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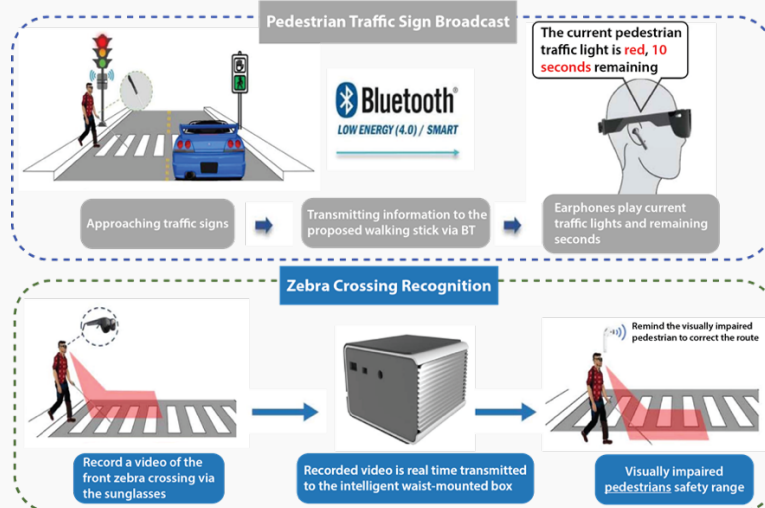

PEDESTRIAN SAFETY APPLICATION SCENARIOS WITH AN AI EDGE COMPUTING-BASED ASSISTIVE SYSTEM

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EDITOR'S NOTE

On behalf of the Editorial Board of IEEE CTSoc News on Consumer Technology (NCT) editor-in-chief Wen-Huang Cheng and editors, Yafei Hou and Lou Yuen Peng I am delighted to introduce the February issue of the News on Consumer Technology (NCT).

The February issue starts with a feature interview provided by NEUNON AI a company specialized in Computer Vision, Machine Learning, and Internet of Things based in the state of Sarawak, Malaysia. Despite being a relatively young company, their team of in-house machine learning engineers and software developers have been making AI solutions accessible to the general public through their work from industrial companies to government-related projects. In this issue, the editor interviewed the team of NEUON AI to share their story, from how they started to where they are going to achieve their vision.

The issue ends with a featured article brought by Filippo Chiarello, Assistant professor at the School of Engineering, University of Pisa, and Irene Spada, Ph.D. student in Smart Industry Program at University of Pisa.

The featured article describes the ASSETS+ project https://assets-plus.eu (Alliance for Strategic Skills addressing Emerging Technologies in Defence). In particular, the authors describe the goal and the approach of the project, the performed automatic data-driven analysis to map technologies to relevant Defence applications. Finally the Brainstorming sessions with industrial experts and the Blending process are summarized.

PhD Luca Romeo,
Department of Information Engineering, Università Politecnica delle Marche

EDITOR: STEPHEN EKAPUTRA LIMANTORO

Based on the published dataset by World Health Organization (WHO), there are at least 2.2 billion people are visually impaired. Generally, visually impaired people might face a certain level of inconvenience in their daily lives. Specifically, it is difficult for visually impaired pedestrians to walk alone in strange and complex outdoor zones. According to a survey of usability studies from 218 visually impaired people in Taiwan, 35.3% of them said that they were unable to determine whether they were crossing the road via a zebra crossing, and 61% said that voice traffic signs are lacking. The above surveys indicate that when visually impaired pedestrians use intersections, they are at a high risk of being struck by vehicles since they cannot determine the current status of the intersection. To overcome the issues, an intelligent assistive system is designed, composed of smart glasses, an intelligent walking stick, a mobile device app, and an online cloud-based management platform for visually impaired consumers to provide functionalities that improve outdoor walking safety. Specifically, the system focuses on the design for the safe use of zebra crossings. Moreover, a deep learning method is adopted to the system for zebra crossing image recognition in real time. Hence, when a visually impaired pedestrian reaches a zebra crossing, they will immediately receive a message about the current situation at the crossing and the traffic light signal. The results show that the accuracy of real-time zebra crossing recognition can reach up to 90%.

