

A hand and a robotic hand are shown touching. The background is a dark blue grid with the word 'EAISI' repeated in a lighter blue color, creating a sense of depth and digital space.

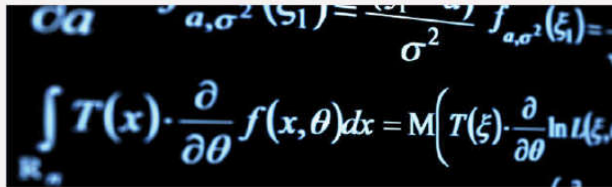
*The Health AI research program of Eindhoven Artificial
Intelligence Systems Institute (EAISI)*

Eindhoven AI Systems Institute

March 9th, 2021

<https://idic.org.il/events/dutch-israeli-artificial-intelligence-ai-mini-symposium>

Nine departments



Mathematics & Computer Science



Applied Physics



Chemical Engineering



Mechanical Engineering



Electrical Engineering



Biomedical Engineering



Built Environment



Industrial Design



Industrial Eng. & Innovation Sciences

Green campus



At the heart of the brainport region



12500 students



Student teams



Challenge Based Learning



1400 PhD candidates



A photograph of a group of people, likely faculty members, seated in an audience. They are wearing dark academic regalia (gowns) over white shirts and ties. The individuals are shown in profile, looking towards the left side of the frame. The lighting is dramatic, with strong highlights on their faces and shoulders against a dark background. The text "600 Faculty" is overlaid on the left side of the image.

600 Faculty

AI for the Real World

*Multidisciplinary AI research that combines
Data Science, Humans & Ethics, and Robotics
(Data – Human – Machine)*



Targets for 2024

Research	<ul style="list-style-type: none">➤ Appoint 50 new AI related professor positions on top of current 150➤ Have 20% of our AI related publications in the top 5% of scientific journals
Education	<ul style="list-style-type: none">➤ 25% of TU/e graduates to be AI specialists or AI 'enabled' engineers (>300 BSc, >300 MSc, >300 professional education students per year)
Acquisition	<ul style="list-style-type: none">➤ Acquire an additional, external annual research budget of 30M€ on top of our own investment of 20M€
Positioning	<ul style="list-style-type: none">➤ Build a dedicated AI lab in the center of the TU/e campus➤ Regular (> weekly) appearance in (inter)national press outings➤ Contribute to a flourishing AI ecosystem in Brainport Eindhoven, building on the High-Tech Systems knowledge base

EAISI Investments

- **Starting packages for new staff**
 - Over 50 new scientific AI staff position have been defined
 - Starting packages: already funded 60 new PhD positions
 - Additional starting packages available
- **Funding for existing staff**
 - **EMDAIR**: *'high gain – high risk'*: 20 additional PhDs
 - **EAISI Impuls** (match industry-funded PhDs): 50 additional PhDs
- **Other investments**
 - **Infrastructure fund**: over 6 M€ is reserved for shared, multidisciplinary infrastructure
 - Funds for **visiting scientists** (spend some weeks at TU/e)

EAISI from a Scientific Viewpoint

Data and Algorithms

- Low data requirements
- Identifying and combining trustworthy data
- Low algorithmic complexity
- Certifiable models
- AI algorithms that cooperate with humans in decision making
- AI algorithms are continuously and autonomously improved by their own outcomes and new data

