

The full potential of combining sensor data and automated expert knowledge is yet unknown

In a unique interview, Dr. Hila Nachlieli, Head of Research at Precognize, reveals what motivates her, how Precognize is making the world a better place, and why women should practice sports

Q. What is your role at Precognize?

A. Precognize has a unique combination of both sensor data and automated expert knowledge. We have the unique ability to transfer experts' knowledge into an automated model within a period of two weeks, which makes it possible for us to obtain this new type of information. The full potential of this combination is yet unknown. As the chief researcher, my role is to identify the benefits that can be harvested from this unique combination.

One such benefit is overcoming the “no free lunch” theoretical limit, which enables us to harvest the data beyond traditional data mining, cracking yet unsolved challenges. True [predictive maintenance](#) monitors the system as a whole, since one-sensor detections are bound to miss the non-trivial problems. In systems with thousands of sensors, the number of possible states is bigger than the estimated number of atoms in the universe. In such a big state-space it is unlikely that a specific state occurred in the past, and differentiating a normal state from an anomaly is prone to error, which is a challenge we can overcome. Another important benefit is our ability to accumulate many anomalies into a few informative issues.

Q. What is your expertise?

A. My expertise is machine learning and data mining. My PhD is in physics, in Non-Equilibrium Statistical Mechanics. My advisor was Prof. Dov Levine, who provided the mathematical explanation for the development of quasicrystals. I then worked at HP Labs Israel, focusing on image processing and machine learning.

Q. How do you see Precognize's technology changing the process industry?

A. The aspect which is most important to me is preventing accidents: zero casualties in system malfunctions or explosions, a pollution-free environment, and the reduction of related health problems. With continuous predictive maintenance, equipment will last longer, which is the ultimate recycling, as there is no need for replacements. Moreover, the more you are able to trust your equipment, the less backup equipment you need and the leaner your factory is, and regions that were once occupied for redundant facilities can host trees and foliage.

Precognize provides the quality alerts required for predictive maintenance in complex factories, but full integration of its capabilities by industry goes far beyond predictive maintenance: imagine a compressor that gradually stops to avoid pressure building up to a possible explosion, as the following valve in the pipeline behaves suspiciously; or a tap that closes automatically because of a detected danger of oil leakage in the pipe; or a forge that cools itself because something in the input flow is just not right.

Precognize's real strength is beyond focused alerts – it is in its ability to automate expert knowledge and build a computer model of the facilities. Advanced use of these models borders on science fiction, such as the automatic design of machines, a factory that changes its manufacturing lines to address

changes in product specification, or to adapt the production mix to changing product prices.

Q. Do you see Precognize's technology being applied to other industries? If so, which?

A. Sure. Precognize technology is general, and can be applied to any system. Precognize's focused alerts and short integration time are crucial in complex systems, but they are beneficial in simpler machines as well, as it replaces the long customized development of a specific alert system or rule design. Instead of building an alert system from scratch, all the customer needs to do is to insert the expert knowledge into the Precognize system, which will take far less than two weeks for a simple system. On the other side of the scale, it would be highly beneficial, though far from the company's focus, to apply the technology to the ultimate machine: the human body.

Q. Where do you see the predictive maintenance industry ten years from now?

A. In ten years, maintenance will include small adjustments and tunings, yielding zero accidents, zero casualties, and a pollution-free environment. Precognize will be embedded in the factory work routine, structures, and machinery, resulting in increased security. Machines with potentially life-threatening problems will not start, and planes with a significant alert will "refuse" to take off, until the problem is fixed, which will be fast because the problem has already been identified.

Q. And on a more personal note, how has your experience been as a woman in traditionally male-dominated STEM?

A. There are semi-cultural differences between a man and a woman, where women are much more likely to think and talk in "we" terms than men. This makes men's contributions much more visible, recognized and compensated, which serves as feedback

for women. As women adapt to the male-oriented culture, we learn to suppress our collaborative tendencies, which is a big miss. One thing I like about Precognize is that we are a one big team, where each person has his or her unique role and expertise, and it is the combination of all these qualities that enables us to act on important goals, such as helping to reduce the pollution in our city.

Q. What would your advice be to women who are interested in getting into STEM?

A.

1. Learn mathematics. Besides being the core of the STEM subjects, it will teach you to exercise perseverance and dedication to the completion of challenging missions.
2. Practice sport and take part in competitions to experience a competitive environment.
3. Your obligations are just as important as those of your spouse, and you are both equally obligated to your kids. Make sure you fulfill all of your obligations, and do not hesitate to hire professional help.

Singapore – Leading the Industrial 4th Revolution



Taking the opportunity of exhibiting in a conference in Singapore, and meeting plentiful and great people of the industry, Precognize renders an overview of what makes Singapore the shining city of Asia

When he was about to serve his second term, President Ronald Reagan spoke of how he saw “the shining city on the hill,” as he described the future of the country he had led for nearly a decade. But it turns out that the shining city of the 21st century isn’t on a hill, but an island; in the midst of the go-go economies of south Asia, Singapore has carved out a unique niche that could serve as a shining example of how to put technology to work to build a country and society that thrive – at all levels. That technology has gone a long way to transforming the country’s economy, to the extent that even traditional heavy industries, like petrochemicals and agriculture, are undergoing a tech revolution that is leaving the country cleaner and the people healthier.

