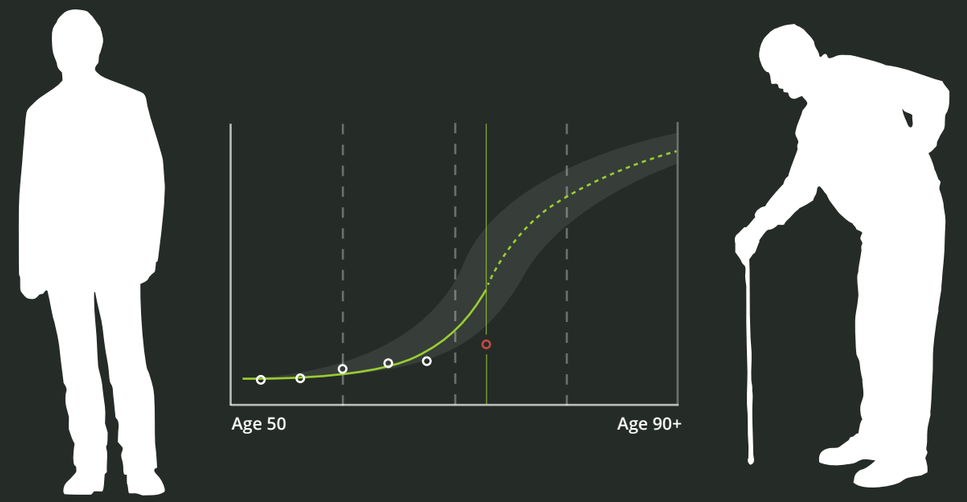
EXECUTIVE WHITE PAPER

PX NORDIC

WHEN IT MATTERS

Risk Based Analytics & Senseneering ™

Enabling fall risk assessment for the older population



The Role of Risk based Analytics in Elderly Healthcare Management

We are well into the Information Age and recent years have seen the rise of data mining and data analytics in virtually all industries. The healthcare industry is now taking its first steps towards making the most of the available data for allocating resources, improving diagnostics, predicting health outcomes and assessing health risks; ultimately aiming to improve care and health outcomes.

Risk based analytics for elderly healthcare management is concerned with assessing the risk of an adverse event, given the available data. The big challenge for risk based analytics is therefore registering the right information at the right time. Electronic health records (EHR) tend to capture episodes *after the fact* such as a diagnosis, an accident, or an intervention; making it difficult to observe or assess a person's slow progress or health decline over time. In order to provide actionable data for clinicians *ahead of time* it is important to also capture data at regular intervals, providing a richer context to EHR.

A major issue for elderly patients is falling. So far, the emphasis in dealing with this problem has largely been on promptly detecting that a fall has occurred and facilitating or initiating contact with emergency services. Little focus has been placed on providing better risk assessment and contextual analytics leading up to a fall.

Advances in mobile technologies, particularly around sensor-enabled solutions, have considerably lowered the costs for frequent data collection. Such measurements may include level of physical activity, gait characteristics, balance, and other quality of life indicators (Hausdorff et al. 2001, Stel et al. 2003, Verghese et al. 2009). Coupled with machine learning techniques and in combination with evidence-based methodologies, this information can be used to aid in assessing risk of falling and how this may increase or decrease over time. (Oliver et al. 1997, French et al. 2007, Bautmans et al. 2011).