INTERVIEW WITH THE TEAM FROM NEUON AI, SARAWAK, MALAYSIA

EDITOR: Yuen Peng Loh

Editor's Note: NEUON AI is a company specializing in Computer Vision, Machine Learning, and Internet of Things based in the state of Sarawak, Malaysia. Despite being a relatively young company, their team of in-house machine learning engineers and software developers have been making Ai solutions accessible to the general public through their work from industrial companies to government-related projects. In this issue, the editor interviewed the team of NEUON AI to share their story, from how they started to where they are going to achieve their vision.

Chief Executive Officer, Dr. KC Chai.
Dr. Chai is a Sarawakian who received his Ph.D. degree and completed his postdoctoral research in 2016 and 2017 respectively. He has developed novel AI models over eight years, resulting in over ten scientific publications in collaboration with a team member at Deakin University and University Malaysia Sarawak. He managed several industrial-university research projects in Malaysia and Taiwan. By aggregating his research skills and business experience, he has founded several companies, including Flinken (Automated Manufacturing Factory) and NEUON AI (AI Consultancy and Solutions Provider.).

Chief Technology Officer, Yang Loong Chang.
Mr. Chang is a Sarawakian who is passionate about deep learning research with interest in machine learning, particularly computer vision, and video content analysis. He pursued his Bachelor of Electrical and Electronics Engineering degree with a full scholarship at Swinburne University. He graduated with first-class honors and was also awarded the Best Student Award by Sarawak Energy. He is a full scholarship Ph.D. researcher in the Department of Artificial Intelligence of the University of Malaya, where he has worked on several deep learning and AI research projects. Recognizing his passion, experience and skills, he was invited into the partnership as a co-founder of NEUON.

What is NEUON AI all about and what are your main focus areas?

[Dr. Chai] The word NEUON originates from the word "Neuron", so we remove the "r" to represent "New things are going on". With this name, we founded the company in the end of 2018 to focus on three key areas, Computer Vision, Machine Learning, and Internet of Things. In NEUON we have 2 main departments, the AI Department led by the CTO and then the other led by myself focusing on IoT. These two departments addresses our long-term and short-term strategies where the IoT focuses on short-term and fast revenue generating solutions like design of systems for the agriculture industry or for the factories in the manufacturing industry such as stock monitoring, inventory management, and warehouse management. The backbone of NEUON AI is the long-term strategy where instead of providing a single sellable product, we provide AI services and platforms that range from solution design till scale-up upgrades, sort of like a continuous services.

We design four main AI cores to serve our clients which are facial recognition, road asset management, object inspection in manufacturing, and agriculture.

What is the inspiration that lead to the conception of NEUON AI?

[Dr. Chai] Before working on NEUON AI, I had been doing my Postdoctoral research in Taiwan and my research background was mainly in mathematical theorems and other theoretical work instead of applications. I had met Dr. Chan Chee Seng from the University of Malaya, Malaysia during a conference trip in India where we discussed about AI and Computer Vision that I am interested in. He also introduced me to our current CTO, Yang Loong who is his PhD student, which we instantly recognize as a talent in the field. We come to an understanding that there are many opportunities in AI especially for the state of Sarawak [our hometown] in Malaysia especially with the local government's "Sarawak Digital Economy" initiative but there isn't an AI ecosystem there. This motivated us to contribute to our own state and country to start-up an AI

ecosystem in order to retain our talents. For us, the founding of NEUON AI is not only to generate revenue but to work on our mission to bridge the gap between academic researches with the industries.

What is this AI ecosystem and what is the relation of it with the retention of talents?