The lessons for Asia as a whole are that indeed, where there is a will, there is a way. Many countries in Asia believe that the way to prosperity runs through the assembly line or the smokestack; perhaps China is the best example of that. That may have been true once – but Singapore proves that with modern technology, it is possible to have a productive economy that provides plenty of jobs in manufacturing and other areas

that do not require PhD's, ensuring that the majority of the population can work and earn a living wage.

It is no secret that Asia – and especially China – has become the “world's factory” in recent decades. For China specifically, the strategy of industrializing and taking on the manufacturing jobs that the West really isn't interested in has been particularly beneficial. So much so that the country is now the world's second largest economy. But like the West, China, it turns out, saw the manufacturing revolution as just a means to an end; low tech manufacturing jobs are moving to places like Cambodia and Vietnam, while China is gearing up for a high-tech industrial revolution that will transform its dirty smokestacks into clean computer screens, robot arms, and high-end manufacturing plants.

Is the choice either clean, smooth computer screens and high-tech robotics, or dirty-smokestack factories – with nothing in between though? Is the “sweatshop method” the only one that can produce a pair of shoes at a price that makes it worthwhile for Western retailers to produce in the Far East? Similarly, China's heavy industries have provided plenty of jobs for workers – but at the price of significantly increasing pollution in many of the country's big cities. Steelmaking, coal mining, and natural gas production are backbones of the country's economy – but everyone, from politicians to environmental experts, realize that things cannot continue the way they have been until now.

Poverty and pollution are the fruits of an economy based on “old tech,” and while that old technology has transformed China into one of the world's most advanced economies in barely half a century, the country – as well as other Asian tigers who seek a more prosperous economy – now needs to find a better way forward. Clearly China can use some guidance on these matters.

That guidance can come from Singapore. This is a country that

has engraved “Fourth Industrial Revolution” on its flag, vowing to use the best of modern technology – robotics, nanotech, communications – to build a modern economy that will encompass not only the tech services we’ve come to expect from modern economies, but the manufacturing technology and heavy industry associated with traditional economies. With a GDP of well over \$50,000 US, a figure typical of an advanced, high-tech service economy – which it is; as the world’s third largest financial center, according to economists. But it’s also a world center of some of what are traditionally considered “smokestack” industries: it is also the 3rd-largest oil-refining and trading center in the world, the world’s largest oil-rig producer and major hub for ship repair services.

It’s in these industries that the tech revolution – called [Industry 4.0](#) by some – is clearly evident, as the government pushes investment programs to automate and implement advanced technology in these heavy industries. In 2016, the government allocated more than \$450 million budget over the next three years to support Singapore’s National Robotics Programme. Such efforts are paying off: In April, manufacturing output rose 6.7 percent on an annualized basis, with semiconductors especially strong.

Tech is also being used in heavy industries like petrochemicals and oil & gas. The IoT tech promises to lower costs, increase safety, and allow for more accurate production of products and deployment of services. Since these industries are massively regulated, the plants are obliged to collect mountains of data. The next step for these plants is to turn this existing data into actionable insights. These insights allow, among other things, to turn reactive patterns towards machine failure, to proactive ones. Precognize is doing precisely that. Leveraging on the existing data, it injects the plants’ experts knowledge into advanced machine learning to give a few, actionable alerts ahead of time.

The government is committed to increase the use of advanced technology in industry – creating an ecosystem that will develop Singapore into an advanced, high-tech economy that will lead the way and set an example for the rest of Asia. It's a job that only Singapore can do – and knowing the country, it will do it right.

[GET A DEMO](#)

Getting Ready for the Holidays

The temperature has dropped, snow is piling up in some places, and everyone is getting ready for the Holidays. We have lots of preparations ahead of us – planning our vacation, buying presents, planning meals, getting together with our families, and sending New Year's greetings.

Some of us, though, have to be at work. Plants, as we well know, operate 24/7. It's not possible to shut them down, not even for Christmas. Well, plants are not alone. Over the past decade, the number of workers who had to work on Christmas increased by 78%. Research shows that an equal number of men and women go to work on Christmas Day here. According to recent research in the US, security and public safety workers, service and maintenance staff, and technicians are most likely to draw holiday shifts here.

Studies show that many shift workers suffer from stress caused by missing out on important parts of their social life. It's harder for shift workers to spend time with their children and to attend school functions with them. Spouses may work the opposite shift, thus resulting in less time together.

Unmarried shift workers miss out on the social life that most daytime workers have (here).

