data from equipment could be learned and understood using advanced software, such that it could be used to improve the operations of the ISS.

“Machines, such as motors and pumps, emit noise signatures while they operate,” said Dr. Samarjit Das, principal researcher and SoundSee project lead at [Bosch’s Research and Technology Center in Pittsburgh](#). “Our SoundSee AI (artificial intelligence) algorithm uses machine learning to analyze these subtle acoustic clues and determine whether a machine, or even a single component of a machine, needs to be repaired or replaced.”

The SoundSee payload will ride on NASA’s Astrobeer Robot, an autonomous free-flying vehicle capable of navigating throughout the ISS. The NASA Ames Research Center’s Astrobeer team has also provided support for ground testing. “The support from NASA has been critical,” said Dr. Andrew Horchler, Astrobotic research scientist and director of Future Missions and Technology. “They have provided feedback and requirements that have helped us design our operational plans and understand the challenges of sending a hardware payload to the ISS.”

On the ISS, researchers will collect data and send it to Earth for Bosch to study. As research progresses, the team expects to update the software or adjust operational routines to improve data-collection results. “This data should allow us to gain insights into the state of the space station,” said Jon Macoskey, research engineer intern at Bosch. “Our long-term goal is to show that we can detect anomalies in the operation of the station and return that intelligence to crewmembers or ground control.”

The research has promise for numerous terrestrial applications and other crewed spacecraft, including missions to the Moon and Mars. “For some time, Bosch has been interested in using audio analytics to monitor critical machines and equipment, such as car engines or HVAC systems,” said Dr. Joseph Szurley, a Bosch research scientist on the project. “The ISS will allow us to study how these techniques can extend to even more challenging and unique environments.”

Astrobotic’s [Future Missions and Technology team](#), a space robotics research group, is developing the flight version of the sensor, known as the SoundSee payload. The team will also lead ground testing and preparation for flight. “Conducting research in space, even when you have an asset like the ISS, is significantly more challenging than testing on the ground,” Horchler said. “As a space robotics company, we are able to help Bosch prepare for operating in this highly controlled space environment.”

The SoundSee project has been in development since the [Center for the Advancement of Science in Space](#) (CASIS) approved funding for launch costs and astronaut time aboard the space station earlier this year. CASIS is the organization tasked by NASA with managing the ISS U.S. National Laboratory. Recently, Bosch and Astrobotic researchers began testing engineering units of the SoundSee payload and added former ISS Commander Dr. Colin “Mike” Foale to the team.

“Since meeting the team at Astrobotic in Pittsburgh for the SoundSee preliminary design review, I am convinced that this novel, cutting-edge approach to using machine learning in space will not only have great benefits for troubleshooting ISS problems, but especially throughout industry on Earth,” Foale said.

“Commander Foale has provided invaluable operational insights into how the mission might operate within the ISS and helped us complete our preliminary design review this summer,” Bosch’s Das said. “Our test facility at Astrobotic is helping us validate the techniques that we will deploy on the ISS.”

The SoundSee payload will launch to the International Space Station as part of NASA’s Astrobe robot, and will be delivered on a future [commercial resupply services](#) mission.

“We have a dedicated team and clear path to flight,” Horchler said. “We couldn’t be more excited to work with Bosch, NASA and CASIS on this critical work.”

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About Astrobotic:

Astrobotic Technology, Inc., is a space robotics company that seeks to make space accessible to the world. The company’s lunar lander, Peregrine, delivers payloads to

the Moon for companies, governments, universities, non-profits, and individuals at an industry-defining price of \$1.2 million per kilogram. The company is also developing advanced space robotics capabilities such as terrain relative navigation, mobile robotics for lunar surface operations, and reliable computing systems for mission-critical applications. Astrobotic has more than 30 prior and ongoing NASA and commercial technology contracts, a commercial partnership with Airbus DS, a corporate sponsorship with DHL, and 12 signed deals for Peregrine's first mission to the Moon. The company is also an official partner with NASA through the Lunar CATALYST Program. Astrobotic was founded in 2007 and is headquartered in Pittsburgh, PA.

