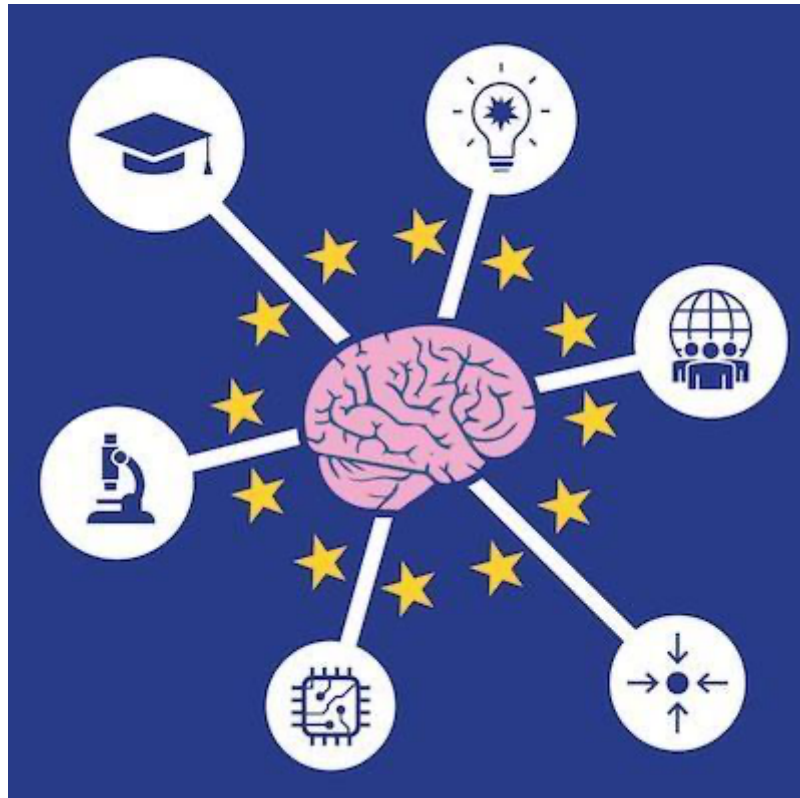# Neurotech^{EU}

The European University of Brain and Technology

[D8.3]
[Neuroinnovations Summit, 3 Report]

Deliverable information	
Work package number	WP8
Deliverable number in work package	D8.3
Lead beneficiary	UD
Due date (latest)	31 October 2023

Document History		
Version	*Description*	*Date*
0.1	UD Draft	17/10/2023
1.0	UD document for review	19/10/2023
1.1	UMH Reviewed document	31/10/2023
2.0	UD Final version	31/10/2023

Table of contents

1. NeurotechEU Technological and Societal Innovation Summit in 2023

Between October 2 and 5, 84 individuals involved in NeurotechEU gathered to discuss innovations in Technology and Society, and to create a roadmap on NeurotechEU's eight dimensions of neurotechnology.

The event, which was organized by Boğaziçi University, took place in Bodrum, Turkey. At the Summit, all NeurotechEU partners were represented by delegations, and   fruitful discussions and networking took place.

The event covered the following areas:

- NeurotechEU partner universities' translational technological innovation focuses.
- Industrial institutions/companies in direct/organized collaboration with NeurotechEU partner universities.
- NeurotechEU partner universities' translational technological innovation ecosystems.
- Identification of challenge-based technology trends.
- Exploration of partners' current focus, strengths, development strategies, and possibilities for within NeurotechEU complementarity.
- Initiation of developing road maps for NeurotechEU technological innovation actions.
- Building synergy across partner universities' translational technological innovation ecosystems.

In parallel, a WP1 management meeting was taking place to clarify the next steps when entering phase two of NeurotechEU.

2. First day of the Summit

The NeurotechEU Technological and Societal Innovation Summit 2023 kicked off with a powerful message: artificial intelligence and robotics are on the brink of ushering in enormous changes that will impact humanity in ways we are not fully prepared for.

The first day of the   Summit   brought together researchers, Technology Transfer Office (TTO) representati   ves, industrial organizations, and companies to discuss the profound impact that artificial intelligence and robotics are poised to have on our world. With these technologies advancing at an unprecedented pace, the summit emphasized the critical need for society to be prepared for the forthcoming changes.