Engineering Systems

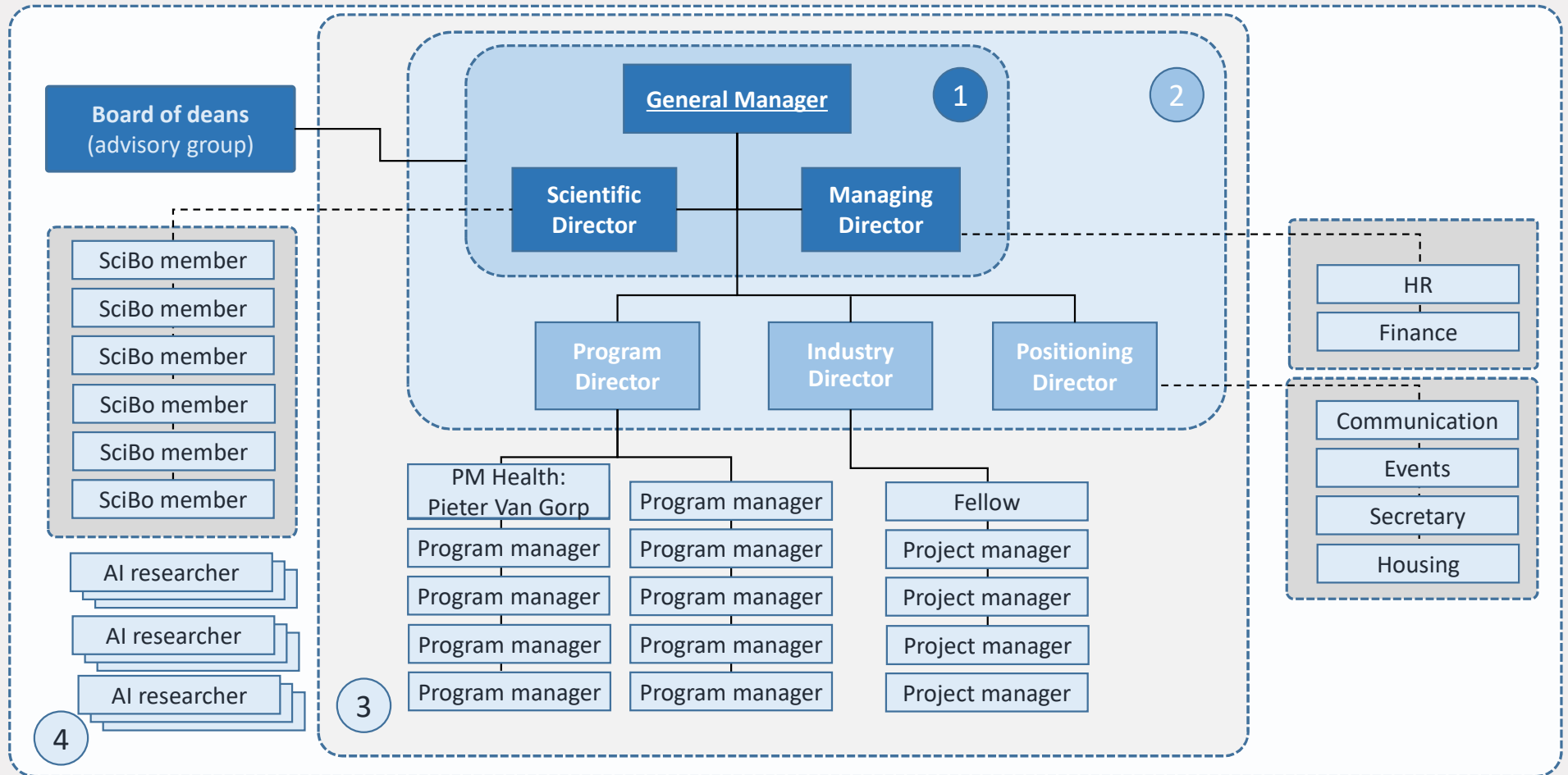
- Robustly coping with uncertainty
- Cyber-physical engineering
- Open world solutions
- Interacting with humans
- Limited sensory information
- Dynamically changing environment
- Guaranteed performance and safety
- Dedicated hardware for AI
- Integrating model driven and data driven techniques

Humans and Ethics

- Optimized organizational processes and human-machine interfaces
- Understanding and mitigating unintended effects of AI
- Overcoming frequently flawed human behaviors
- Recommendations that are robust, fair, explainable and contestable
- Socially, emotionally and morally intelligent machines
- Able to understand human language, emotions, intentions, values and behaviors

