

Artificial Intelligence in Parkinson's Research

Doctoral Network AIPD – *Artificial Intelligence in Parkinson's Disease*

Are AI and digital technologies the key to earlier and more precise diagnosis of Parkinson's disease?

Sometimes the first signs are subtle: the voice sounds different, steps become shorter, and movements seem less fluid. Researchers are investigating whether such early changes in speech and movement can be detected before a clinical diagnosis is made.

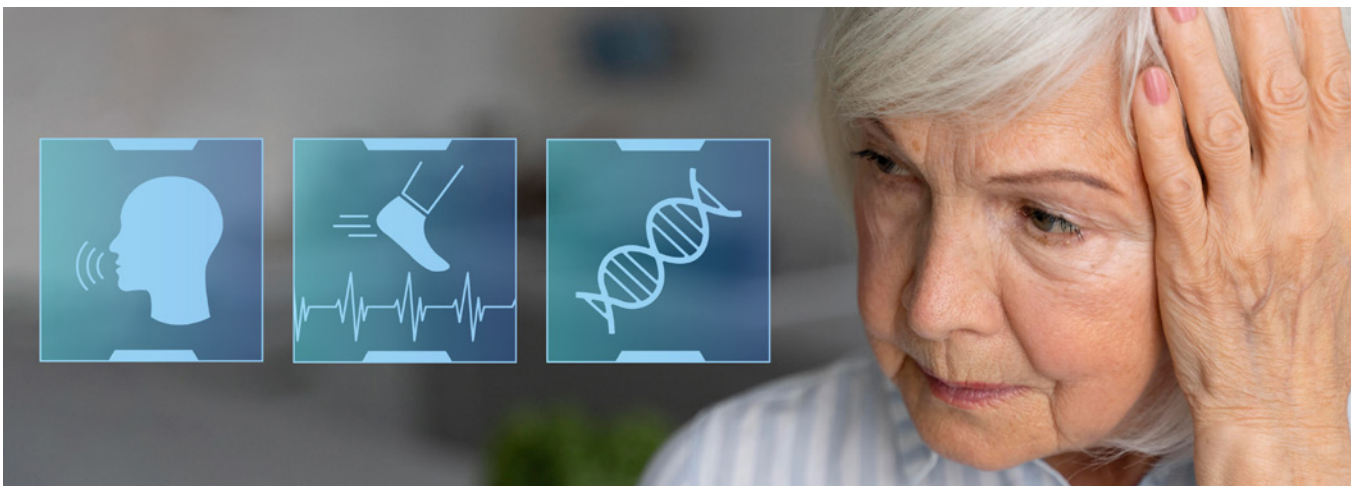
Can voice, movement, and other digital signals help predict how the disease will progress and support more personalized treatment? These questions are at the heart of the Marie Skłodowska-Curie Doctoral Network "Artificial Intelligence in Parkinson's Disease" (AIPD).

Parkinson's disease is one of the most common neurodegenerative diseases, and its prevalence is rising. It is a chronic, progressive condition in which specific nerve cells in the brain gradually die. In addition to motor symptoms such as tremor, stiffness, and slowed movements, many

people experience sleep problems, mood changes, cognitive difficulties, and autonomic symptoms. These changes often vary widely between individuals and are typically described only qualitatively, making diagnosis and treatment challenging.

Despite decades of research, there is still no cure, and diagnosis is often made only at relatively advanced stages of the disease.

At the same time, emerging artificial intelligence (AI) methods and digital technologies are opening new opportunities for earlier and more accurate diagnosis, improved tracking of disease progression, and more personalized treatment strategies. For example, AI-based analysis of voice recordings and gait sensor data shows great potential to provide early indications of typical Parkinson's symptoms and to objectively track changes over time.



What is AIPD?

AIPD is a European Marie Skłodowska-Curie Doctoral Network that will train 14 doctoral candidates to work at the intersection of AI, neurology, and digital health. The network develops data-driven methods to improve early detection, prognosis, and personalized treatment strategies for Parkinson's disease. Beyond technical performance, questions about the trustworthiness, ethics, and regulation of AI solutions are central to the research.

Fields of expertise of the project partners

- Specialists in AI, machine learning, and data science
- Experts in neurology, movement disorders, and clinical research
- Specialists in digital biomarkers, including voice, and wearable sensor data
- Experts in molecular profiling (omics) and medical imaging
- Pharmaceutical and medical technology companies with experience in drug development and imaging
- Experts in ethics, law, data protection, and health technology regulation

The approach

To advance AI-supported diagnosis and personalized treatment of Parkinson's disease, the network pursues several complementary approaches:

- **Data-driven modeling:** Multimodal patient data (clinical assessments, imaging, omics, and digital biomarkers such as voice and sensor data) are analyzed with state-of-the-art AI methods to identify early markers of Parkinson's disease, distinguish it from related conditions, and predict disease progression and treatment response.
- **Digital twins and prognostic models:** Partners develop AI-based techniques to simulate "digital twins" of individual Parkinson's patients and to improve predictive models individual disease trajectories.
- **Explainable and trustworthy AI:** The project focuses on explainable AI models that clinicians and patients can understand and trust. Special attention is given to transparency, robustness, bias mitigation, data protection, and alignment with relevant regulatory frameworks.
- **Experimental and clinical validation:** AI models and digital biomarkers are evaluated together with clinical and industrial partners to assess their clinical utility and potential for real-world application.

Training and collaboration

The AIPD network brings together academic institutions, pharmaceutical companies, and medical technology enterprises:

Academic partners

Fraunhofer SCAI (Coordinator), University of Bonn, University of Luxembourg, University of Namur, University of Pisa, Erasmus Medical Center Rotterdam, Luxembourg Institute of Health, and Royal College of Surgeons in Ireland

Industrial and associated partners

Novo Nordisk, GE Healthcare, Petanux, ki:elements, Centre Hospitalier de Luxembourg, and IESE Business School

Aims

- To develop AI-based biomarkers (e.g. from voice and sensor data) for earlier, more accurate diagnosis of Parkinson's disease.
- To build predictive, explainable models and digital twins that capture individual disease progression and support personalized treatment decisions.
- To investigate ethical, legal, and regulatory questions surrounding the use of AI in Parkinson's care and promote trustworthy AI.
- To train a new generation of researchers at the intersection of AI, neurology, and digital health who can translate research findings into clinical practice.

Funding

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