Keynote talks at the event provided invaluable information about NeurotechEU partner universities' translational technological innovation focuses and ecosystems. The presentations also showcased the collaborative efforts between industrial institutions and companies working with these universities. These discussions shed light on neurotechnology's current state of the art and its challenges. It highlighted the importance of collaboration, ethical considerations, and the role of education in shaping a future where these technologies benefit society at large.
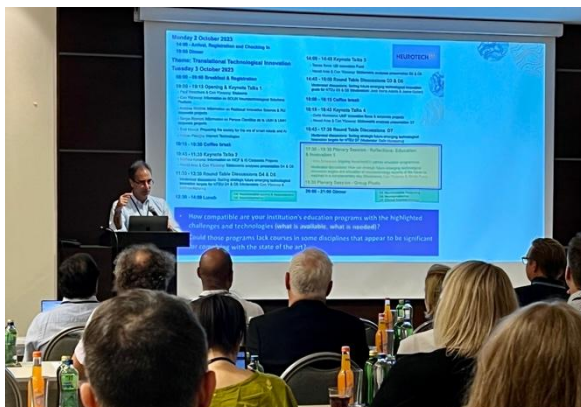
Fig. 1. The audience

2.1. The morning session

1. 2.1.1. Opening and Keynote Talks 1 (09:00-10:15)

Can Yücesoy, the Institute of Biomedical Engineering Director at Boğaziçi University (BOUN), presented the Neurotechnological Solutions Platform at BOUN focusing on neuromodulation, the importance of wearable devices, education, and medical imaging .

Fig. 2. Can Yücesoy - Opening session

The morning session featured a presentation by **Antoine Wellink**, the head of Radboud Innovation Science. He provided insights into how the Knowledge Transfer Office of Radboud University (RU) is organized and how it supports scientists with innovation funding, knowledge exploitation, and collaborations with companies. Wellink's extensive background in various domains, including drug development, highlighted the importance of bridging the gap between academia and industry in neurotechnology.

Fig. 3. Antoine Wellink – Information on RU Innovation Science and corporate projects

Sergio Román Gárcia from the Scientific Park Universidad Miguel Hernández de Elche (UMH), Elche, Spain, talked about the University barriers to transferring more knowledge. He emphasized the passion that brings teams together. Their multidisciplinary team has deep expertise in helping UMH spin-off and

start-up companies, mostly focused in electronics, health, and data analysis, making it possible to achieve a great solution with the potential to change patients' lives.

Emil Novák, a representative from Enjoy Robotics, discussed their collaboration with the Faculty of Engineering of Debrecen University (UD) and their mission to create socially acceptable robots like waiters, nurses, and receptionists. During the presentation, Novák highlighted research in etorobotics based on observations from human-dog interactions. He stressed that we are in the era of artificial intelligence and intelligent robots, which can pose challenges due to people's resistance to change and distrust of unfamiliar systems. Researchers and developers are responsible for ensuring a safe and reliable future with advanced robots.

Fig. 4. Emil Novák – Preparing the society for the era of smart robots and AI

2.   2.1.2. Keynote Talks 2 (10:45-11:30)

Mathew Abrams from Karolinska Institutet (KI) has a focus on traumatic Brain Injury Informatics. His fascinating presentation covered the topics of Neurobot (for data sharing), Knowledge Space (with EBRAINS, encyclopedia, and search engine), iNeuro Project workshop, and Training Space, launched in 2019.
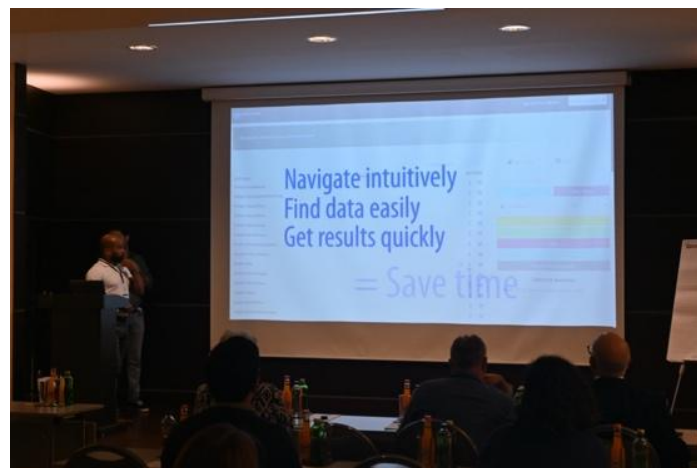

