

## MIDICON

**Doctoral course for Modern process data analytics by case studies on mineralogy driven control of the production chain from mine to products (MIDICON)**

### Learning outcomes

The five (5) ECTS credits MIDICON doctoral level course will provide an introduction to the modern data analytics and tools, focus on their application to the control of the industrial minerals processing chain - and, prompt student to assess business opportunities from the new applications of data analytics in the raw materials sector. Students will learn general knowledge about European Industrial Minerals industry.

### Programme

#### Part 1

**Location:** Falmouth, Cornwall, southwest England, UK

**Address:** The Falmouth Hotel, Cliff Road, Falmouth, Cornwall, TR11 4NZ, UK

**Directions:** <http://www.falmouthhotel.co.uk/>

<b>MIDICON Kick-off and workshop, day 1, Tuesday 4 April, 2017</b>	
<b>Time</b>	<b>Title</b>
8.30 – 8.55	Registration
9.00 - 9.10	Opening words <i>Prof. Sirkka-Liisa Jämsä-Jounela, Aalto University</i>
9.10 – 9.30	Data as an asset in problem-based research challenges <i>Prof. Sirkka-Liisa Jämsä-Jounela, Aalto University</i>
9.30 – 10.00	General Introduction of Raw Materials and Life Cycle of Industrial minerals <i>Dr. Aurela Shtiza, IMA-Europe</i>
10.00 - 11.00	Production of Kaolin <i>Prof. Hylke Glass, University of Exeter</i>
11.00 – 11.30	Break
11.30 – 13.00	Characterization of the ore deposits <i>Adriana Guatame-Garcia, (Prof. Mike Buxton, Prof. Joerg Benndorf) ; TU Delft</i>
13.00 – 14.00	Lunch

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14.00 – 15.30	Integrated extraction and refining data analysis for kaolin production chain <i>Prof. Hylke Glass, University of Exeter</i>
15.30 – 16.30	Sensor-based material characterization <i>Adriana Guatame-Garcia, TU Delft</i>
16.30 – 17.00	Life cycle of a mine and Sustainability of the industrial minerals sector <i>Dr. Aurela Shtiza, IMA-Europe</i>
17.00 –	Informal get-together
<b>MIDICON Kick-off and workshop, day 2, Wednesday 5 April, 2017</b>	
<b>Time</b>	<b>Title</b>
	Methods and tools for data analytics <i>Prof. Sirkka-Liisa Jämsä-Jounela, Dr. Alexander Smirnov, Aalto University</i>
9.00 – 11.00	Data analysis and monitoring methods <ul style="list-style-type: none"> <li>• PCA, multi-way PCA, multiscale PCA, recursive PCA, Dynamic PCA, Nonlinear PCA,..</li> <li>• The partial least squares (PLS), Nonlinear PLS, Multiway PLS, Recursive PLS, SMI, MLP, RBFN,..</li> <li>• The self-organizing maps SOM</li> <li>• Other advanced monitoring methods...</li> </ul>
10.00 – 10.15	Break
11.00 - 11.40	Kasem (data analytics software) overview, <i>Christophe Mozzati, Predict</i>
11.40 – 12.00	Introduction to the case study Multiple Hearth Furnace: <i>MSc Jose Gomez, Aalto University</i>
12.00 – 13.00	Lunch
13.00-14.00	Case study (data preprocessing) <i>Dr. Jukka Kortela, Aalto University</i> <ul style="list-style-type: none"> <li>• Detection of data compression</li> <li>• Selection of process variables</li> <li>• Data storing, fetching and manipulating</li> <li>• Visualizing the process data</li> </ul>
14.00-14.30	Introduction to data-preprocessing
14.30-15.30	Case study continues <ul style="list-style-type: none"> <li>• Selection of relevant data sets</li> <li>• Excluding the outliers and data filtering</li> <li>• Data scaling</li> <li>• Resampling (upsampling, downsampling)</li> <li>• Delay estimation and compensation</li> <li>• Creating calculated variable</li> </ul>

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15.00-15.30	Coffee Break	
15.30 – 17.00	Case study continues (data analysis and monitoring methods) <ul style="list-style-type: none"> <li>• PCA, PLS, SOM, other advanced monitoring methods</li> </ul>	
17.00 – 18.00	Case study continues	MIDICON Kick-off meeting (invited partners only)
19.00	Networking dinner	
<b>MIDICON Kick-off and workshop, day 3, Thursday 6 April, 2017</b>		
<b>Time</b>	<b>Title</b>	
9:00 – 10:00	Assignments for the students: <ul style="list-style-type: none"> <li>• Distribution of the industrial case studies on data analytics and instructions for the assignment</li> <li>• Outotec's fluidized bed based fuel gas generation processes <ul style="list-style-type: none"> <li>○ Technical introduction to the process and data set <i>Robert Schiemann, Outotec</i></li> </ul> </li> </ul>	
10:00	Departure	
10 -11:00	Penryn Campus, Camborne School of Mines, University of Exeter	
12:15 – 13:15	Lunch	
13:15-14:45	Visit to China Clay Country Park ( <a href="http://www.wheal-martyn.com/">http://www.wheal-martyn.com/</a> ) which combines a museum of china clay mining, historical buildings, and a viewing platform overlooking a working IMERY'S pit.	
15:00-	Visit at Karlake viewing area (The Karlake pits are Imerys' biggest working quarry in the area.) <i>Chris Varcoe, Imerys</i> On the way back to the hotel we will stop off at other points of interest.	