[Dr. Chai] The AI ecosystem is something like a circle of talents and the industry. AI courses are increasingly promoted in universities [in Malaysia] and many talents are getting into it to aim for better future employment. If there is lack of industry here, these talents will flow out to other countries. The power of the ecosystem that we start-up with the investments on NEUON AI is that instead of importing costly solutions, we will already have the starting AI cores for the industries. There will be more [local talent] developers required to work right here, and slowly the infrastructure will grow due to the increasing needs, and that would lead to more students [talents] in the universities [to fill the needs] and continue to grow the industry. Additionally, in having this ecosystem, we can have the flexibility for those who are interested to work on AI in the future to collaborate with us without the need to put large investments on machines and processing hardware as the ecosystem will have the infrastructure to get them started on what they would like to do. I can see the community grow in such way and that is our vision for the ecosystem with our passion as entrepreneurs and technopreneurs.

You have mentioned that your company mission is to bridge the gap between academic researches with the industries. Could you elaborate more on this and the challenges you face?

[Dr. Chai] I would consider the research done in universities as the "research of tomorrow" rather than the "research of today", as it depends on a lot of assumptions. When we have discussions, we will often talk about the datasets and the research that looks promising with high accuracy but it doesn't transfer well.

[Mr. Chang] As we both have research experience, what we are trying to do in the company in bridging the gap is to train the team members that we hired in their research capability and also software development because we believe there is a gap between them that we need to fill if you want to do real applications with AI or even other applications. At first we will have a starting point to show the client that something is possible and we will continue to fill the gap, which we call the POC (Proof of Concept). This is the hybrid between lab results and practical results where real case scenarios are inside this POC to fit more to industry needs. Usually, the POC results will be closer to reality compared to lab results and it will not always be encouraging for investors. But we are showing them the possibilities and impossibilities where we are honest about what can be done and propose solutions that are sensible within the time period. The clients will see the initial hybrid between practical and "academic" outcomes in the POC proposal for them to decide on their willingness to invest in the real product. From this, we can understand the "magic" that they expect from the AI and then try to let them understand the so-called "trick" behind the AI as well.

Following the part about the "magic" and "tricks", there has been many misconceptions about AI. How do you manage the expectations of your clients and consumers of your products?

[Dr. Chai] For this question, it is definitely a challenge especially in our industry as it is something [relatively] new and people's perception of AI is like "magic". When we show [the AI systems] the public, it looks very advanced and they will have many different expectations. So in terms of this, we handle it through management and education. We manage by breaking down the tasks and scoping down the work to be more focused for our clients. If the clients were to set their own requirements, they tend do go wide and requests for many features at the same time. Instead, we will understand the niche and problem statement of the clients, the thing that they actually want to focus on and work from there before scoping up to handle more problems later. The methodology and the way we operate is actually similar to research because I was previously working on research. So basically, we will be able to grab their attention and anchor-in the problem as well as to slowly gain their trust.

For education, we conduct different types of roadshows and educational talks from time-to-time before the pandemic. We focus on our service the NEUON BOX, an interactive advertisement panel with facial and emotion recognition technology that eases our communication to the public about what AI is about. We find that by just talking about the AI cores is very difficult to be understood by the general public, but once we put it into an application, it is much easier for the people to digest. For specific clients, we provide a lot of educational work in both physical and virtual trainings [due to the pandemic] to let them know what actually we are working on for them in our services.

As you have brought up about the pandemic, has this changed the need and demand for AI solutions? How has it impacted your company?

[Dr. Chai] One thing is for sure in this, there are a lot of delays for our company due to travel restrictions. For example, the growth of our agriculture cores, and the deployment of the NEUON BOX as well gets delayed and postponed because it was designed for shopping mall events with games using our facial core.