Fig. 5. Mathew Abrams – Information in INCF and KI Corporate Projects

Fig. 6. Necati Aras – Bibliometric analyses presentation D4 and D5

Necati Aras showcased bibliometric analyses for the various dimensions to understand and relate scientific studies in the neuroscience areas defined by the dimensions. By extracting the number of keyword occurrences and the number of co-occurrences of the keywords in the scientific documents, including journal papers, conference papers, and reviews, the aim is to determine the focal points of neuroscientific research. He presented the results for the D3-D7 dimensions. The presentations aimed to address two key questions: 1) What are the prominent challenges characterizing state-of-the-art research within each neurotechnology dimension? and 2) What are the notable technologies that define the state-of-the-art research in each neurotechnology dimension?

3.   2.1.3. Round Table Discussions on dimensions D4 and D5

The summit also featured Round Table Discussions aimed at facilitating dialogues to identify technology trends, strengths, development strategies, and potential synergies among Neurotech^{EU} partners. These discussions laid the groundwork for developing roadmaps for technological innovation within the Neurotech^{EU} ecosystem. The morning roundtable discussions focused on Neuromorphic Control & Neurorobotics and Neuroinformatics.

2.2.   The afternoon session

2.2.1. Keynote Talks 3 (14:00-14:45)

Tamas Bene provided insights into how the Science Park of Debrecen University fosters collaboration, supports knowledge transfer, and drives regional economic growth. The Innovation Fund fuels these efforts in health-related fields, aiming to improve public health and innovation. The "UD Impact Program" bolsters these endeavors by providing financial support for innovative research, highlighting the university's commitment to making a lasting impact.

Fig. 7. Tamas Bene – UD Innnovation Fund

The bibliometric analyses presentation regarding Neuromorphic Computing and Neuroprosthetics followed by **Necati Aras and Can Yücesoy**.

Fig. 8. Can Yücesoy – Bibliometric analyses presentation D3 and D6

2.2.2. Round Table Discussion on dimensions D3 and D6

The round table discussion moderated by **Juana Gallar and José María Azorín** focused on establishing future goals for emerging technological innovations in Neuromorphic Computing and Neuroprosthetics. The debate involved addressing significant questions such as creating a translational technological innovation ecosystem in these fields, identifying the relevant stakeholders, and planning the following steps, including data communication, data storage, and designing the path from initial design to the ultimate patient benefit.

Fig. 9. José María Azorín – Neuromorphic Computing and Neuroprosthetics

2.2.3. Keynote Talks 4 (16:15-16:45)

Volkan Patoğlu, a professor in mechatronics engineering at Sabancı University, was invited to present his envision of a research area focused on physical human-machine interaction, particularly mechatronic design and interaction control of robotic systems with applications to rehabilitation applications. His research extends to cognitive robotics.

He highlighted the potential of synergistic integration of rehabilitation robotics and artificial intelligence technologies for restoring the mobility of patients with neurological disorders. Through the AssistOn-Arm upper-extremity rehabilitation robot system case study, he demonstrated how the mechatronic design, interaction control, and personalized software challenges can be addressed to translate research results from the laboratory into the clinic, directly benefiting patients.

Bibliometric analyses presentation of Clinical Neurotechnology (D7) followed (moderated by **Can Yücesoy and Necati Aras**), showcasing the most occurring keywords (cancer, Alzheimer's disease, Parkinson's disease, stroke) and challenges for medicine, biochemistry, engineering, and neuroscience.

2.2.4. Round Table Discussion on dimension D7

The presentation was followed by a round table discussion about Clinical Neurotechnology. The round table discussion aimed to:
- identify of challenge-based technology trends,
- explore of partners' current focus, strengths, development strategies, and possibilities for within NeurotechEU complementarity,
- initiate of developing road maps for NeurotechEU technological innovation,
- create synergy across partner universities' translational technological innovation ecosystems.