EAISI from an Organizational Viewpoint

- 1 = EAISI core
- 2 = EAISI MT
- 3 = EAISI PM
- 4 = EAISI Large



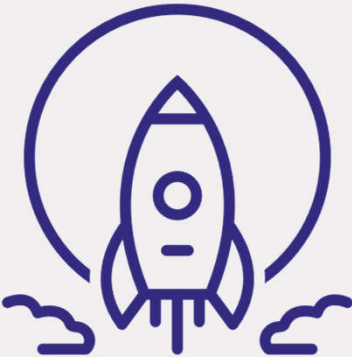
EAISI from a Societal Viewpoint

Health



Healthcare
Anywhere

Industry



Autonomous &
Zero-waste

Mobility



Zero-Accident

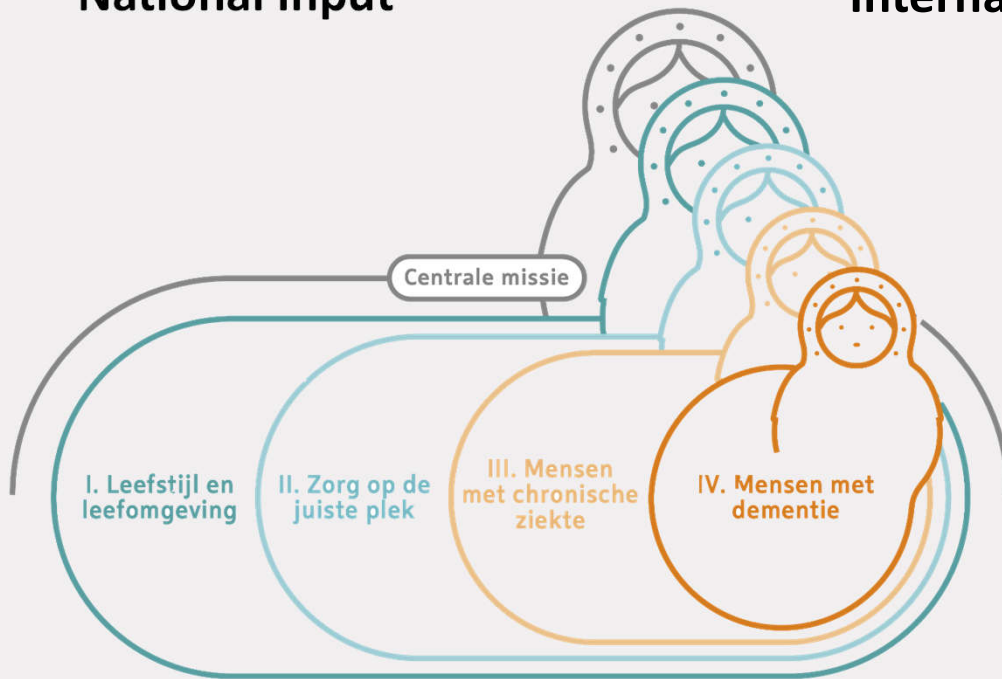
EAISI from a Practical Viewpoint

- **Research interaction**
 - **Research communities** around research program lines and moonshots
 - **Research Meets**: give podium to (young) researchers to connect to others
 - **Match-making** events
 - **Consortia** building for successful proposals
- **Education**
 - AI education (BSc programs, MSc programs, Professional Education)
- **Knowledge sharing**
 - Yearly **EAISI Summit**
 - **AI Talks** (open, both speakers and audience can be external and internal)
 - **AI Lunch lectures** (mainly internal speakers and audience)
 - Bi-monthly **newsletter**
- **Agenda setting**
 - EU / NL networking engagement in public-private working groups on AI related topics

