imec
embracing a better life

University of Antwerp

SMART HEALTH

COMPUTER-AIDED DIAGNOSIS FOR FOOT PAIN

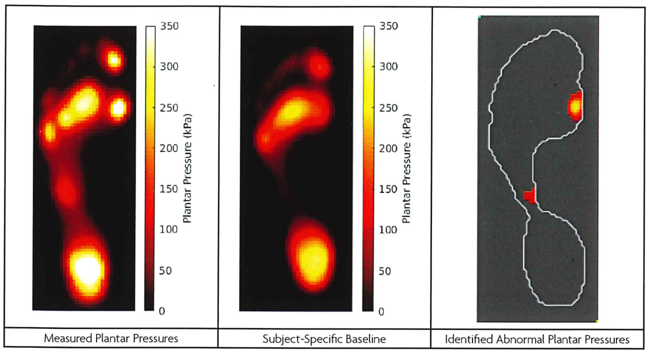
Foot pain affects up to 41% of the population, but more than half of those with debilitating foot pain never get professional treatment. The problem is that it is very hard to diagnose foot problems correctly. Patients are often asked to take a short walk on a pressure-sensing plate to measure the pressure between their foot and the ground while they walk. This kind of measurement can provide valuable insights, but the pressure video contains an overwhelming amount of information. As a result, current solutions only look at a fraction of the collected data.

GETTING THE MOST OUT OF PLANTAR PRESSURE MEASUREMENTS

Pressure-sensing plates measure plantar pressures in action, i.e. how the pressure between the foot and the ground changes while someone walks. One such a short walk can yield well over 10,000 pressure measurements. As this is too much to analyze visually, clinicians currently only evaluate portions of the plantar pressure video. For instance, they only look at the average pressure footprint or divide the foot into zones and report the average pressure for each zone. Another option is to aggregate all the data to create a time curve to show how the average plantar pressure changes while one walks. While all these approaches have valuable uses, they all also discard a large portion of the pressure data before evaluating it.

It is believed that this discarded data can provide additional insights into a person's walking pattern, insights that cannot be discovered using existing analysis techniques.

At Vision Lab, an imec research group at the University of Antwerp, we developed a computer-aided diagnosis algorithm for plantar pressure measurements. The difference with existing methods is that our solution takes into account all data, automatically compares it to a healthy baseline and then highlights areas with abnormal pressure measurements for further analysis by the clinician.



WALKING IN THE SHOES OF YOUR (HEALTHY) TWIN

The strength of the CAD WALK tool is in the innovative algorithms. In an initial training phase, an automated algorithm aligns plantar pressure images both spatially and temporally. With this input – the aligned results – statistical models can be built. Because we do not just want to compare people's plantar pressure measurements to a generic model, we also introduced a metric learning algorithm to identify the effect of demographics such as age, weight and gender. Simply put, you could say that this allows us to compare people's plantar pressures to data from their imaginary (healthy) twin rather than to a standardized baseline.

Plantar pressures are compared via a statistical test for outlier detection that allows us to identify, both in space and in time, abnormal plantar pressures. These are then highlighted in an 'abnormality map' for the clinician to analyze.

BETTER TREATMENT THANKS TO MORE PRECISE DIAGNOSTICS

We have already completed a first clinical validation study, which focuses on the diagnosis of hallux valgus or bunions. This is a very common foot problem that causes a deformity of the joint connecting the big toe and the foot. Depending on the severity of the problem, there are over 150 possible treatments (e.g. resection, osteotomies, joint fusion, etc).

Because the CAD WALK technology provides a more detailed analysis – taking into account all data and comparing it to a healthy baseline similar to the patient – it provides clinicians with precise information that can help them choose the most appropriate surgical option.

LOOKING FOR MEDICAL AND INDUSTRY PARTNERS

CAD WALK is an example of how Vision Lab's expertise in imaging and statistical modelling can help doctors understand and see what is going on inside a person's body. As a research group, Vision Lab focuses on technology that can enhance medical imaging and can facilitate diagnosis, e.g. through improved quality of MRI and CT scans as well as statistical modelling of human anatomy or biomechanics.

We are looking for partners interested in licensing the lab's technology (e.g. to integrate it into existing imaging devices), but we are also interested in collaborating with medical partners to fine-tune our technology to clinicians' needs and to better understand the diagnostic challenges in this field.

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