The mission of the Alan Turing Institute Almere (ATIA) is to achieve improved diagnosis and individualized treatment. This is realized by integrating knowledge from different health domains and research disciplines by using Artificial Intelligence (AI) systems. These disciplines include (bio-) medical, (neuro-) psychological and computational sciences. The goal is to support healthcare professionals with these systems.

ATIA, located in the Netherlands, was established in 2009. The research and development of the institute are based on the scientific work of Professor John-Jules Meyer and his team. The team consists of experts on artificial intelligence, agent technology, and various health care domains. ATIA has a particular focus on cognitive capacity, obesity and female sexual dysfunction (FSD).

As defined by the US President’s Council on Advisors on Science and Technology: “Personalized Medicine refers to the tailoring of medical treatment to the individual characteristics of each patient ... to classify individuals into subpopulations that differ in their susceptibility to a particular disease or their response to a specific treatment. Preventative or therapeutic interventions can then be concentrated on those who will benefit, sparing expense and side effects for those who will not”.

The ATIA approach to Personalized Medicine is characterized by taking into account multiple patient characteristics for classification into subtypes, a focus on treatment indication beyond diagnosis and transparent reasoning. Knowledge is derived from scientific literature, guidelines and original data. For data mining the latter, ATIA has developed an in-house implementation of an advanced decision tree classification algorithm.

Obesity is a multifactorial disease, associated with a variety of comorbidities. At present the effectiveness of treatment strategies for obesity is disappointing. At ATIA, we feel that this lack of effectiveness stresses the need for more custom-tailored, interdisciplinary approaches. Even though scientific literature supports the existence of obesity subtypes based on psychological evaluation scales, no specific diagnostic protocols, nor custom-tailored treatment strategies have been developed. It is feasible that classical statistical analyses are not suitable for the identification of unexpected complex interactions contributing to an increased caloric intake and subsequent development of obesity.
ATIA aims to develop diagnostic protocols and treatment strategies, by using an integrative approach. To tackle analytical difficulties we will use the Heterogeneous Multi-Agent System (HeMAS), which has a number of advantages over classical statistical analyses:

- All information obtained from distinct fields of research is taken into consideration in the analyses, which will allow us to uncover unexpected interactions.
- Our separate agents can interpret the same conditions, meaning that the outcome of one agent can serve as input for another, allowing us to combine separate AI-techniques.

The motivational background of overeating is likely to play an important role in the development of obesity, in addition to environmental (socio-economic), genetic and biochemical and physiological parameters. ATIA aims to obtain, analyze and integrate data from these distinct research fields. To this end ATIA has set up a collaboration with the Obesitaspoli (Lelystad) and started a clinical trial in which a cross-sectional study will be performed on 400 obese subjects. We will gather data in all disciplines mentioned above. The knowledge obtained will be modeled in such a manner that -in addition to conventional statistics- we can combine the use of predicate logic, decision trees, Bayesian networks, Machine learning, etc. This will not only give us information on linear, but also on more complex nonlinear relationships which will help us define subgroups. The information will be used to identify obesity subtypes and tailored to these subtypes, develop a pharmacological/psychological intervention that will be offered to an obese study cohort. We will also incorporate the risk of development of comorbidities of obesity.

Unique aspects of the ATIA approach

- Close collaboration between AI-researchers and experts within the biomedical field within ATIA, but also with medical experts involved in patient care.
- Data is gathered from large clinical trials performed by ATIA in close collaboration with healthcare professionals.
- Wide variety of data is obtained for every subject, and an integrated analysis is performed.
- Large potential to uncover unexpected nonlinear interactions, which will ultimately contribute to the development of novel treatment strategies.