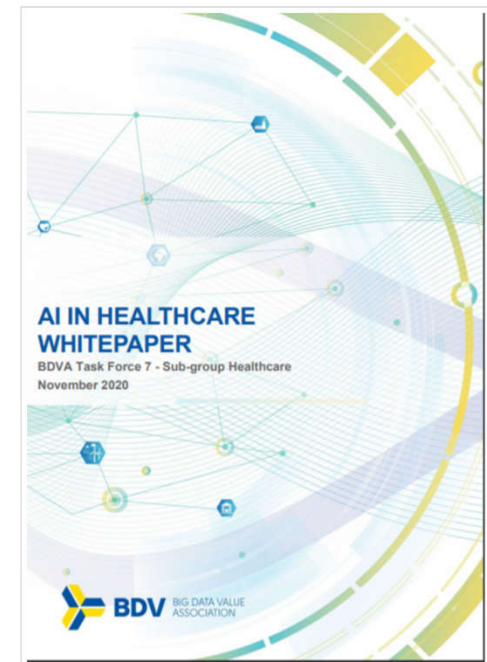
EAISI Health AI Strategy

National Input

International Alignment



Release of the BDVA Whitepaper on AI in Healthcare



The BDVA Task Force 7 - Sub-group on Healthcare is proud to release the first BDVA Whitepaper on AI in Healthcare. This publication aims to feed policy makers with the information that is needed for realising the full potential of AI in healthcare.

Moonshot: Hospitals Anywhere, Nowhere



- **Anywhere:** Through advanced AI, specialized health support will be delivered increasingly **outside of hospitals:** anywhere and at any time. AI-powered **prediction** and **scheduling** tools will protect scarce resources and direct them timely to where they are most **effective** in the care chain. For example, the surgeon of the future will be supported by **real-time imaging** and **precision robotics** at locations that **minimize waiting time** and **maximize throughput**.
- **Nowhere:** Care will move from today's fractured business model, often characterized by limited patient contact, to a new holistic approach in which clinicians and caregivers **continuously manage each person's health remotely:** scalable and personalized preventive services will **reduce the need for hospital care** in the first place. Such services will also **amplify the wellbeing** in local communities by promoting participation in **social** activities.

Healthcare Anywhere: 5 Program Lines

- H-1 E-Lifestyle as a medicine
- H-2 AI for value-based care
- H-3 Precision Diagnostics
- H-4 Warm tech for Dementia
- H-5 Health Data Infrastructure

H: Hospital Anywhere, Nowhere

H-1 E-Lifestyle as a medicine: Citizens of the future will enter the hospital much more rarely since provenly effective digital lifestyle interventions will be adopted in daily life and routine care. These interventions will be personalized and participatory by means of digital patient twins that consider sensor data “on” and “around” the citizen. Such twins will also consider the psychological and emotional profile of the patient in order to intervene more effectively than today.

H-2 AI for value-based care: decision support systems and robots will carry out tasks where humans do not add value (e.g., e-triage, autonomous delivery of goods, lifting heavy weights, ...). Nurses and informal caregivers will also be aided in their decision making by suggesting actions that have proven most effective. Nurse capacity will then be available more for emotional support. Specialist care will also be augmented with AI and robotics: AI will aid in better considering patient profiles across disciplines while robotics will aid in precision surgery. Due to an increase in quality, care can ultimately be reimbursed on outcomes rather than on the resources spent.

H: Hospital Anywhere, Nowhere

H-3 Precision Diagnostics: Holistic data analyses for AI-based diagnostics will consider the microbiome, genome, and exposome. Specifically, hospital data such as physician notes, images and lab results will be considered in relation to lifestyle data.

H-4 Warm tech for Dementia: given the pressure on personnel in care homes, technology support is emerging quickly. EAISI will ensure that such technology increases the warmth of care: first, AI will support caregivers to give better emotional support. Second, items that were previously considered as commodities (pillows, speakers, ...) will be augmented with digital personalization features.

