

# AI-Mind – New initiative to develop artificial intelligence tools for dementia prevention

The AI-Mind project with its intelligent digital tools for screening brain connectivity and dementia risk estimation in people with mild cognitive impairment will facilitate a paradigm shift in clinical practice.

The AI-Mind project kicked-off in March 2021 with a consortium meeting of 52 collaborators setting up a multidisciplinary approach to address the challenge of effective dementia prevention. Funded by Horizon 2020 with a duration of five years, the project has an initial budget of around EUR 14 million distributed across a total of 15 partners from multiple sectors including academic institutions, medical centres, SMEs, spin-off companies and patient associations. In this project, Alzheimer Europe is representing the patient perspective and will be involved in the ethics and communication activities of the project.

More than 10 million Europeans show signs of mild cognitive impairment (MCI), a condition defined by deficits in memory but not severe enough to significantly impact activities of daily life. Although people with MCI have clinical symptoms but limited disability, MCI is associated with a very high risk of dementia.

It is estimated that around 50% of people with MCI will develop dementia within five years (risk more than 20 times higher than in the healthy elderly population).

Current clinical practice (e.g. diagnose, examination) lacks the necessary screening tools to identify those at 50% of risk. The patient's journey typically takes many years and involved several clinical visits before a conclusive diagnosis of dementia is finally reached. A timely and early diagnosis can help people take control and would result in numerous benefits (e.g. early support, health improvement, early-stage intervention). AI-Mind will radically shorten this journey to a week, through a digital solution that is able to provide a fast and accurate (>95%) prediction for the individual dementia risk. This would give doctors and patients a window for preventive interventions, therapies and rehabilitation measures early in the course of the

disease. AI-Mind aims to use artificial intelligence to enable clinicians to perform early population-based screening assessment of dementia risk for all people with MCI.

AI-Mind will develop an “Intelligent diagnostics toolkit” for brain connectivity screening and dementia risk estimation in people with MCI containing two new artificial intelligence-based digital tools: the AI-Mind Connector and the AI-Mind Predictor. The AI-Mind Connector will identify dysfunctional brain networks (e.g. synaptic malfunction and loss of connectivity which characterise signs of dementia) and the AI-Mind Predictor will assess dementia risk using data from the Connector, advanced cognitive tests and genetic biomarkers.

These two tools will be delivered to clinicians through a digital platform designed to analyse and process routinely collected data in an innovative manner. With the goal to distinguish people at risk and not at risk of dementia in a group of MCI subjects, the AI-based platform will be tested and validated in five European clinical centres:

- Complutense University of Madrid (Madrid, Spain)
- Helsinki University Hospital (Helsinki, Finland)
- Oslo University Hospital (Oslo, Norway)
- Scientific Institute for Research, Hospitalization and Healthcare, San Raffaele Roma (Rome, Italy)
- Università Cattolica del Sacro Cuore (Milan, Italy).



### Ira Haraldsen, the project coordinator, presents the overall vision of AI-Mind

#### What are the benefits of artificial intelligence for dementia prevention?

Thanks to using artificial intelligence in well-established technologies, such as electrocardiogram (ECG) or electroencephalogram (EEG), we reach beyond the state of the art where more information becomes available to us. For example, in ECG and EEG the human eye has for over 100 years identified important information like the risk of acute heart attack/stroke. Until recently, most analyses of technologies were built on our own experiences alone.

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Using artificial intelligence in EEG interpretation will not only reduce the amount of time needed for manual calculations done by computer but will enhance the quality of our understanding of electrical phenomena and its correlation to dementia. We know from research that one of the earliest signs of pathological dementia-like processes is of an electrical art, noticeable a long time before structural changes occur. Therefore, artificial intelligence will help us to open up a new window of opportunities in dementia treatment.

#### What are some of the main challenges you are facing with this research?

The first one that comes to my mind is to get access to sufficient data. Artificial intelligence needs big data; traditional storage of files connected to each journal file in one traditional hospital won't be sufficient for machines or deep learning. Therefore, we have to establish international and European databanks where such analytical models can be developed and serve as a benchmark for results of individual

patients. This would require fast adaptations in our health care system journal file procedures.

Interactive solutions with the outer world are demanded but they have to be secure and take care of our personal rights. One important pre-conditioning will be the harmonisation of the different national legal frameworks to have a European model understanding and implementing our human rights into AI based algorithms. Our willingness to adapt will be utterly important. Artificial intelligence is changing the world as we know it. Part of the fourth industrial revolution, AI is just as challenging as the use of electricity for lighting, or railway expansion were in another century. Not everybody liked using light bulbs, in the beginning some preferred candlelight, but now in the long term it enabled us to make substantial new discoveries.

#### How did you come up with the idea to launch this innovative AI-Mind project?

One of my PhD students was interested in functional and electrical brain network analyses. I respect very much his interdisciplinary and his technological knowledge but watching him every day working so hard and achieving so little, pushing constantly one or another computer button, writing another instruction on how the computer should calculate, was already for me exhausting to watch. Due to the demanding expertise in data processing, he submitted his first paper after 2.5 years. I thought, that even though all this information is of great importance, no patient would ever enjoy the journey. If we do not change the approach and benefit from AI revolution, this will be a standard research method used forever and I cannot accept this! There is another way.

My first job at the Max Planck Institute at Cologne in Germany taught me a lot in this regard. Back in the beginning of the '80s, Positron Emission Tomography was introduced to the clinic. There we were only successful by locating research facilities close to the hospital. We introduced physicists, mathematicians, engineers to the clinical research world by building strategical interdisciplinary teams. I loved observing other experts



Ira Haraldsen

looking at my knowledge background from a completely different angle. A friend of mine always says: “Education is looking at the same thing from different angles, like humans or birds differently experience water”. I love being part of projects where one can learn from others. The AI-Mind project gives us the opportunity not only to exchange knowledge but to develop AI-based technology that reaches beyond the state of the art and can be used for dementia prevention.

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#### What are your expectations from and hopes for the project?

I hope that AI-Mind team will contribute to the change in the health system. By developing a new screening method we can make one step

forward into taking care of our brain. Dementia is still stigmatised like cancer was in the '60s-'70s. If we look now at cancer disease, a lot of changes happened. We regularly join preventive programmes, like mamma, prostate and cervix cancer screening programmes. However, we are not screening our brain function regularly, and not early enough to be able to intervene at the earliest possible time point, when cognitive changes are starting becoming pathological.

Unfortunately, today we are investigating brain function when it is too late. We are only able to diagnose dementia when structural changes are obvious. Functional methods like functional Magnetic Resonance Imaging and Positron Emission Tomography are only used in about 15% of the European dementia cases. It is an extremely expensive method and we note an inequity for those who have access to it. I really wish that AI-Mind can contribute to change this.

By developing an artificial intelligence-based prediction tool that is accessible, affordable, and non-harmful, we will do our duty to work for equity in health. It is irresponsible that only high technology-driven countries can have access to the latest innovative methods. Aging is a worldwide phenomenon and artificial intelligence will contribute in many areas such as dementia's prevention to increase equality.

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