[Mr. Chang] The launch of our NEUON BOX was during a bad time which is the first year where COVID-19 hit. It was during the Lunar New Year as well, where many people were reluctant to come out. Our NEUON BOX rely on customer interaction requiring some touching actions to gain their interest in the shopping mall and products they are offering, but once the travel ban was enforced [within Malaysia], even the shopping mall have difficulty to maintain business. So this business model of ours has been delayed but then I can see other directions and opportunities to work on especially going contactless with gesture recognition to fit to the current needs of this recovery period. So the effects can be project-based, for instance our projects that require district travels like our road asset manage-ment project, RoadPlus would get delayed due to movement restrictions and even our client's contracting COVID-19. So there is this negative but at the same time we get customers requesting mask detection and

contactless access systems which are mainlydue to the pandemic. While we do not wish for the pandemic to be around any longer, it actually opens up some opportunities for growth and market demands.

You have a lot of projects from both industrial companies and also government agencies. Could you briefly introduce your projects and which has been the most challenging so far?

[Dr. Chai] The first one we worked on is the advertisement board the NEUON BOX which we built our own facial and emotion recognition AI core with our own software as well. Following this, we collaborated with Willowglen MSC to deploy our AI facial core in their SCADA systems with customizations for their special requests such as blacklists, whitelists, managing credentials and activity logs, even anti-spoofing and tailgating. We then worked on object inspection used in factories for product bag counting and recording, which is more on the QRQC aspect. We also collaborate with Dr. Lee Sue Han from Swinburne University of Technology Sarawak for agriculture related projects such as plant disease classification. Last but not least, the current project we are actively participating in is on the road asset management, RoadPlus, to be delivered to the Ministry of Science Technology and Innovation (MOSTI), and Ministry of Works (KKR) of Malaysia. We actually won the MYHackathon 2020 competition which provided us with the needed funding and coaching in terms of project deployment from both MOSTI and Cradle Fund for this project. They have also provided the support and endorsement to the ministries which lead to an invitation to Expo 2020 in Dubai for an exhibition as well. We

consider ourselves very lucky to be able to do this despite the difficult time. RoadPlus is a pilot project with the road concessionaires in Sarawak for road asset management. In scoping down and managing the expectations of this client, we are working with them to address the specific problem of potholes instead of the general and wide range of road damage problems. They term this as the "Zero Pothole Initiative" and to address this problem within 24 hours. Our AI solution would be doing the monitoring and inspection processes [through a mobile app] where potholes can be detected and tracked [using computer vision] and then reported to the road concessionaires. We designed everything from scratch, where from nothing into a full system. Up till December 2021, we had managed to deploy and digitized up to 4,000 km of roads in the city of Kuching and all the road concessionaires in Sarawak are currently having a trial with us.

[Mr. Chang] The most challenging project would be this RoadPlus even if we get a lot of help from different parties. This is the largest scale project that we are conducting [so far] that involves a lot of human resources and AI models. The level of challenge is quite high especially when deploying into the field with a lot of devices and managing different data coming into the server at real time and also to respond to all the AI requests. For this pothole detection, we also have to handle duplicate reports and management of the data before handover [for the road concessionaires' action].
In our opinion, although the complexity is high to manage and design everything by ourselves without collaborators or 3rd parties, it is the optimum way of doing it as we have flexible control of the system design and workflow to be proposed. We are able to customize the solution to the client's specific needs and handle both the front- and back-end instead of using an off-the-selves, generic design that may not fulfill their needs.

Other than Malaysian-centric projects, do you also have collaborations or projects with international counterparts?

[Dr. Chai] We do communicate with a few international parties. One of them is CIRAD (The French Agricultural Research Centre for International Development) which we are connected with through Dr. Lee of Swinburne University for our agriculture projects. We also talked with Swedish and Canadian counterparts who are interested in our RoadPlus project to work on surface inspection and also underground inspection as well. We are actually in talks with them as they have the hardware. Most of our projects are in collaboration with people who have the hardware and machines to hybridize them with our software. So we are also discussing with potential collaborators in China to integrate our software into their hardware as one product.

Would this be the direction of expansion? What is next for NEUON AI?

