metrum

Managing Partner

European Pattern Recognition project

PATTERN RECOGNITION TECHNOLOGY ENABLES HIGHER LEVELS OF RENEWABLES IN THE GRID

By investigating, developing and demonstrating within six application areas, the European Pattern Recognition project (EPR project) explores the vast potential of pattern recognition technology combined with power quality measurement in electrical grids.

What is Pattern Recognition?

Pattern Recognition is a branch of machine learning that focuses on the recognition of patterns and regularities in data. Algorithms such as support vector machines, often trained by labeled training data, form its core. Today, the technology is used in many applications such as finger print recognition and in online search engines.

The EPR project will apply pattern recognition technology to power quality and other related electrical grid data such as smart energy meter readings to develop tools for grid operators and energy companies to optimise the power system and enable a higher share of renewable energy generation.

What will the project bring?

Pattern recognition technology in electrical grids helps tackle present and future challenges, e.g. distributed generation, power electronics, EVs, while:

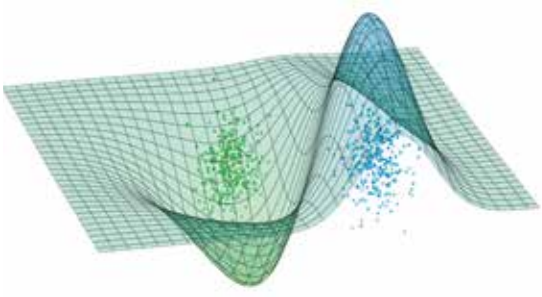
- Keeping stability
- Increasing capacity
- Increasing flexibility
- Improved power quality and security of supply giving decreasing costs for interruptions

EPR actively contributes to the European knowledge community by forming a basis for further research in pattern recognition technology.

Practical applications

Six fields of application that Pattern Recognition is a promising technology are investigated:

- Pro-active Maintenance
- Power Consumption
- Micro-grid & solar power applications
- Voltage Regulation
- Hosting Capacity
- Inertia evaluation and support



Key Figures

Seven partners in three countries:
Sweden, Norway and Turkey

Project period: 2016 - 2018

4 demonstrators in the Nordic and Turkish power systems:

- HV, MV and LV substations
- Rural and urban grids
- High and low penetration of renewables

Project budget: 1.6 MEUR

Key deliverables

Measurement instruments with built-in pattern recognition technology.

Developed applications in the six selected fields.

Building a European knowledge community for pattern recognition technology in electrical grids:

- Key findings will be available in reports and articles
- Knowledge sharing database with labeled power quality data samples

PROJECT PARTNERS:

European Pattern Recognition project

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3RD GENERATION METERING

Metrum offer power quality solutions, specifically software applications and measurement instruments. Metrum is a market leader and now developing 3rd generation metering, using pattern recognition. This will reduce costs, result in less power cuts and enable cost-effective preventive maintenance. The current offering from Metrum include a very wide Class A measurement instrument portfolio and one of the world's strongest software application offering. With over 10 years' experience of measuring energy and power quality, working close with universities, Metrum is a true competence partner.

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PROJECT PARTNERS

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FUNDING PARTNERS

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DETAILED WORK PACKAGE DESCRIPTIONS:

European Pattern Recognition project

WP2 Leader:

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WP2: Proactive Maintenance

There is a large need for automatic asset management in order for the grid owners to be able to streamline preventive maintenance. The power quality measurement and new pro-active trend analysis can possibly detect incipient faults at a very early stage.

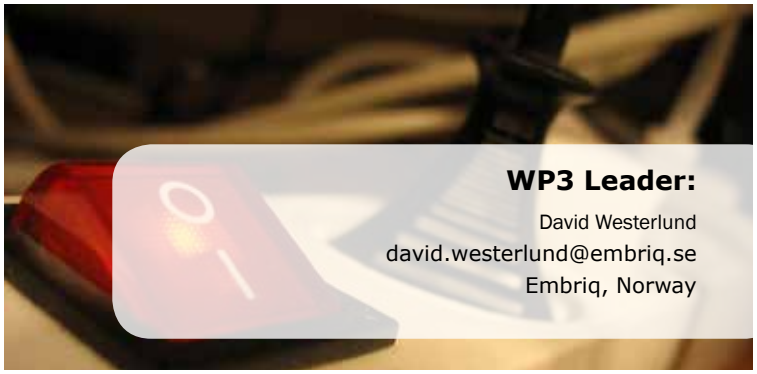
The theory for WP2 is that new development including pattern recognition techniques can be used for pro-active trend analysis to minimize the total interruption time for the electrical grid. In this Work Package, solutions will be developed and tested to verify this assumption.