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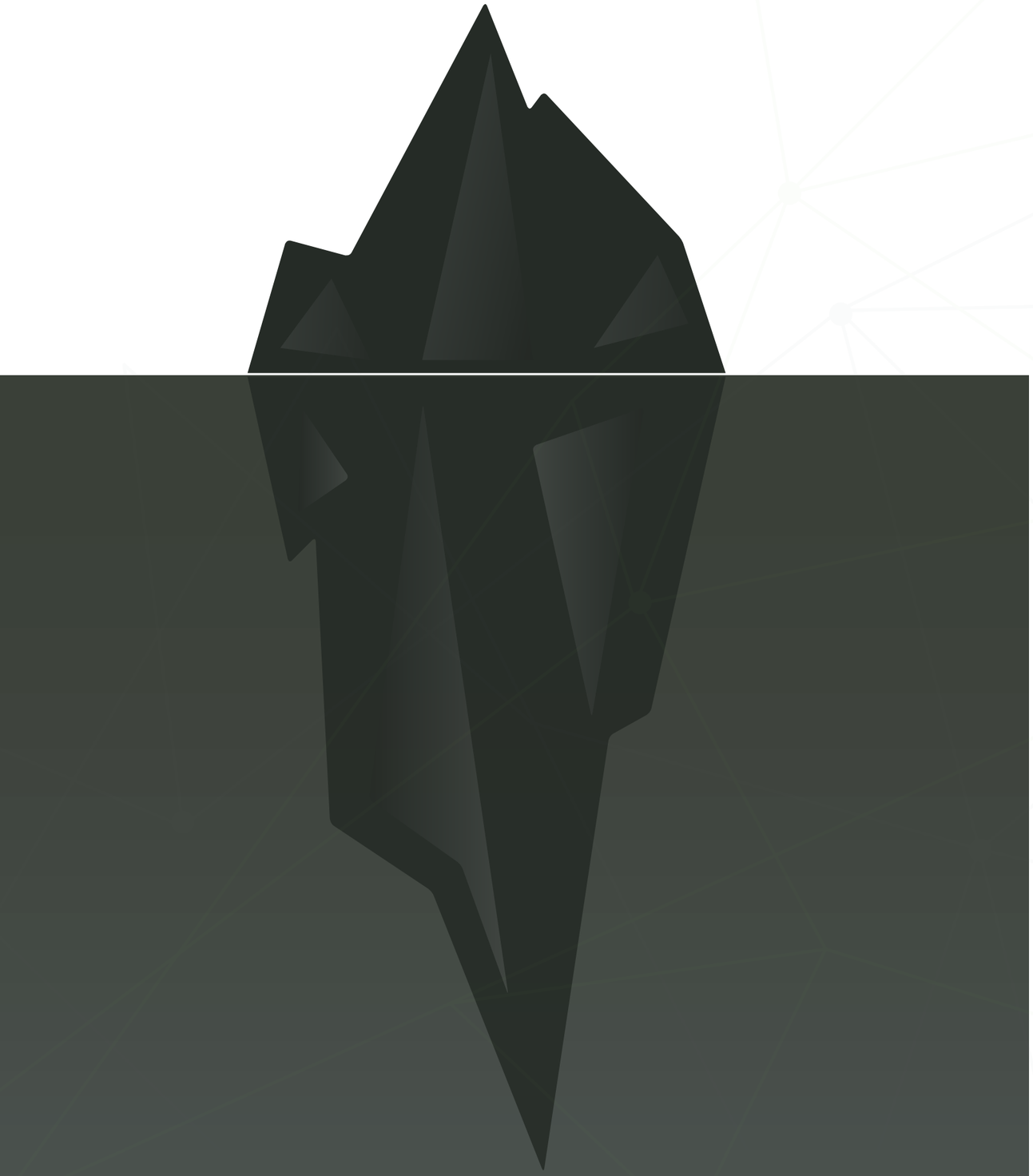

Sensor-enabled solutions

Wearable fall detectors and panic buttons are the de facto standard for improving the safety of elderly persons. These technologies, however, are mostly useful after a fall has already occurred.

In order to gain insight into a person's risk of falling, it is important to monitor a number of factors related to physical ability, such as balance, gait variability, foot clearance, level of physical activity, among others (Rogers et al. 2003, French et al. 2007). All Many of which can be objectively measured with the help of wearable sensors (Mayagoitia et al. 2002, De Rekeneire et al. 2003, Troiano et al. 2008).

Although current activity monitors such as the Fitbit, the Nike Fuel band and Smart watches could potentially provide some much needed information for fall risk assessment, current solutions suffer from mainly three problems: lack of accuracy for gait analysis; lack of tailoring to the elderly population; and difficulty distilling and interpreting the data.