[Dr. Chai] That is one of the idea we are currently on. For this year, we plan to start a RoadPlus Command Center hopefully during the first half of the year. We plan to have this to manage the reporting of the potholes by the general public. We have the first stage where we engage the road concessionaires to use our solution for the road inspections. The second stage would open up for a selected public users to assist in [further] digitizing the roads. Then the next stage would be for the general public to come in as well. The command center would be able to centralize the processes and the distribution to related authorities. That is our roadmap for this project and that is how we bring in the AI to help government agencies and local authorities as well as the general public who can benefit from this road asset management.

Do you have some words of advice for young talents interested to join in the field of AI technology? Or could you share what talents do you look for and how do you get them in your team?

[Dr. Chai] We focus very much on the technical side at the moment and all our technical team are interviewed by the both of us because we have certain requirement for our projects. We actually have quite a few staff that were our interns and then converted to permanent staff when we see their performance. That is one strategy for our company to work. We also have a good networking with university academicians that not only effectively advertise NEUON AI by word-of-mouth, but also to connect us with researchers, potential candidates, and staff. We are lucky to have met passionate professors and researchers to guide us like Prof. Lim Chee Peng from Deakin University who has been voluntarily sharing about our work and introducing new talents.

[Mr. Chang] Ideally, we would want talents with multiple skillsets but most graduates are very focused on either software or AI development only. It is quite rare to have talents being very skilled in both, but we take in talents depending on different projects and team needs. The work distribution is not full-stack and each will have their own work distribution. But in our company, we try to train talents to eventually shift in either directions instead of restricting them to a narrow job scope. We do let them have room for exploration for their tasks and through discussions come to the best solution. We would want them to communicate and discuss with different teams to understand both sides of the problem so that the design can be more efficient on both ends. So communication skills are very important, and then later we will slowly shift them to be a more multi-direction-based talent.

[Dr. Chai] Well, also personality and passion. The value of the candidate themselves is much more important with the right attitude. The rest like theoretical and technical work can be trained.

[Mr. Chang] Of course, if they have the passion, we don't mind training them. Most of the staff doesn't come with the exact skillset we expected. Usually, we push them to learn something new to fit to the current project needs. You will always have to learn new things. This is unavoidable in this field. So the new talent has to be able to withstand such environment and the need to keep changing their pace according to different projects. But this also guarantees that they never get bored of this job, unlike those with redundant tasks.

[Dr. Chai] We are a flexible company with systematic management. Let's say there are any youngsters who have the passion for AI research, but don't have the means to start like the needed machines, we encourage them to join the AI ecosystem that is in our vision. We are open for discussions for the problems that they are interested to solve. Our flexibility is there, if you have the passion, we can work on the potential from there.

Blending brainstorming with industrial experts and automatic data-driven analysis
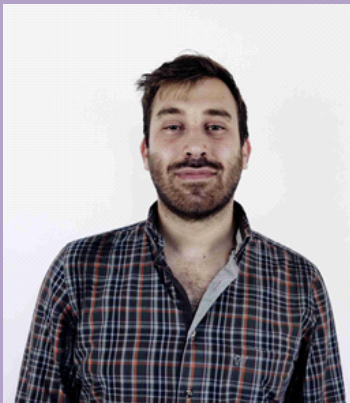
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The goal and the approach

The goal of ASSETS+ project is developing a strategy to upskill and reskill students and professionals in Defence sector, starting from identifying and mapping the most important technologies and exploring their impact on skills and human capabilities. The technological focus of the project is on Robotics, Autonomous Systems, Artificial Intelligence (AI), Cybersecurity, and C4ISTAR.

The relation of technology, work and education is generally difficult to investigate, and even more in the Defence sector, as it is at the frontier of innovation and information (both R&D and HR related) are mainly confidential for strategic purpose. We propose the use of qualitative and quantitative methods to handle the complexity of such tasks. We rely on Natural Language Processing (NLP) techniques for big data analysis of technical and scientific documentation; then we look at the trends of technologies and skills in a holistic and future-oriented way, harnessing the expertise of the academic and industrial partners of the ASSETs+ Consortium.