H: Hospital Anywhere, Nowhere

H-5 Data Infrastructure: EAISI will invest in European personal health record systems and European platforms for conducting privacy-preserving data science at large. AI models will be trained on global data sets via federated learning and secure multi-party computation. Transfer learning techniques will optimally leverage local context data such as dietary culture and socio-economic status. Besides algorithms and tools, EAISI will deliver data sets of unprecedented precision.



Example Project in EAISI Health

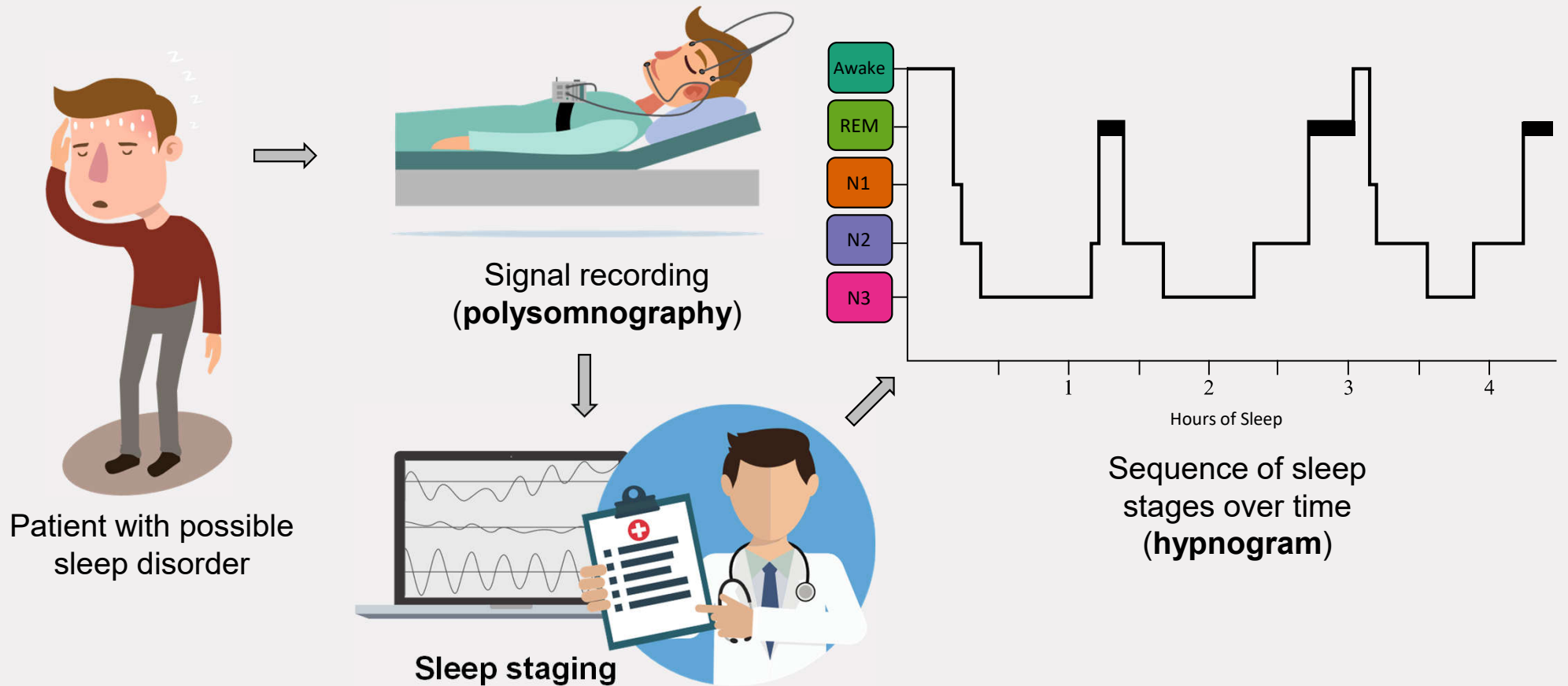


PerSleep

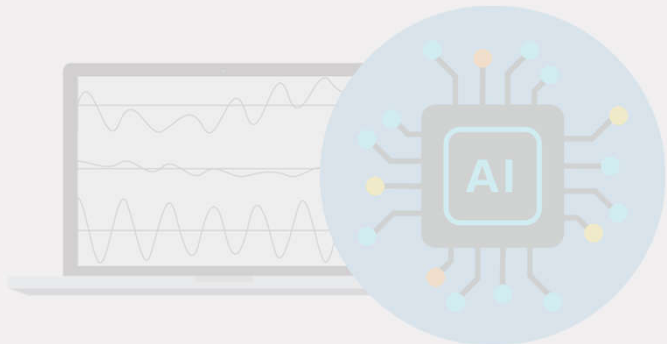
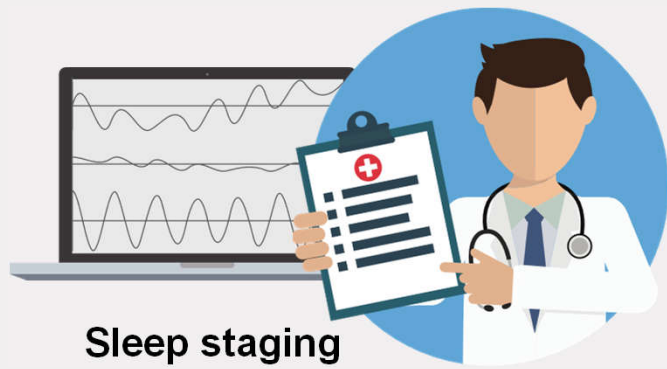
Humberto Garcia Caballero, M. A. Westenberg, A. Corvò, P. Fonseca, F. van Meulen, S. Overeem