About CASIS: The Center for Advancement of Science in Space (CASIS) is the nonprofit organization selected to manage the ISS National Laboratory with a focus on enabling a new era of space research to improve life on Earth. In this innovative role, CASIS promotes and brokers a diverse range of research in life sciences, physical sciences, remote sensing, technology development, and education.

Since 2011, the ISS National Lab portfolio has included hundreds of novel research projects spanning multiple scientific disciplines, all with the intention of benefitting life on Earth. Working together with NASA, CASIS aims to advance the nation's leadership in commercial space, pursue groundbreaking science not possible on Earth, and leverage the space station to inspire the next generation.

Artificial intelligence: Bosch is expanding its involvement in Cyber Valley New AI campus planned for Tübingen

July 11, 2019

PI 10967 RB Cwi/BT

- ▶ Bosch plans to invest some 100 million euros in a campus for applied research into artificial intelligence
- ▶ Workplaces for up to 700 AI experts
- ▶ Campus to strengthen exchange among experts in Cyber Valley

Stuttgart and Tübingen, Germany – Bosch plans to ramp up its activities in the emerging technology of artificial intelligence (AI): in Tübingen in Germany’s Cyber Valley, the supplier of technology and services intends to invest some 100 million euros in a new “Bosch AI Campus.” Bosch is currently in talks with the city of Tübingen to negotiate the purchase of a roughly 12,000 square-meter plot on which to build the campus. The move into the new research complex is planned for the end of 2022. Roughly 700 experts will work on applied AI there. “Bosch aims to be among the global leaders in industrial AI research,” said Bosch CDO/CTO Dr. Michael Bolle. “The new Bosch AI Campus will bring us a step closer to achieving this goal.”

Space for startups and in-depth exchange

The Bosch AI Campus in Tübingen will be situated close to the research facilities of the Max Planck Institute for Intelligent Systems and the University of Tübingen’s AI research building. Besides laboratories and offices, the campus will offer spaces in which startups and external AI research groups can take up temporary residence. Freely accessible areas on the first floor of the campus will serve to foster exchange among Cyber Valley experts. Other parts of the facility will also be open to the public. “In the new building, experts from the Bosch Center for Artificial Intelligence (BCAI) will work on projects together with experts from other Bosch divisions and from startups. The campus structure will do a lot to foster an exchange of ideas,” Bolle said.

Bosch is a founding member of [Cyber Valley](#), which was established in 2016. This joint research venture brings together partners from industry, academia, and politics to drive forward AI research in the German state of Baden-Württemberg. The idea is to quickly transfer research findings into real-world industrial applications. “Excellence clusters like Cyber Valley are important, as they make Germany even more attractive to top AI experts and strengthen our position in international competition,” Bolle continued. “The Bosch AI Campus also enhances Baden-Württemberg’s international appeal as an AI hub.”

From research to practical application

Bosch is researching artificial intelligence that is safe, robust, and explainable. Its investment in the new AI campus is yet another step by the company to strengthen AI research in Cyber Valley. Last year, Professor Matthias Hein was appointed to a Bosch-endowed [chair](#) at the University of Tübingen. The company sponsors two Industry on Campus professorships, which allow the university to integrate practical industrial expertise into its research and teaching.

These professorships focus on the issues that arise when preparing for industrial applications. One example is predictive diagnostics, which makes it possible to predict machine breakdowns long before a fault actually occurs. Well-timed maintenance can avoid protracted machine downtimes. Predictive diagnostics is an example of machine learning, which is the focus of the research conducted at the BCAI. Currently, the BCAI has some 200 associates at a total of six locations in Germany, the United States, India, and Israel.

Press photograph: #959035, #988670, #1402989

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www.bosch-ai.com



Cyber Valley: top researcher Matthias Hein appointed Bosch-endowed chair University of Tübingen and Bosch working closely together

June 6th 2018

PI 10661 RB Cwi/BT

- ▶ Hein to research machine learning at the University of Tübingen
- ▶ Bosch endows the chair with 5.5 million euros
- ▶ Bosch expert in artificial intelligence appointed to Industry on Campus professorship in Tübingen

Stuttgart / Tübingen, Germany. Bosch is bringing a top researcher in machine learning to the state of Baden-Württemberg: Professor Matthias Hein, 42, is joining the staff at the University of Tübingen thanks to a Bosch-endowed professorship that the company will provide 5.5 million euros to support over ten years as part of [Cyber Valley](#). Hein's research is on statistical learning for applications relating to image processing and genetics. His focus is on developing reliable and comprehensible learning processes. A case in point is the development of automated decision-making systems that apply machine learning processes to rule out any discriminatory decisions. A current example of such a decision is when a system is more inclined to approve a loan to a man than to a woman. "Such an example shows that machine learning processes can have a positive effect on society," Hein says. "This is a goal well worth pursuing."

