



**Helseboka, the  
intelligent diagnostic  
tool, connects  
patients and doctors**

The national Helseboka platform connects patients and doctors in Norway. An underlying intelligence, Intmed, was built to allow patients to get the help effectively and accurately they need.

The system allows easy access to their journals, future appointments, lab-results and so on.

When a patient schedules a doctor's appointment via Helseboka, the system asks the patient a series of questions, about their symptoms. This way, the patient can describe their symptoms at depth, from the comfort of their own home, without time-pressure or fear of forgetting important details. Furthermore, the doctor won't have to spend the first 5 out of 20 minutes on initial diagnosis and will have a better basis for preparation.

At its core, Intmed provides an intelligent question-engine that supports doctors in diagnosing patients following a brief interview. The process is fully automated – the engine will pose questions about symptoms to the patient and depending on their answers throughout the interview, will provide a trustworthy diagnosis. The algorithm takes the patient's existing health data into account. For example, if the patient has diabetes the questions are adjusted to fit this.

In fact, trustworthiness is a fundamental part of Intmed's design. The diagnosis of a patient may be a question of life and death.

## The background for Helseboka

The two Norwegian doctors Marius Christensen and Anders Stormo had a vision to create a system allowing patients to get a better overview of their own health data. It should provide easy access to their own health journal and make communication between patient and doctor easy and efficient. The system should furthermore provide clinics with a better tool for daily operations and patient follow up.

A search for experts within app-development and machine-learning brought the doctors and Ambolt together in 2017, and programming of Helseboka soon took off. The App was ready for deployment in 2019 and is continually developed with new functionalities alongside an increasing number of users.

## Connecting for health

Currently, Helseboka is used by several hundred healthcare professionals in Norway, including doctors, nurses, therapists, chiropractors, etc. The solution has a 5-digit number of users in total.

As such, transparency and trustworthiness are paramount in making such a solution viable. Although deep learning has made incredible strides in machine intelligence and has become the new default approach to most things intelligent, this explainability and transparency is simply not possible using standard deep learning methods. So, a novel Bayesian-network-based prediction model with accuracy and explainability as the key acceptability metrics was developed together with professors from Aalborg University.

As a result, every decision made by the system – from individual question selection to the final diagnosis – is completely transparent and directly supported by empirical probabilities learned from real-world patient health data.

At any time, a doctor can receive an empirically supported report of the decision-making process conducted by the model to investigate how and why a diagnosis was reached. Not only does this increase trustworthiness - it directly enables and incentivises the user to become part of the decision-making process rather than a simple bystander.