2.2.5. Plenary Session – Reflections: Education and Innovation 1 (17:30-18:30)

The Plenary Session on Education and Innovation was kickstarted with **Wim Scheenen**'s presentation about aligning NeurotechEU partner education programs. He talked about the plans of Radboud University to move towards joint, accredited programs, the importance of aligning educational programs of partners, the introduction of the NeurotechEU Diploma and exchange of teachers, the mobility of students, and having a student-driven university in which they are involved in discussions and communication.
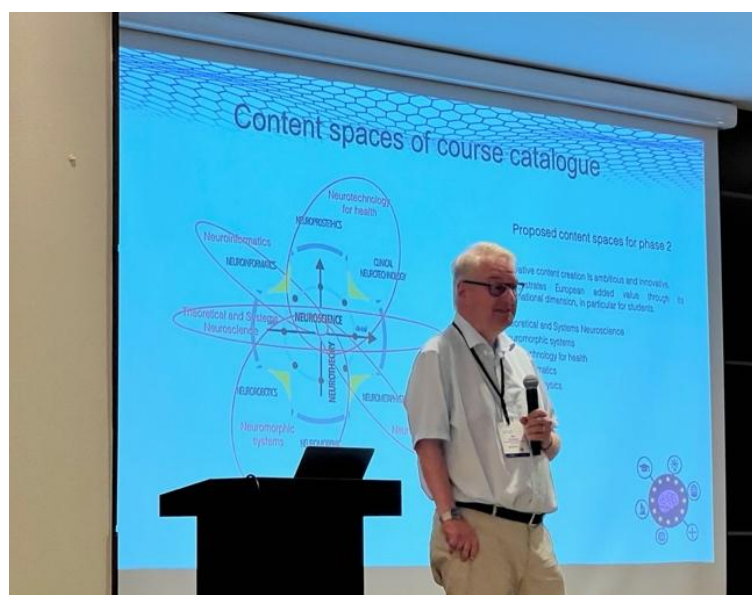

Fig. 10. Wim Scheenen – Aligning NeurotechEU partner education programmes

The following discussion, moderated by **Stefan Fuss** and **Can Yücesoy**, delved into the compatibility of educational programs offered by partner institutions with the challenges and technologies highlighted during the summit. It focused on aligning strategic future emerging technological innovation targets with the education of future neurotechnology experts in a complementary manner. Questions were raised about the need for courses (e.g., basic AI/ computer science programs) addressing these challenges and the possibility of complementing educational programs across NeurotechEU partners to equip future neurotechnology experts with the necessary multidisciplinary skills. It also touched on the importance of social, legal, and ethical aspects of Neurometaphysics.

Fig. 11. The Summit participants

3. Second day of the Summit

NeurotechEU Summit Day 2 brought forth a rich tapestry of discussions and presentations, offering profound insights into the intersection of neuroscience, technology, and their impact on society. NeurotechEU Summit Day 2 showcased teamwork and creative ideas. The diverse presentations and discussions provided a comprehensive overview of the challenges and opportunities, paving the way for a future where neuro-technologies align seamlessly with societal needs and values.

3.1. Morning session

3.1.1. Plenary Session – Case Studies (09:00-10:00)

Daniela Schulz and **Martin Reuter** delivered an insightful presentation on understanding societal challenges from the NeurotechEU perspective. They emphasized the critical importance of society's support for future universities' success. Positive public attitudes toward neuro-technologies are pivotal, influencing policy decisions and funding allocations.

Fig. 12. Daniela Schulz (left side) and Martin Reuter (right side) – Understanding Societal Challenges: a NTEU perspective

To address this challenge, they introduced the idea of a transnational survey named the 'Understanding Societal Challenges Questionnaire (USCQ).' The USCQ aims to assess public perspectives on neuro-technological advances, encompassing needs, interests, access, knowledge, trust, and policy-making across EU/AC countries. The ultimate goal is better to understand public concerns and preferences regarding neuro-technological advances. By integrating this valuable knowledge, NeurotechEU may be better equipped to develop ethical, user-friendly, and well-regulated neuro-technologies that align with societal needs.

Fig. 13. Begüm Özkaynak (left side) and Necati Aras (right side) – Smart Cities – a case for NT applied to Societal Innovation

In their presentation, **Begüm Özkaynak** and **Necati Aras** discussed the relationship between neuroscientific studies and smart cities. Smart city development is a complex multi- and transdisciplinary challenge requiring context-aware decision-making practices to improve human functionality and capabilities while respecting societal and environmental rights and ethics. This vision in the nexus of neuroscience and technology, urban space, and society requires co-producing knowledge towards a hybrid intelligence. There is an urgent need for action to enhance the health and well-being of individuals residing in cities while ensuring that no one is excluded from urban development, also for resilience and sustainability through the intelligent design of public spaces, mobility, and transportation, as well as improved disaster management, planning of city logistics and waste management.