Hein has been teaching mathematics and computer science at Saarland University since 2011. He studied physics in Tübingen and received his PhD in computer science at TU Darmstadt. From 2002 to 2007, Hein was part of Professor Bernhard Schölkopf's working group at the Max Planck Institute for Biological Cybernetics. Today, Schölkopf heads the Max Planck Institute for Intelligent Systems in Tübingen and is counted among the world's leading researchers in the field of machine learning.

Hotspot with international appeal

“The interplay of science, industry, and politics in Cyber Valley has an appeal that stretches far beyond the region. Baden-Württemberg is becoming a global hotspot for top researchers,” says Dr. Michael Bolle, the head of Bosch research. “We are very much looking forward to working with Professor Hein. Given the outstanding caliber of the scientists and researchers already working in Cyber Valley, we can expect an ideas economy to emerge that will really drive new business start-ups. This is how we shape digital transformation,” says Theresia Bauer, Baden-Württemberg’s science minister.

In addition to the appointment of the endowed chair, the physicist Dr. Björn Andres will set up an Industry on Campus group at the University of Tübingen. Andres works at the [Bosch Center for Artificial Intelligence](#) (BCAI) in Renningen. Industry on Campus professorships allow the university to integrate external experts into research and teaching practices. “This benefits both Tübingen as a research hub and those who study here,” says Professor Bernd Engler, President of the University of Tübingen. “Our collaboration with Bosch is another example of how we achieve our goal of coupling basic research with a high degree of practical application.”

Close collaboration between research and industry in Cyber Valley

Industry on Campus professorships focus on finding answers to the leading questions in industrial applications. Take research into vibration sensors, which are used in predictive diagnostics: vibrations that are virtually undetectable to humans can predict a machine failure long before it happens. This means wear parts can be replaced in time to prevent longer downtimes. Predictive diagnostics is an example of machine learning, which is the focus of the research conducted at the BCAI. Bosch currently has 120 associates working on artificial intelligence at three locations around the world.

Bosch and the University of Tübingen are among the initiators of Baden-Württemberg’s [Cyber Valley](#), in which partners from politics, industry, and science pool their expertise in artificial intelligence. Bosch is supporting the Cyber Valley venture to the tune of some seven million euros. As part of its involvement in Cyber Valley, the University of Tübingen will first establish five new professorships as well as additional junior research groups. The university also plays a role in the education of PhD students at the International Max Planck Research School for Intelligent Systems.

About the University of Tübingen:

The University of Tübingen is one of 11 German universities honored by the country's Excellence Initiative. In the area of life sciences, it conducts leading research in the disciplines of neuroscience, translational immunology and cancer research, microbiology and infection research, and molecular biology. Other research focal points include geoscience and environmental research, archeology and anthropology, language and cognition, and education and media. More than 28,400 students from all over the world are currently enrolled at the university. They can choose from some 300 courses of study – from Egyptology to cellular neuroscience.

Press photographs: #1371317, #1371319, #1371384, #989179, #1371329, #1371383

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Cyber Valley: Bosch establishes an endowed chair for machine learning Baden-Württemberg is becoming a hotspot for top international researchers

December 15, 2016
PI 9505 RB cwi/KB

- ▶ Denner: “Artificial intelligence is a key competence in shaping the connected world.”
- ▶ Bosch supports endowed chair and Cyber Valley with a total of some seven million euros
- ▶ Partners from the worlds of government, business, and science pool their strengths for artificial intelligence in Baden-Württemberg

Stuttgart, Germany – Germany is getting its first Cyber Valley: to drive forward research in Baden-Württemberg on artificial intelligence, Bosch and partners from politics, business, and science are pooling their strengths in a new initiative. Modeled after Silicon Valley, Cyber Valley’s aim is to translate findings from basic research into concrete industrial applications. “Machine learning and artificial intelligence are key competencies in shaping the connected world,” said Bosch CEO Dr. Volkmar Denner at the Cyber Valley kickoff in Stuttgart. “In the international competition for innovation, Germany should not sit back and allow major IT companies from abroad to dominate these areas.” Bosch is supporting the Cyber Valley venture to the tune of some seven million euros.

