Ice detection using image analysis

Utilize latest research in image analysis

Image analysis used together with:

- meteorological data

- MultiVariate Data Analysis

- Neural Networks or Support Vector Machines

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Utilize latest research in image analysis

State of the art embedded computer system ODIN has the capability to perform real time image analysis in the field

Ice detection on rotor blades necessary

- Optimize production
- Activate de-icing system
- Warning system for service personnel

Technical solution

- Images of rotor blades
- Meterological data

↓

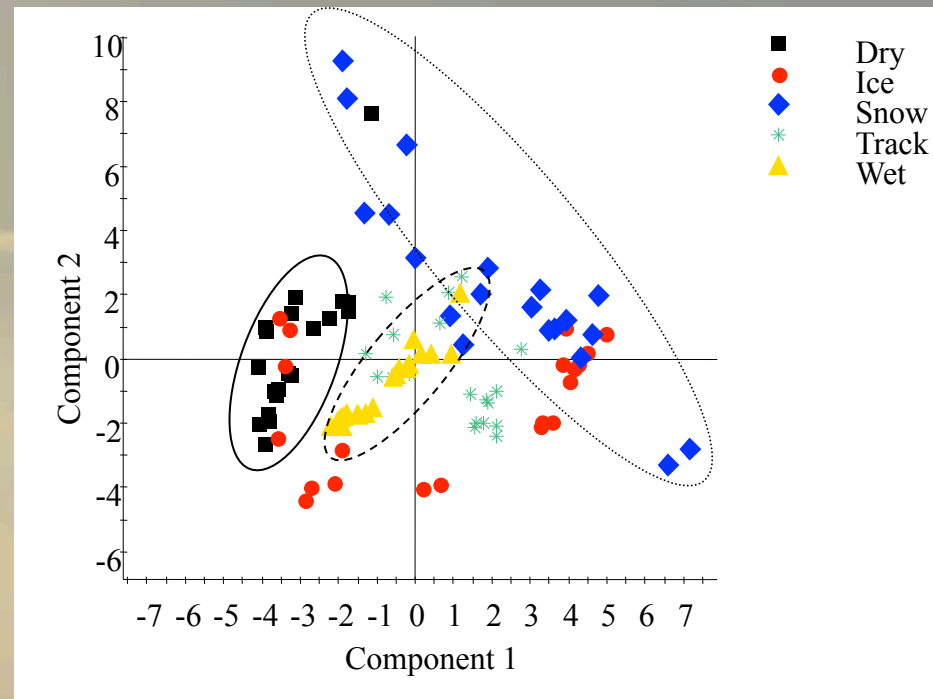Mulitvariate data analysis model

↓

Classification of icing condition
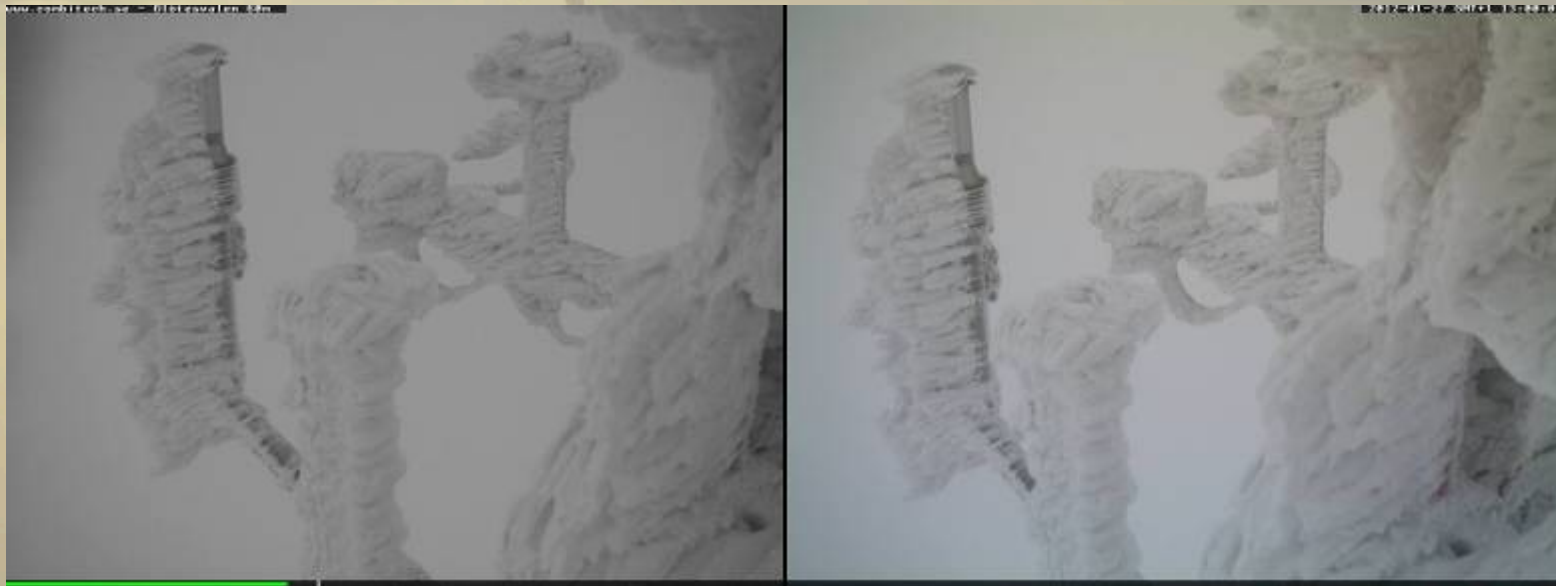
Technical solution

- Based on Combitech research on icing condition at roads

- A licentiate thesis is presented of this work[1]

[1]   P. Jonsson, "Intelligent Networked Sensors for Increased Traffic Safety," Licentiate Thesis, Department of Information Technology and Media, Mid Sweden University, Östersund, 2011.

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Advantages of image analysis

- Detection of very small amounts of ice
- Possibility to detect ice on non-rotating wind turbines

Advantages of image analysis

- Measuring directly on the rotor blade

- In operation even when the wind turbine isn´t operating

- Useful for general surveillance of the site

Cameras and IR search light

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Cooperate with Combitech

- Long time experience:
    - measurement systems
    - harsh climate
    - camera systems (color and NIR with search lights)
    - advanced image analysis using Neural Networks started 2002

    - Analyzing methods have been further exploited:
        - Neural Networks (NN)
        - Support Vector Machines (SVM)
        - MultiVariate Data Analysis (MVDA)

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Installed measurement systems in icing conditions

INSTALLATIONS	Customer	Installation site	Date
5 pcs complete systems *	Wind turbine supplier	Sweden	Autumn 2010
8 pcs complete systems *	O2 Vindkompaniet	Nationwide Sweden (Bliekevare, Sveg, Glötesvålen, Tåsjö)	2009-2010
1 pcs complete system	O2 Vindkompaniet	Aapua, Sweden	2008
4 pcs complete systems	Elforsk	Sveg, Sweden	2008
6 pcs IceMonitor	Cost727 project	Germany, Finland, Sweden, Switzerland, Poland and Japan	2007
14 pcs IceMonitor	Varying customers		2006-2010

*These systems are installed on top of wind turbines and tall masts. These systems collects data from integrated meteorological sensors (wind speed/direction, humidity, air temp/pressure, ice load, ice detection, visibility, cloud height). They are also equipped web cameras with motion detection for taking pictures of the blades.

Feel free to contact us for further information

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