Commercial activity monitors are often placed on a wrist band, similar to a wrist watch. This form-factor is very convenient for estimating general activity patterns but it cannot provide accurate gait analysis. In addition, tailoring sensor-enabled solutions to elderly users is also essential. Not only do their activity measurements often differ from those of a younger population, but also because they experience technological solutions differently. Furthermore, distilling activity data into actionable data for fall risk assessment requires specialized data mining and machine learning solutions, as well as visualization tools to facilitate their interpretation.

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"Monitoring deterioration and other changes in a person's gait is ideal because it doesn't require expensive technology or take a lot of time to assess"

- Bill Thies CMO of Alzheimer's Association International

The Role of Movement Analysis

Our movements are a good indicator of our overall health status. Our ability to move and walk is paramount to our independence and quality of life. In addition, several health conditions directly or indirectly affect the way we move. For example, disorders such as Parkinson's or Multiple Sclerosis are greatly characterized by motoric symptoms (Salarian et al. 2003, Spain et al. 2012). General aging, mild cognitive impairment and Alzheimer's have also been shown to affect walking (Maquet et al. 2010, Lamoth et al. 2011). Movement analysis can therefore provide great insight into a patient's risk profile when combined with traditional electronic health records.

The PX Nordic team includes technologists, strategists, clinicians, and physical therapists who are strong in movement analysis and understand the complexities of providing a broader and contextual view of an elderly at-risk patient. Leveraging the core strengths of the team by measuring motion with high frequency sensors, analyzing patterns, and building specialized motion libraries and models, we believe movement analysis can be a leading indicator of progress or decline in a patient.

This core information used in combination with other important health related information can provide effective risk assessment of elderly patients, wellness monitoring, or rehabilitation.

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Analytic Feedback Loop (decision support)

The value of high-end analytic applications is defined by their ability to provide actionable data to physicians, care givers and patients alike. Our solution does not seek to replace clinical assessment and diagnosis but to support the decision making process by providing accurate measurements in a timely fashion.

Measurements, however, are meaningless if not properly interpreted. Our solution makes use of user friendly graphics that present results together with contextual information. The user may navigate the system from a general overview (dashboard) to more detailed results, as needed.

This feedback is important not only to support physicians and care providers in taking decisions about a patient, but it is also a very intuitive way for patients (and care givers) to follow-up on their own progress.

David & Lisas story

David is 55 years old, and his wife Lisa is 53. They are aware that their health may deteriorate in the coming years and they would like to minimize the effects of aging by maintaining an active and healthy lifestyle. David has had some issues with his knee and Lisa has cases of Alzheimer's in her family. They think it is important to go for regular health checks in order to detect any problems as early as possible. This year, they decided to start annual gait analysis check-ups.

David was a little apprehensive before their first gait analysis test. They went to their usual clinic and were met by the nurse who explained that it was a very simple test. They started by going over their medical history, filling in some forms with the help of a tablet. The nurse then showed them three small plastic boxes containing movement sensors. Two sensors were placed around the ankles and one was attached to the back of the belt. They were instructed to walk normally for a few minutes and before they knew it, the check-up was done!

Lisa wondered what kind of information they could get from this test and they were shown the results. They could see, among other things, details about their walking pattern. David was limping a little, not bending his hurt knee as much as the other. He was advised to see a physiotherapist because this type of gait asymmetry could lead to back pain. Lisa found out that her walking speed is close to the norm for her age. Next year, they can measure her walking speed again and compare. If she starts walking much more slowly, she should go for a more complete medical check-up.

The couple left the clinic more confident of their health, knowing what signs to watch out for in order to detect possible problems early on.

Powered by Senseneering™

Senseneering™ - sense by engineering

Senseneering™ allows users to extend their perception and reasoning with the help of technology. They are able to see more with the help of sensors, and are able to make better decisions based on more complex data analysis.

PX Nordics provides a complete platform for robust data collection, data analysis, and user-friendly analytic feedback.

With the **Senseneering™** technology there is no need to “be online” or be “connected” constantly. The sense by engineering technology will analyze relevant information when it matters, process it and convey with valid insights or feedback.