Endowed chair for fostering the next generation of researchers

To drive forward research in machine learning, Bosch is establishing an endowed chair at Eberhard Karls University in Tübingen, near Stuttgart. Over a period of ten years, the company will fund the chair with a total of 5.5 million euros. “We want to attract the best minds to this region. World-class research will make Baden-Württemberg even more attractive for up-and-coming scientists from around the world,” said Denner, who is also in charge of research and advance engineering at Bosch. Located in the Stuttgart-Tübingen region, the Cyber Valley

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Center will bring together top researchers from a range of disciplines, such as software engineering, physics, biology, materials science, and neuroscience. In addition to the endowed chair, Bosch will be providing funding to Cyber Valley in the amount of some 1.3 million euros over five years. “The interplay of industry, research, and government will make this regional cluster a global hotspot for top researchers,” stressed Denner.

Strengthening the region’s start-up scene

Besides expanding scientific excellence and fostering young talent, Cyber Valley also aims at enhancing the start-up scene in the Stuttgart-Tübingen region. Young researchers working in Cyber Valley will be encouraged to found their own companies, so that they may quickly transfer scientific findings to product and service development. “Artificial intelligence must also prove worthwhile financially. A vibrant start-up scene in Cyber Valley will play a key role in this regard,” said Denner. Alongside Bosch and five other companies, founding members of Cyber Valley include the Max Planck Society, the state of Baden-Württemberg, the University of Tübingen, and the University of Stuttgart.

Facts and figures on Cyber Valley:

- Participating companies: Bosch, ZF Friedrichshafen, Daimler, Porsche, BMW, and Facebook
- Bosch is endowing a chair of machine learning at the University of Tübingen with 5.5 million euros over ten years
- Research at Cyber Valley focuses on robotics, machine learning, computer vision
- A research building to be constructed in Stuttgart by 2022
- First step: Nine research groups to be created
- Endowed chair at the University of Stuttgart
- Founding of the International Max Planck Research School for Intelligent Systems (100 doctoral students in six years)

Press photos:

will be available for download at bosch-presse.de as of December 15, 2016

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Keeping tomatoes healthy Bosch plantect project: better yields, fewer chemicals

January 2018
PI 10007 RB
Cwi/BT

- ▶ Artificial Intelligence aids plant cultivation
- ▶ Risk of plant disease lowered, use of chemicals reduced
- ▶ Solutions for other vegetable crops in the pipeline

Rennigen/Tokio: Farmers lose their harvests because they don't know the right timing of spraying. Now, growers can benefit from a Bosch project in Japan: Plantect is a smart solution that analyzes sensor data using artificial intelligence technologies to optimize plant growing in greenhouses. The project is part of the Bosch growth initiative called Future with Japanese Innovation (FUJI), in collaboration with the Bosch Center for Artificial Intelligence (BCAI). "At present, farmers act based on their past experience," project manager Ryosuke Suzuki says. "They use more pesticides than necessary." Plantect uses sensors to measure the humidity, temperature, carbon-dioxide levels, and sunshine. Such environmental parameters are of paramount importance for plant growth. They are transmitted via a gateway (hardware) to a cloud server, where a system equipped with algorithms analyzes the data together with other important agronomic parameters as well as weather forecast and visualizes the results on a user-friendly app.