A VISUAL ANALYTICS APPROACH FOR PERFORMANCE ANALYSIS IN SLEEP STAGING

POLYSOMNOGRAPHY & SLEEP STAGING

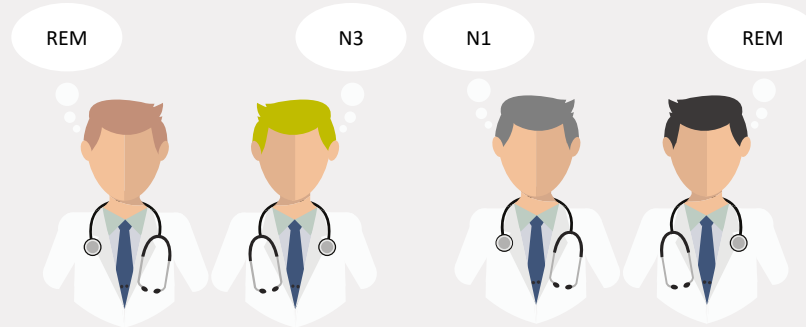


AUTOMATED SLEEP STAGING



Subjective

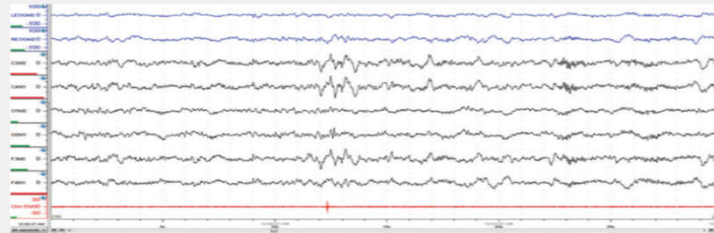
→ (potential) disagreement



Manual approach

→ **time consuming**

> 1 hour per patient

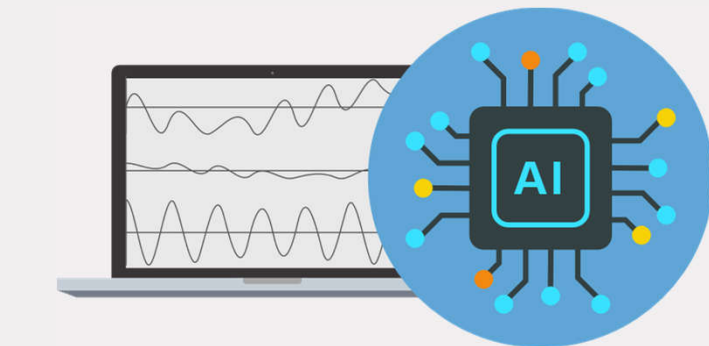


AUTOMATED SLEEP STAGING