In the presentation, they also reviewed the state of knowledge in the literature based on a bibliometric analysis to describe how neuroscientific and neurotechnological expertise and solutions are currently used in smart cities.

3.1.2. Plenary Session: What is Neurometaphysics for Each Partner? (10:30-12:30)

In the plenary session moderated by **Can Yücesoy** and **Begüm Özkaynak**, we discussed what 'is D8' for each partner. The discussion aimed to explore how Neurometaphysics (dimension 8) can serve as a framework for incorporating various disciplines from partnering universities into NeurotechEU and promoting sustainable regional development. It also highlighted the importance of approaching this concept from theoretical, practical, and marketing perspectives and considering factors like intercultural differences, risk perception, quality control, and transdisciplinarity.

Fig. 14. Can Yücesoy – What is Neurometaphysics for Each Partner?

3.2. Afternoon session

3.2.1. Keynote Talks 6 (14:00-15:00)

The afternoon began with **Christine Useillie's** presentation on "Information about SATT du Nord ", the Association for Acceleration of Technology Transfer of Northern France. SATTs are local and trusted organizations with access to the skills and inventions of researchers in their respective regions. They are responsible for identifying, evaluating, protecting, and bringing these inventions to market by partnering with existing companies or supporting future startups. Additionally, they provide financial support for the technological development of innovations stemming from French public research through an exclusive investment fund.

Fig. 15. Christine Useillie – Information on SATT du Nord

Ángeles Gallar gave a vibrant presentation on the communication of science projects at UMH. She discussed the importance of targeting diverse groups through various communication channels, including social and written media such as science magazines, Twitter, Instagram, and newsletters. She also highlighted the significance of reaching patients through online games and local news broadcasts. Additionally, she stressed the importance of engaging with the audience at science fairs and schools and underscored the value of storytelling in the context of science.

3.2.2. Round Table Discussions on dimension D8

Necati Aras's bibliometric analysis for potential D8 disciplines was followed by a discussion moderated by **Bryndis Asgeirsdottir** and **Juana Gallar** about what dimension 8 (D8) means for each partner, the importance and possibilities of growth within this dimension, the significance of having a clear strategy for attracting people and defining how we can make the content less intimidating. Additionally, it was concluded that while Neurotechnology is a shared interest, a cool yet unapproachable name may encourage people to engage, and we should also address the differences among the partners while trying to find connections and a designated contact person.

Fig. 16. The audience

4. Third day of the Summit

In summary , the third day provided valuable insights into funding options, collaborative opportunities, and strategies to address societal challenges at the intersection of neuroscience and technology, setting a clear path for NeurotechEU's future endeavors.

4.1. Plenary Session: Establishing NEUROFUND (09:00 – 10:30)

The last day of the conference opened with a Plenary Session about Establishing NEUROFUND, which featured an insightful presentation by **Jutta Escher- Kolski**. Her presentation aimed to start brainstorming about complementary funding opportunities for our NeurotechEU consortium other than the Erasmus+ European University Initiative grant. Several types of funding are available under key action 2 of the Erasmus+ programme. Decentralized projects, funded by the Erasmus+ national agencies, allow much freedom in implementing projects. But there are also centralized actions steered and funded by the European agency Education and Culture in Brussels with two main types of partnership: Partnerships for excellence such as Erasmus Mundus Joint Masters and the European University Initiative, and there are partnerships for innovation. This Summit in Bodrum brought together

representatives from industry and 'TTO' transfer to industry centers; therefore, the Erasmus+' Alliances for Innovation' seems relevant for our consortium.

Fig. 17. Jutta-Escher Kolski – Information on the funding scheme: „Erasmus+ Alliances for Innovation"

The Alliances for Innovation aim to strengthen Europe's capacity for innovation through cooperation and the exchange of best practices, sharing knowledge between higher education, the professional environment in education and training, both initial and continuing education, and the broader socio-economic environment, including research.

Generally speaking, Alliances for Innovation projects are to stimulate the development of new emerging skills and to remedy the mismatch between the supply of skills and the demand for skills by the labor market by designing and creating new cross-disciplinary and trans-disciplinary curricula for vocational training and higher education.

The Alliances for Innovation Action is divided into two lots of varying sizes and requirements: Lot 1 covers the Alliances for education and enterprises, and Lot 2 is the Alliances for sectoral cooperation on skills, the so-called 'implementing the blueprint' projects. Lot 2 proposals must focus on one of the 14 industrial ecosystems defined in the "New Industrial Strategy for Europe" and aimed at reducing the skills shortages and mismatches hampering growth in specific areas.