Nipping disease in the bud

The disease risk analysis solution, jointly developed by the FUJI and BCAI, leverages artificial intelligence to predict the need for pesticides. Ryosuke Suzuki: "Farmers can then see whether they really need the spray pistol." It pays to check the app: With the current field test, Plantect shows a 66 percent reduction in the number of diseases as well as a 29 percent reduction in the usage of chemicals. With an accuracy of 92 percent, the system can detect whether there is any risk of infection in the air. Through the systematic use of chemicals, farmers can prevent the breakout of diseases such as gray mold. "It's

the same for plants as for people: infections are invisible. Once they are sick, all you can do is limit the damage. You have to nip the infection in the bud.”

Global cooperation

The standard version of Plantect, which provides real-time monitoring of environmental parameters, is suitable for all types of plants. The version featuring early detection of infections is only available for tomatoes at present. However, developers are in the process of adjusting the algorithm for additional species. Versions for cucumber and strawberry plants should follow by the end of 2018. Farmers appreciate the price model: the entry-level product is free of charge; only a monthly subscription fee is charged. Plantect uses wireless hardware and – depending on the size of the greenhouse – is made up of one or several sensors along with a central gateway that transmits data to the cloud for analysis. The battery-operated sensors can be installed anywhere in the greenhouse without any need for sockets, cables or other constructions.

If, for instance, a farmer wants to gauge whether environmental parameters differ between different sections of a greenhouse, multiple sensors can be installed accordingly. In their development work, Ryosuke Suzuki and his colleagues collaborated closely with the BCAI. The BCAI supported colleagues in Japan from the data compilation phase to implementation: “We advised the team in Tokyo, and we jointly developed the artificial intelligence algorithm especially together with FUJI agronomists,” says Vusirikala Nataraju, who is responsible for the project at BCAI. In 2018, Plantect will be launched on the Chinese and South Korean markets. Ryosuke Suzuki has confidence in his team’s work and the collaboration with BCAI: “We’re not just talking about it, we are putting our plans into action. That is allowing us to create products that will make people’s daily lives better.”

Press photo: #1306096, #1306093

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The Bosch Group is a leading global supplier of technology and services. It employs roughly 400,500 associates worldwide (as of December 31, 2017). According to preliminary figures, the company generated sales of 78.0 billion euros in 2017. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected industry. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group’s strategic objective is to create solutions for a connected life, and to improve quality of life worldwide

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Artificial intelligence: Bosch and University of Amsterdam to cooperate closely

Joint research laboratory facilitates knowledge transfer between academic and business worlds

April 6, 2017

PI 9631 RB cwi/BT

- ▶ Bosch to support research alliance to the tune of 3 million euros
- ▶ Further expansion of expertise in the field of artificial intelligence
- ▶ Deep learning is the basis for smart machines and products

Amsterdam, Netherlands/Stuttgart, Germany – Artificial intelligence is poised to fundamentally change the world: in the future, machines will be capable of autonomously learning from experience and acting on this basis. The foundation for this is deep learning. In the future, the University of Amsterdam and Bosch will cooperate closely in this field. To this end, the two partners have announced a research alliance in Amsterdam. Known as Delta Lab (“Deep Learning Technologies Amsterdam”), the alliance aims to promote regular professional exchange and knowledge transfer. In this way, Bosch is further expanding its expertise in the field of artificial intelligence. Over the next four years, the company will make a total of 3 million euros available to support the research of ten PhD students and postdoctoral fellows at the University of Amsterdam.

These young scientists will work closely with researchers from the Bosch Center for Artificial Intelligence at the Renningen research campus. In return, Bosch will send associates to work on joint scientific projects at the University of Amsterdam. “Industrial basic research in the field of artificial intelligence benefits from close contact with academic institutions,” says Dr. Michael Bolle, head of research and advance engineering at Bosch. “I’m very much looking forward to working with Professor Max Welling and his team from the University of Amsterdam. Worldwide, he is one of the leading names in the field of deep learning.”

Machines learn from a wide range of data

The model for deep learning is the human brain with its neural networks. In the research projects, the PhD students will develop mathematical models and algorithms that enable machines to learn from information and experience. In the process, they will be supplied with a large volume of data gathered by sensors and cameras. To give a concrete example: once the learning phase has been completed, an automated car will be able to distinguish a playing child from a ball rolling across the street and make the decision to brake.

“In connection with connected manufacturing and smart assistance systems as well, deep learning is gaining increasing importance,” Max Welling says. “We hope the research findings from Delta Lab will result in applications and products in which Bosch is a global market leader.”