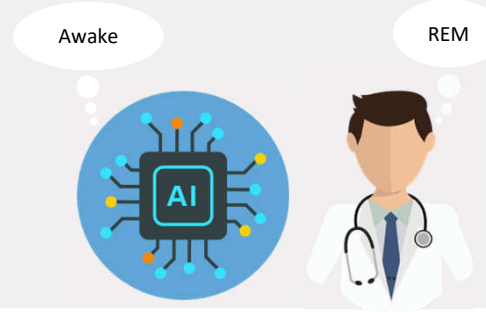


✓ **Objective** → agreement

✓ **Automated approach** → quick
several patients per minute



✗ **Automatic** → **misclassifications**
performance?
accuracy?
biases?
...

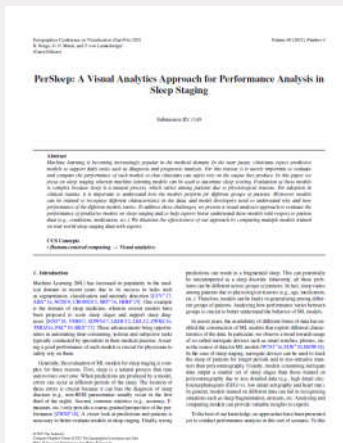


PerSleep: Solution

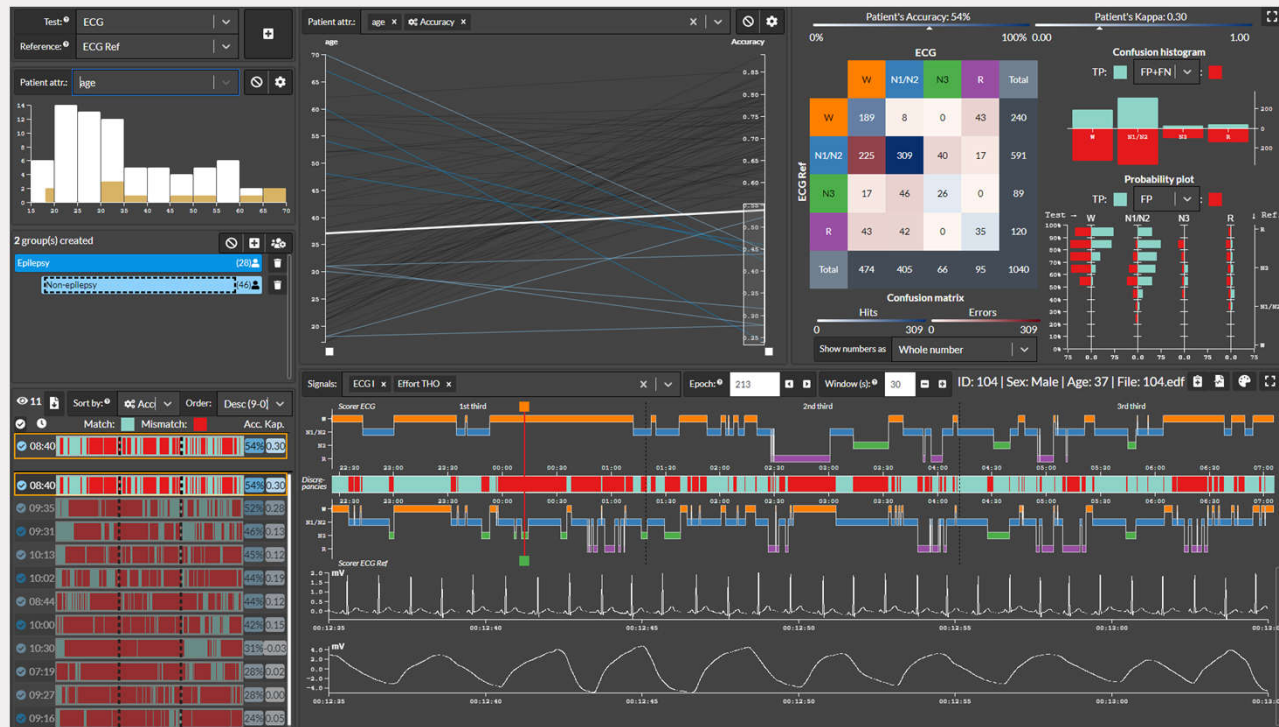
1 Somnologist 2 ML Experts (sleep knowledgeable)