Automatic data-driven analysis

The first step is to map technologies to relevant Defence applications. The approach has a twofold goal: the exploration of each domain to

identify the core technologies, their trends and classify them according to their maturity level; and the identification of applications of the technologies, to describe how these are adopted and applied in Defence sector. We outline the technological domain in analysis and further generate a list of technologies and applications collecting sector-specific documents and analysing them using NLP tools and expert revisions. The documents are collected among research institutions, standardization and best practices institutions, companies, thematic websites, and market surveys, with the purpose to have a heterogeneous database of resources.

A data-driven approach allows to automate the process of extracting keywords related to technologies and to defence applications from the collection of documents. The process makes use of lists and regular expressions to detect relevant information in a text corpus, as explained by the authors in [1]. Several documents have been also examined by experts to validate and refine the list of technologies and applications. The identified technologies have been thoroughly analysed with qualitative and quantitative measures, such as maturity level and the abstraction level. Those compute the interest from research and industrial parties, the growth production of new scientific and technical knowledge, indexes widely adopted to evaluate the technologies evolution [2].

The relationship between applications and technologies are then described in a so-called relevance matrix, where each row is a technology, each column is an application, and each cell contains the relevance score that quantifies the importance of each technology for a given defence application. The definition of the relevance score is based on the number of scientific papers containing each pair application-technology. We also used a survey to defence-related industrial organization to gain additional insight on the relevance score.

The second step is to understand the skills demand in the Defence sector related to the selected technologies to help design new educational and training programmes. The current skills landscape has been delineated in terms of 3 categories of skills, namely technical skills, required to correctly exploit a certain technology within a given defence application; defence-related skills, connected to the knowledge, the use and the management of methods and procedures typical of the defence applications; and transversal skills or soft skills that are having an increasing importance in all the industries. We used job posting, industrial surveys, literature analysis, and skills and occupation taxonomy (European Skills, Competences and Occupation Classification, ESCO) to identify skills and job profiles linked to the technologies and applications mapped in the first step, as demonstrated in [3].

The analysis again mixes Natural Language Processing and expert judgment. The relevance of the skills is measured with qualitative and quantitative indicators, namely the degree of specialization, i.e., how important the skill is for the relative job profile in the defence sector, the degree of knowledge, i.e., the required level of a skill for the relative job profile to perform a defence-related job, and the demand from labor market, that indicates how much a skill is required for the given job profile.

We detected and classified 97 technologies, 59 applications, 172 skills, and 181 job profiles, developing a full picture of the actual landscape in the Defence sector, that represents the foundation for building up a comprehensive roadmap to guide the future development of defence-related training courses.