Delta Lab is Bosch’s second AI research alliance. Late last year, Bosch and partners from politics, business, and science created [Cyber Valley in the German state of Baden-Württemberg](#).

Delta Lab:

- Research partnership between Bosch and the University of Amsterdam
- Goal: close professional exchange between the Bosch Center for Artificial Intelligence and the University of Amsterdam
- Research focus: deep learning
- Over a period of four years, Bosch will provide 3 million euros in funding for ten PhD students and postdoctoral fellows at the [University of Amsterdam](#)

Bosch Center for Artificial Intelligence (BCAI):

- Around 100 associates in Renningen, Palo Alto, and Bengaluru
- Goal: to expand research in the field of artificial intelligence
- Bosch will invest around 300 million euros in the BCAI by 2021
- Research findings will be incorporated directly into applications and products

Press photo:

Photo of the research campus, photo of UvA

More information on connectivity and artificial intelligence is available [here](#).

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The Bosch Group is a leading global supplier of technology and services. It employs roughly 390,000 associates worldwide (as of December 31, 2016). According to preliminary figures, the company generated sales of 73.1 billion euros in 2016. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected industry. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "Invented for life." The Bosch Group comprises Robert Bosch GmbH and its roughly 450 subsidiaries and regional companies in some 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company's future growth is its innovative strength. At 120 locations across the globe, Bosch employs 59,000 associates in research and development.

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Artificial intelligence: Germans see no reason to fear robot coworkers Bosch presents survey on the eve of an AI conference

November 19, 2018
PI 10801 RB Cwi/BT

- ▶ Germans believe AI will bring great benefits to mobility and manufacturing
- ▶ One in two people would be willing to work with a robot
- ▶ Michael Bolle: “Humans will be in control of AI”
- ▶ Bosch announces award for young researchers

Stuttgart, Germany. Whether at home, in traffic, or at work, artificial intelligence (AI) is going to transform the world. It’s a future that is not so distant. Smartphones already come with smart voice-controlled assistants, and physicians are using AI to diagnose conditions. But even if smart systems are already with us, most Germans (85 percent) still have no clear picture of the purposes that AI already serves today. Much the same can be said of the public’s understanding of AI. Although most respondents – 82 percent – are familiar with the term “artificial intelligence,” more than half (53 percent) know only vaguely what it means. These are the findings of a representative survey conducted by Bosch and the market research institute Innofact in the run-up to the [AI CON](#) AI symposium at Renningen near Stuttgart. Commenting on [AI CON](#), where 200 and more experts are to talk about the opportunities and challenges of AI, Dr. Michael Bolle, the chief digital and technology officer at Bosch, says: “The more intelligent systems now shape everyday life, the more important it is to show people their benefits, and in this way to foster acceptance for this key technology. We have to get the message across that humans will be in control of AI.”

No fear of robots

One example of how AI can benefit people is automated driving. Bosch is striving to make road transportation emissions-free, accident-free, and stress-free. With nine out of ten accidents are currently attributable to human error, smart technology could use AI to prevent many of these from happening in the first place. Connected manufacturing is another banner field for AI. In a smart factory, people and machines will work together as an intelligent team. Robots will relieve

people of strenuous and dangerous tasks and learn from experience. This will reduce people's burden. The Bosch survey found that many Germans could imagine being able to accept this situation. Two-thirds of respondents – 67 percent – believe that manufacturing and mobility are going to benefit greatly from artificial intelligence. They are also open to working with a robot if it takes over routine chores. Half of all respondents could well imagine such a situation, and would above all devote the free time gained to social or creative activities. Views on the use of AI vary with age, with 18- to 29-year-olds most likely to see AI applications as potentially useful for smartphones and households.