Several meetings and brainstorm sessions



Manuscript being reviewed for publication at Euro Vis 2021



PerSleep: highly interactive Visual Analytics solution to be used by experts to gain insights into their models.

Back to E AISI from a Scientific Viewpoint

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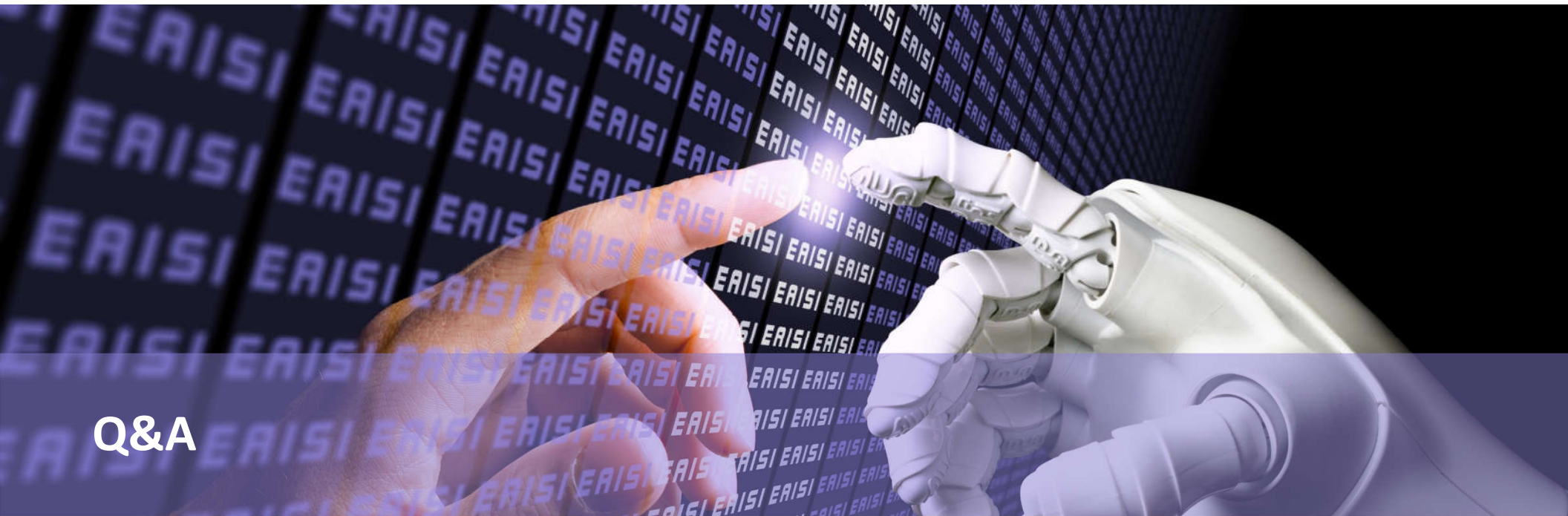
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Q&A

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