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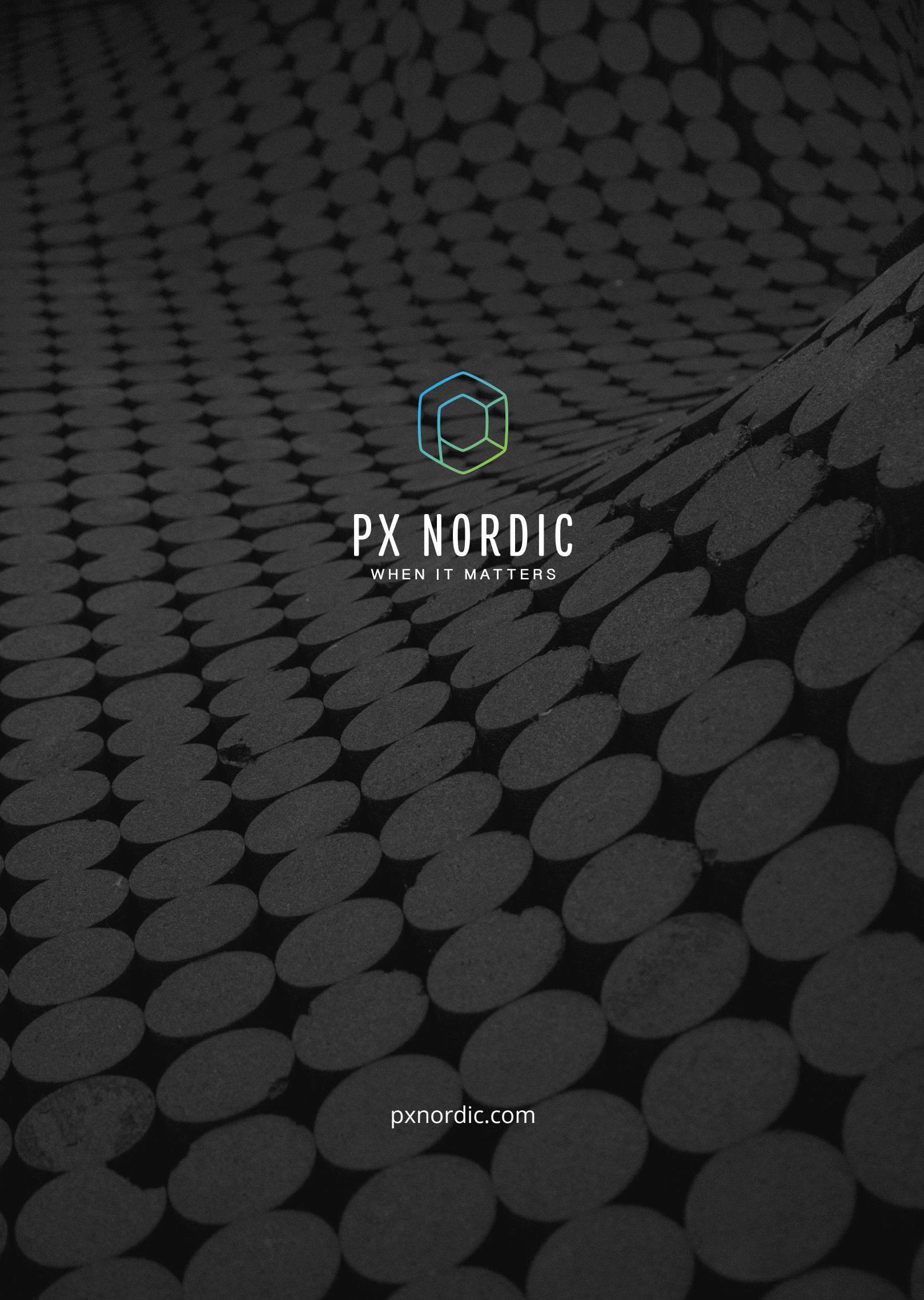
Contact PX Nordic

PX Nordic team is outstanding in movement technology and innovation. Born in Sweden, the company was founded by hard-core, multi- disciplinary engineers and problem solvers. The broader corporate team is international, with distributed domain experts in technology and healthcare. Embracing the unique Swedish innovation model, we strive to keep things simple, open, and of premium quality.

Contact us and learn more about **Senseneering™**

For more information, email us at info@pxnordic.com
Corporate Head Office in Malmo, Sweden
International Representation in Thailand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