The map reported in the Figure 1 represent the distribution of the technologies among the different domains and their maturity, reported on the horizontal dimension, and abstraction levels, presented on the vertical dimension. It is one of the possible visualizations derived from the automatic data-driven analysis and it has been used as an input for the brainstorming in the second phase.
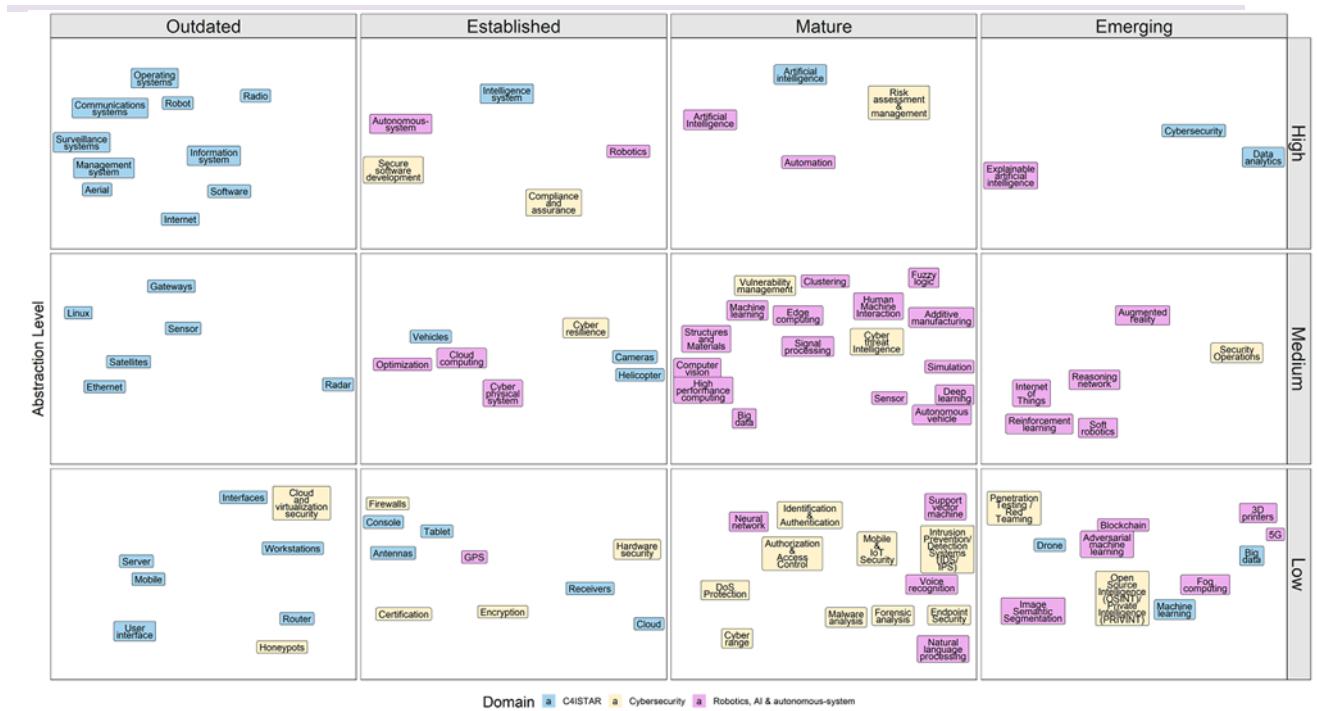
Figure 1 - Technologies map in the domains of Robotics, AI & Autonomous System, C4ISTAR and Cybersecurity.

Brainstorming sessions with industrial experts

If the first part was quantitative and data-driven, looking at the future of such a complex domain can be done only by using human expertise. Indeed, the analysis of the cutting-edge technological domains is complex, given that these are strongly entangled. In addition, the strategic issues related to the Defence knowledge and information increase the complexity of foreseeing future scenario in R&D and HR management. Therefore, qualitative methodologies may help in discovering new elements and gathering new insight [4].

We developed an updated version of C4ISTAR, a version 4.0, called C4AID. This is an acronym that stands for "Command, Control, Communication, Cybersecurity, Artificial Intelligence in Defence". This framework is for us the natural evolution of C4ISTAR, given that it includes the emerging technologies addressed in the project allows to have a systemic and holistic view of their interaction. First, for what concerns the "Cs" of the previous version (Command, Control,

Communication, Computer), the Command, Control and Communication applications are still crucial for the Defence sector (and always will be). The computational part has evolved, moving to a new way of processing information, that has converged in Artificial Intelligence. This is the reason why, the "I" of the previous "Information" has been removed, leaving the space for adding "AI". At the same time, it is evident that complex and ICT related defence systems cannot now do not consider Cybersecurity. For this reason, the "Cs" are still four: we removed "Computer" and added "Cybersecurity". Finally, the "ISTAR" part of the previous framework (Intelligence, Surveillance, Target Acquisition, Reconnaissance) has been substituted by "D", standing for "Defence", that contain all the four functions.