## Part 2

- Online lectures on entrepreneurship in the industrial minerals sector, *Prof. Ainomaija Haarla, Aalto University, available from 1 May, 2017*
  - Online office hours for students to assist with the assignments on data analytics, *Dr. Jukka Kortela, Dr. Alexander Smirnov, Aalto University; Robert Schiemann, Outotec*
    - 5<sup>th</sup> of May at 12 CET
    - 5<sup>th</sup> of June at 12 CET
    - 7<sup>th</sup> of August at 12 CET
    - 14<sup>th</sup> of August at 12 CET
  - *Deadline for the written assignment 20th of August at 12 CET*
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## Part 3

**Location:** Aalto University School of Chemical Engineering, Otaniemi, Espoo, Finland

**Address:** Kemistintie 1, Espoo, Finland

**Directions:** How to get to Otaniemi: [http://www.aalto.fi/en/about/contact/route\\_otaniemi/](http://www.aalto.fi/en/about/contact/route_otaniemi/)

**Campus maps:** [http://www.aalto.fi/en/about/campuses/campus\\_maps/](http://www.aalto.fi/en/about/campuses/campus_maps/)

<b>MIDICON Summer Camp, day 1, Tuesday 29 August, 2017</b>	
<b>Time</b>	<b>Title</b>
8.30 – 8.55	Registration at Aalto University School of Chemical Engineering (CHEM) <a href="http://chem.aalto.fi/en/">http://chem.aalto.fi/en/</a>
9.00 - 9.15	Opening words <i>Prof. Sirkka-Liisa Jämsä-Jounela, Aalto University</i>
9.15 - 9.45	Aalto University – research and education <i>Dean Janne Laine, School of Chemical Engineering</i>
9.45 – 11.30	Results from the assignments: preparation for presentations in groups
11.30 – 12.30	Aalto CHEM in brief and visit to laboratories of Mineral Processing and Recycling, Hydrometallurgy and Corrosion and Process Automation <i>Professors Rodrigo Serna, Mari Lundström, Sirkka-Liisa Jämsä-Jounela</i>
12.30 – 13.30	Lunch
13.30 – 15.00	Presentations of project works: 5 x 25 min (presentations 15 min + questions and feedback)
15.30-17.00	Visit Outotec head office, Espoo <i>Christian Binder, Robert Pardemann</i>
17.00 -	Trip to Nuuksio Natural park: Haltia, the Finnish Nature Centre <a href="http://www.haltia.com/en/">http://www.haltia.com/en/</a>
<b>MIDICON Summer Camp, day 2, Wednesday 30 August, 2017</b>	
<b>Time</b>	<b>Title</b>
9.00 – 10.00	Lecture - entrepreneurship <i>Prof. Ainomaija Haarla, Aalto University</i>
10.00 – 11.00	Lecture on how to develop a profitable start up, including funding or business in general <i>Prof. Ainomaija Haarla, Aalto University</i>
11.00– 12.00	Lecture – making a business plan and starting a venture <i>N.N (tbc)</i>

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12.00 – 13.00	Lunch
13.00 – 15.00	Basics on pitching training <i>CEO Juha Ruohonen, Value Chain Ltd</i>
15.00 – 15.15	Break
15.15 – 16.00	Pitching training continues <i>CEO Juha Ruohonen, Value Chain Ltd</i>
19.00-	Networking dinner, Suomenlinna (World heritage site) <a href="http://www.suomenlinna.fi/en/">http://www.suomenlinna.fi/en/</a>
<b>MIDICON Summer Camp, day 3, Thursday 31 August, 2017</b>	
<b>Time</b>	<b>Title</b>
9.00 – 9.45	From research to market with EIT RawMaterials <i>Dr. Olli Salmi, EIT Raw Materials CLC Baltic Sea</i>
9.45 – 10.15	Mining in Finland <i>N.N (tbc)</i>
10.15 – 11.00	Feed type control of mineral processing – industrial case studies, <i>Prof Sirkka-Liisa Jämsä-Jounela, Aalto university</i>
11.00 – 11.30	Preparing for the pitching competition
11.30 – 12.30	Pitching competition Pitches á 3 min, 5 groups <i>Judges: Company and University representatives</i>
13.00 – 15.00	Lunch buffet and Networking with Aalto doctoral candidates: sharing the experiences
15.00 –	Closing remarks <i>Prof. Sirkka-Liisa Jämsä-Jounela, Aalto University</i>

**Version 2 April, 2017**

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