While we all understand that hospitals, plants, as well as vacation resorts must operate on holidays, let's see what kind of measures can be taken by human resource departments to "sweeten the kitty". First of all, it is recommended to give employees the chance to volunteer for these shifts. For some of them the extra money might make a real difference, and they would seize any opportunity to benefit. Then, offer some kind of compensation, in addition to the guaranteed extra money for the shift. It could be a significant supplement (always appreciated), and if that is not an option, some kind of a gift card (dinner, movie, etc.) to show appreciation for their being at work when everybody else is celebrating or relaxing. Another idea is to create some holiday atmosphere around the work premises – some festive decorations or a special toast for the ones at work could turn these shifts into something a little different.

However, preparations for the holiday season also exceed our private lives. At the workplace, things are different during the Holidays. There are fewer personnel on-site, presumably the minimum required, and some workers are on call, ready to leave their friends and family should an emergency occur. As far as maintenance goes, only an emergency team is on-site to handle the most urgent, unexpected failures. Obviously, there is no scheduled maintenance for this period.

Having fewer people on-site, and the understandable reluctance to call in more employees on their days off, should encourage us to prepare beforehand. Maintenance is part of our routine all year round, but preventing shutdowns and machine failures during the holidays is even more important. Today, we have cutting-edge predictive maintenance solutions that can assist us. Take Precognize, for example, which can achieve zero machine failure. There's no need to call someone in the middle of dinner on Christmas Eve because a valve has frozen, or

because an operator at the control room has made a mistake. Having a reliable software that detects everything, produces only a few true alerts (instead of hundreds of false alarms), and notifies 48 hours in advance is advantageous throughout the year. During the Holidays, it sounds like the right way to celebrate: with very little noise, and peace of mind.

Learn more about Precognize: www.precog.co, and in the meantime have a Merry Christmas and a Happy New Year!

It's Time for Evolution!

For some years now, there are rumors that change is in the air: ["Industry 4.0"](#), ["digitizing the industry"](#), ["IIOT"](#), are but a few examples of buzz words we've been hearing for the past few years. Headlines dated three and four years back foretell that Predictive Maintenance is embracing analytics (here). Although the rumors are in the air for some time, we now feel a tremendous change. Now it's time, and let us share with you why.

Let's begin with the economy. Years of slow economic growth forced tightening one's belt. Lowering expenses, getting rid of all excess fats, firing personnel, and focusing on production became mandatory. During the 11-year period from 2003 to 2013, the chemical industry in the European Union had an average production growth rate of 0.6%. Just a little bit more than the entire manufacturing which was up 0.3%. EU chemical industry production in 2012 declined by 2.3% compared with 2011. Recovery was slow in 2013, and also in 2014 production levels were slow and sales stagnant (Eurostat and Cefic Chemdata International(2014), slide 23). After applying all other measures, manufacturers are now looking for more sophisticated ways to save money. Manufacturers realize they

can apply the sensors data they collect, and is mounted in their database anyway, to achieve great maintenance savings and additional production, while keeping all employees on-board.

It is important for plant managers to understand that the investment in analyzing the data for [Predictive Maintenance](#) cannot be postponed. Their operation people are always, busy, have daily problem to deal with, and there always seem to be something more urgent, or not enough people to run the project. But lowering maintenance cost to a minimum, minimizing failure, and being reliable is precisely the plan for a leaner, cost-minded plant.

In addition, past solutions were not good enough. The previous Predictive Maintenance solutions triggered thousands of false positives a day, which operators, as well as plant managers, had become numb to. Today, the reliability of the solutions, such as Precognize, increased immensely and it provides three to four true alerts a week. This significant cut down of noise enables to address the real problems timely and effectively.

And there is something else. Perhaps the key reason for withholding change is due to organizational culture. Embracing change is always a challenge. More so in a conservative environment where work habits, rules, and regulations had been nurtured and cultivated for years. Bear in mind that the average age of a plant manager is 58, 17% are over 60, and only 2.3% are under 30 (here) . It is important to understand that knowledge is disappearing as operation people grow older and retire. The intimate knowledge of the asset, the ability to detect failures as a result of years of experience, will fade away eventually. Their knowledge is essential for implementation of any analytical solution, especially for Predictive Maintenance. The experienced people should not be viewed as a stopper for a change, but as a critical driver of the transition.

We believe that the best way to win the trust of the people of the industry is to make them part of the solution, not the problem. Do not offer them a black box, but harness the experts' knowledge and draw on their experience. For example, we at Precognize, embed the experts' knowledge of the plant into a mathematical graph when implementing the system. By applying a mathematical graph on top of the machine learning, Precognize transforms real-time data from hundreds of sensors, into a few actionable alerts. Customer use cases demonstrate that Precognize's innovative solution reduces maintenance budget substantially by preventing machine failure, saving time spent on false alarms, and calling off the need for several backup systems. The reliability of the plant depends on pursuing the best solutions that are offered today. One cannot stay behind.

The landscape of the industry keeps changing: emerging markets, technological breakthroughs, challenges, and opportunities. To succeed in this ever-changing environment, it is key to look for cutting-edge solutions in order to ride the wave of the digitalization of the industry and not get swamped by it.