This novel framework has the form of a matrix, and it is reported in Figure 2. It presents on the rows the technological fields under analysis in ASSETs+ (Robotics, AI, Autonomous Systems, and Cybersecurity); on the columns the main areas of the Defence sector (factory, land, air, sea, space, and the cyber-space); on the intersections the applications of a technology related to a given domain a specific Defence area.

Figure 2 - Framework C4AID (Command, Control, Communication, Cybersecurity, Artificial Intelligence, Defence: Intelligence, Surveillance, Target Acquisition, Reconnaissance).

As already mentioned in the introductory part of this section, our aim is to forecast, within the scope of C4AID, technologies, skills, and education in the Defence sector. We identify the technical experts among the industrial and academic partners and group them based on similar technology-application intersection, with the purpose to set up homogeneous panels for each intersection of the C4AID matrix. In this step, we need to consider that an expert can cover more than one (adjacent of not) boxes in the matrix. After this collection is done, we can cluster together multiple adjacent boxes, creating the so-called scoping areas. Indeed, we aimed at combining different professional background to trigger ideas and discussion during the sessions, as highlighted in [5].

For each group of experts, we organise a technology-sector specific structured brainstorming session, to discuss on the future oriented time framed views of technologies, skills, and education. The structured brainstorming sessions for each scoping area are based on the following 5 rules:

- Encourage Wild Ideas: Embrace the most out-of-the-box notions. Strange ideas trigger the most interesting ideas.
- Build on the Ideas of Others: Use other ideas, and explicit the link that exists between your ideas and someone else's ideas.

- Stay Focused on the Topic: Try to keep the session on the target scoping area and step. Divergence is good, but there is the need to keep your eyes on the goal.
- One Conversation at a Time: Ability to listen to other ideas is as important as having good ideas.
- Go for Quantity: Our goal: 100 ideas per session.

Blending process

The final step of the forecasting process consists of building roadmaps, combining the results of the brainstorming session with the results of the data-driven analysis. Indeed, data-driven analysis and expert judgement are powerful methods that can lead to better results when combined rather than separated [6].

The blending process is based on a contrast and comparison all collected information, to enable the interpretation of the knowledge behind the data. The experts' ideas are compared with the technologies and applications identified in the data-driven analysis with the purpose to detect the missing elements. The elements are tagged as missing, i.e., technology or application not included dataset and to be added; or included, i.e., relevant technology or application, already included in the dataset or already exists as a

combination of technologies or in a more generic terminology. Then, the events are identified and collocated in a timeframe considering the level of maturity of the technologies. Finally, the connections are highlighted in the roadmap.

The ASSETs+ roadmap will have the form of a radar. Radar is an iconic defence-related technology, that is used as detection system, and has been chosen for several reasons. First, the product lifecycle of the radar is an example of the traditional innovation paradigm in technological R&D. Indeed, radar was elaborated for military purpose and now civil uses were widely and vary. This contrast aims to highlight the radical transformation we are experiencing nowadays. Second, radar is a detection system used to monitor a context and identify the relevant information within a given scope. It is a technological representation of the ASSETs+ goals, i.e., spot the trends in technologies and skills, translate them into concrete concepts as a basis for new education and training programs for the current and future workforce in Defence sector, leveraging on the expertise of the Consortium. Those two last elements recall the importance of human resources both in defining and applying policies, in fact the human brain is in the middle of the radar. Finally, it is the in line with the logo of the ASSETs+. The roadmap will include the most relevant job profiles, the most relevant skills for each job profiles and the most relevant technologies. The technologies will be positioned around the job profiles, considering the importance of a technology for a given job, and along the radial dimension, considering the level of maturity of a technology. In this way, the technologies, the skills, and the job profiles will be distributed in four main areas, that describes the most relevant capabilities for the Defence sector with reference to the technological domains of Robotics, Autonomous Systems, AI, Cybersecurity, and C4ISTAR. The results of these analysis will be available on the ASSETs+ website at https://assets-plus.eu/results/.

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