The objectives, the activities and the key facts of both Lots were presented in detail, and their differences were expressed.

While Lot 1 Alliances for education and enterprises are increasingly popular among universities and VET providers, with a very competitive success rate of 8% in 2022, the Lot 2 "Blueprint" Alliances are only addressed to current partners of large-scale partnerships under the Pact for Skills.

In summary, Lot 1 is an attractive financial instrument for encouraging collaboration between consortium members and their associated partners and for developing educational programs in neurotechnologies that meet the future needs of the labor market. Lot 2 is also highly relevant for NeurotechEU. Still, before applying, the consortium needs time to meet the requirements and study the EU policy background regarding the European Skills Strategy.

Guillermo Talavera's presentation was about the funding possibilities and collaboration with other alliances. He emphasized the importance of "stabilizing" NeurotechEU, involving partners and associate partners fully, and establishing robust procedures and protocols. He also provided insight into the

programs, focus, and budget of Horizon Europe (EU's key funding program for research and innovations) COFUND, Erasmus, and EIT-Health, underlining the available funding opportunities.

Fig. 18. Guillermo Talavera - Funding possibilities and collaborations with other alliance

Furthermore, he touched upon collaborations with other alliances, for instance using the forum FOREU2, which aims to promote cooperation and share best practices. He also mentioned the contacts Neurotech EU has so far , alliances we approached, and the alliances that came to us. His conclusion was that there are many funding opportunities, but we need a pragmatic strategy.

4.2. Plenary Session: What are the plausible mechanisms of matching funds? (11:00 – 12:00)

The subsequent Plenary Session, moderated by **Can Yücesoy**, revolved around discussions on raising matching funds at both local and global levels for NeurotechEU. The importance of establishing a dedicated Neurotech EU body for promoting fundraising (NEUROFUND) was emphasized, underscoring the need for collective efforts to ensure the sustainability and growth of NeurotechEU.

5. Keynote Takeaways of the 2023 NeurotechEU Summit

The keynote takeaways from the NeurotechEU Technological and Societal Innovation Summit 2023 include:

Enormous Impact of AI and Robotics: The summit underscored that artificial intelligence and robotics are advancing rapidly and are poised to bring about profound changes that will affect humanity. These changes will be significant, and there is a need for society to be prepared for these forthcoming advancements.

Collaboration and Partnerships: The event emphasized the importance of cooperation between research institutions, industrial organizations, and companies. It highlighted collaborative efforts between industrial institutions and universities, showcasing the importance of working together to advance neurotechnology.

Current State of Neurotechnology: Keynote speakers presented the current state of the art in neurotechnology and discussed the challenges facing this field. Topics covered included neuromodulation, wearable devices, education, medical imaging, and the development of intelligent robots, among others.

Translational Technological Innovation: Presentations provided insights into the translational technological innovation focuses and ecosystems of NeurotechEU partner universities, emphasizing the importance of bridging the gap between academia and industry in neurotechnology.

Societal Impact and Ethical Considerations: Discussions touched on the societal impact of neurotechnology and the ethical considerations surrounding its development. The summit also highlighted the importance of public support, ethical regulation, and user-friendly applications.

Education and Innovation: Discussions emphasized the importance of aligning educational programs across partner institutions with emerging technological innovations in neurotechnology, including multidisciplinary education and addressing   social, legal, and ethical aspects   .

Funding and Collaborations: The summit explored potential funding avenues, including the Erasmus+ "Alliances for Innovation" program and the importance of stabilizing NeurotechEU through partnerships and collaboration with other alliances.

NEUROFUND: The discussion about the establishment of NEUROFUND highlighted the importance of collective efforts for the sustainability and growth of the Alliance   .

Smart Cities and Neuroscience: The relationship between neuroscientific studies and smart city development was explored, focusing on improving human functionality and well-being while respecting societal and environmental rights and ethics.

Understanding Societal Challenges: The importance of understanding public perspectives on neuro-technological advances and aligning neurotechnology with societal needs was a recurring theme.

The S   ummit highlighted the transformative potential of neurotechnology, the importance of aligning education and research with emerging technologies, the need for collaboration, and the consideration of societal and ethical aspects as these technologies continue to evolve and impact various aspects of our lives.

6.   List of Figures