Investigating safe, robust, and explainable AI

Bosch founded the Bosch Center for Artificial Intelligence, or BCAI, in early 2017 to expand its AI skill-set. A big part of the BCAI's mission is to explore the rules by which machines learn and what conclusions they draw from these lessons. To promote young talent in this field, Bosch will be presenting the Bosch AI Young Researcher Award, endowed with 50,000 euros, for the first time next year. "We are investigating artificial intelligence that is safe, robust, and explainable. AI will augment humankind's abilities," says Professor Thomas Kropf, the president of the Bosch corporate sector for research and advance engineering. In late 2016, Bosch joined forces with partners in science, business, and government to set up [Cyber Valley](#) and drive research into artificial intelligence. Speaking at [AI CON](#), Professor Bernhard Schölkopf, director of the Max Planck Institute for Intelligent Systems in Tübingen, said: "Science and industry are working together in Cyber Valley to create an ecosystem for the best AI research." Cyber Valley aims to transfer research findings into real-world industrial applications as quickly as possible, to attract highly qualified researchers from all over the world to Baden-Württemberg, and to train and retain AI experts.

Branch out the network, step up knowledge-sharing

Organized by the BCAI and the Cyber Valley research alliance, [AI CON](#) is being held for the first time this year. It will bring together leading AI industry and research experts to explore the opportunities and challenges inherent in the technology. The conference will feature the Bosch experts Dr. Michael Bolle and Dr. Christoph Peylo (head of the BCAI), Professor Bernhard Schölkopf, the Max Planck Institute's world-class authority on machine learning, and speakers from Carnegie Mellon University in the U.S., ETH Zurich in Switzerland, and from Austria, Israel, and the United Kingdom.

Survey design: For this major study conducted on behalf of Bosch, the market research institute Innofact polled 1,022 people throughout Germany between the ages of 18 and 69. The survey was carried out in October 2018.

Press photograph: #1709865, #988742, #695148

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Research on artificial intelligence

October 2018

- ▶ **BCAI** The Bosch Center for Artificial Intelligence (BCAI) was established on January 1, 2017.
- ▶ **Investment** Bosch plans to invest some 300 million euros in BCAI by 2021.
- ▶ **Associates** Some 150 people currently work at four BCAI locations worldwide.
- ▶ **Locations** Renningen, Bengaluru, Sunnyvale, Pittsburgh.

Research focus and use cases

- ▶ **Machine learning:** The focus is on machine learning; that is, recognizing patterns and contexts and exploiting these insights. This information is derived from vast amounts of data generated by sensors. Example: parking sensors.
- ▶ **Use cases:** Mobility (automated driving), connected industry (predictive maintenance), robotics.

Partnerships in the area of artificial intelligence

- ▶ **Cyber Valley** Partners from industry, academia, and government are collaborating closely in the field of artificial intelligence. The aim is to fast-track efforts to translate basic research findings into real-world applications. Bosch plans to invest 7 million euros in Cyber Valley.
- ▶ **Delta Lab** A research alliance with the University of Amsterdam. This partnership aims to facilitate the exchange and transfer of expert knowledge in the field of deep learning.
- ▶ **CMU** A research alliance with the Carnegie Mellon University (USA) that aims to facilitate the exchange in the field of robust deep learning.



Bosch AI mission-bound to the ISS

November 2018

- ▶ **SoundSee** The SoundSee module is integrated in NASA's AstroBee. This autonomous robot will be able to find its way around inside the International Space Station on its own. The device will be transported to the ISS in May 2019. The SoundSee module is a Bosch AI-based system designed to monitor sounds made by ISS's mission-critical infrastructure.
- ▶ **Partners** The Bosch Research and Technology Center Pittsburgh and Astrobotic Technology developed the instrument in a joint effort with the NASA Ames Research Center.
- ▶ **Function & objective** This technology is based on an audio analysis function that will detect and recognize noise signals from machines on board the ISS, such as motors and pumps. Its machine learning capabilities will enable the AI module to eventually understand these sounds. The system will report any acoustical anomalies, with the result that repairs can be made early on, before a machine fails. This means it will be possible to quickly identify any deviation from normal operation, enabling the crew and ground personnel to respond that much faster, and gain deeper insight into the space station's technical status. Bosch will also use the data collected on the ISS for further research, with the aim of deploying similar modules in other systems, such as car engines.

AI CON 2018

- ▶ **Model** The Bosch Center for Artificial Intelligence (BCAI) will exhibit a model of this device. An expert from the Bosch Research and Technology Center Pittsburgh will be on hand to answer questions about the project.