The work package will include two main areas below:

- PQ System Pro-Active Trend Analysis – using historical power quality data.
- PQ System Pro-Active Fault Analysis – using historical disturbance (waveform) data.

WP3: Power Consumption Studies through Pattern Recognition

The ongoing changes of production and consumption in the power system requires a better understanding, WP3 will explore measurement and pattern recognition methods and techniques for analysis in order to enable a more effective use of the power system. WP3 will develop, test and validate different methods to identify unwanted events in the power system, suggest recommendations for the development of predictive maintenance indicators and to enable the integration of renewable electricity production and increase flexibility.



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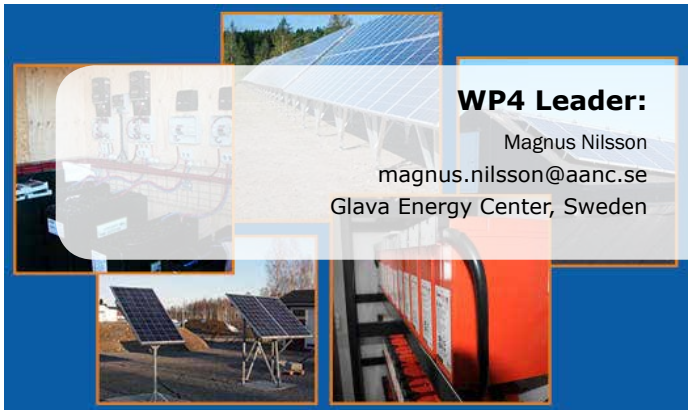

WP4 Leader:

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WP4: Local Energy Systems – Micro Grids

Analysis of advanced asset management on PV, inverters and energy storage by using pattern recognition.

They will test the concept of micro grids, both with and without connection to the grid.

Two demonstrator areas:

Smart distributed power with PV and energy storage (Glava test park and Eltek system)

Optimised operation of PV plants with advanced error detection and prediction (Glava test park and Arvika PV parks and Prediktor O&M software).

WP5: Power Regulation by Voltage Control

Investigate the relationship between changes in voltage and power in order to estimate how much power can be regulated under the applicable regulations and under the consideration that no voltage variations cause damage or disturbances.

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DETAILED WORK PACKAGE DESCRIPTIONS CONT.:

European Pattern Recognition project

WP6: Hosting Capacity

STRI's Hosting Capacity methodology can be used to identify the maximum amount of new production or consumption that can be connected to a system without resulting in an unacceptable reduction of power quality, or adversely impacting other customers. Performance indicators can be e.g. disturbance levels of slow voltage variations, overloading or harmonics.

Knowing the actual bottlenecks, which are often not of a technical nature, allows for optimal use of resources to increase the Hosting Capacity. By investigating how different performance indicators limit the amount of renewables that can be integrated to the grid, bottlenecks can be identified. This can help with network planning and investment decisions which will in turn lead to improvements in capacity, flexibility and power quality.

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WP7: Inertia Support

The level of inertia in the power system has become a major challenge in many countries as the share of renewable production increases. At the same time, TSOs have challenges in assessing the actual amount of inertia operational in the system. In this Work Package, pattern recognition technology will be applied on measurement and analysis of frequency derivatives, thereby assessing the level of inertia. Combined with inertia support by wind power this can make a vital contribution to the stability of the grid and reduce the risk of major disruptions and enable the integration of more renewable (wind) energy sources and distributed generation in the system.

Dissemination - Knowledge Community

In general, we put high focus on knowlege sharing and close communication during the project, both internally and externally with weveral key activities that ensure this will be delivered. Sharing existing experiences and new findings between the differrent project partners and countries will be very useful for a general awareness of Smart Grids, but also ideas on how to improve the grid operations. The conclusions, reports and new solutions developed by the project will also be very useful to share with all EU countries, ensuring this will be implemented and drive the development of Smart Grids. We believe we included many activities to ensure this will be taking place.

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