MODCC MINING OBSERVATORY DATA CONTROL CENTRE

MODCC is a physical and virtual centre to foster interdisciplinary data analysis to promote data driven innovation for the mining industry.

Marcus Thomson, Director of Innovation and Prosperity Office  August 17, 2017

SUPPORTED BY

canada mining innovation council  Ontario
Agenda

1. About CEMI
2. Why MODCC?
3. What is MODCC?
4. Where is MODCC headed?
   a. Vision
   b. Obstacles
   c. Plan
About CEMI
About CEMI:

The following slides show our:

1) Team
2) Vision
3) Collaborators
4) Strategic Initiatives
Develop new mines
Sustain existing mines, & Improve environmental performance.
The Innovation Process
Research - Development - Implementation - Commercialization

We close the Gaps!
# CEMI’s COLLABORATORS IN INNOVATION

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<td>Komri Systems</td>
<td>Mindtree</td>
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[Logos of universities and other institutions]
TO HELP THE MINING INDUSTRY TO ADOPT COMMERCIAL VAILABLE R&D PROJECT RESULTS, AND ACCELERATE THE DEPLOYMENT OF PROVEN INNOVATIVE TECHNIQUES AND TECHNOLOGIES.

Canada’s Ultra-Deep Mining Network

27 projects

45 network members

$35 million in private and public funds
CEMI: Strategic Initiatives

2010: Rio Tinto Centre for Underground Mine Construction $10M
2010: Ventilation on Demand (CAF) $8.25M
2011: Innovation and Prosperity Office (IPO)
2012: Smart Underground Monitoring & Integrated Technologies (SUMIT) for Deep Mines $6.7M
2012: Mining Observatory Data Control Centre (MODCC) $1.5M
2014: Ultra-Deep Mining Network (UDMN) $35M
2015: Greater Sudbury (Comm. Attainment Program) $1M
2015: Northern Ontario Heritage Fund Corp. (MNDM) $1.8M
Why MODCC?
Why MODCC?

Smart Underground Monitoring & Integrated Technologies (SUMIT) for Deep Mines $6.7M

- Research is more effective when data is properly inputted into a common data management platform.
- Digital technology in mining is going to be a big deal, and Canadian SMEs have the opportunity to compete.
What is MODCC?
What is MODCC?

- Digital technology in mining is going to be a big deal, and Canadian SMEs have the opportunity to compete.
  - Incubation space, collaboration with world-renowned physicists and data management professionals.
  - Managed IT with fast connectivity on the ORION network
  - Access to data and data management tools
    - Mira Geoscience
    - Revolution Mining Software
    - Tunik Inc
- Research is easier when data is properly inputted into a common data management platform.
  - SUMIT and FOOTPRINTS datasets stored on MODCC servers
  - Mira Geoscience’s Geoscience INTEGRATOR
Mira Geoscience’s Geoscience INTEGRATOR
Where is MODCC headed?
Where is MODCC headed?

- **Vision**
  - Artificial Intelligence for mining

- **Obstacles**
  - Clean, Contextual Mining Data

- **Plan**
  - Digital demonstration use case with mining companies
  - Resources for small-to-medium companies
  - Strategy for MODCC
Vision:
Artificial Intelligence in Mining
Artificial Intelligence

• The AI industry is projected to grow from $8.2B in 2013 to $70B by 2020, with a disruptive effect between US $14 to $33 trillion. [http://fortune.com/2016/06/03/tech-ceos-artificial-intelligence/](http://fortune.com/2016/06/03/tech-ceos-artificial-intelligence/)

• Estimates are that half of the global workforce will be replaced by AI driven technology over the next 15 years. [https://s3.amazonaws.com/uploads.massively.ai/tmp%2Faiconference%2FAIReport](https://s3.amazonaws.com/uploads.massively.ai/tmp%2Faiconference%2FAIReport)

• In 2013, only 1% of all data collected by mining companies was used. [http://www.mckinsey.com/industries/metals-and-mining/our-insights/how-digital-innovation-can-improve-mining-productivity](http://www.mckinsey.com/industries/metals-and-mining/our-insights/how-digital-innovation-can-improve-mining-productivity)
Trudeau Announces New Pan-Canadian Artificial Intelligence Strategy
“Artificial intelligence and deep learning are, in fact, all about people. We will harness these cutting-edge technologies to improve everyday life in Ontario, while also attracting the world’s best talent to our province. These investments strengthen our position as a global leader in the innovation economy, which is critical to creating more well-paying jobs and shared prosperity for the people of Ontario.”

Kathleen Wynne
Premier of Ontario
Canadian AI Superclusters

Universities | Machine Learning Researchers | Labs & Institutions

University of Alberta
Richard Sutton
Alberta Machine Intelligence Institute (AMII)
Reinforcement learning and artificial intelligence group (RLAI)
Bionic Limbs for Improved Natural Control (BLINC)

University of Toronto
University of Waterloo
Geoffrey Hinton
Russ Salakhutdinov
Vector Institute
UofT Machine Learning Group
Canadian Institute for Advanced Research (CIFAR)

Université de Montréal
McGill University
Yoshua Bengio
Ian Goodfellow
Institut de Valorisation des Données (IVADO)
Montreal Institute for Learning Algorithms (MILA)
Obstacles:
Clean, Contextual Mining Data
Digital Requirements

Data Generated → Data Stored → Data Processing → Actionable Insights

- Big Data
- Artificial Intelligence

Structured and unstructured (ex. video) data

Data is stored in databases and servers

Process the data using CPU/GPUs and AI algorithms to detect patterns

Predictive signals are generated
The IoT Technology Stack

Applications
- Apps
- Analytics and bus. intelligence tools
  - Application developer toolkit: User Interface components, composer, runtime environment etc.
  - APIs / external systems orchestration
  - Analytic algorithms
  - Data management
  - Data models (software defined machines)
  - Cloud (private or public)

- Applications running on real-time data, providing recommendations to users, built with common components
- Enables rapid, efficient development of analytics
- Aims to provide 80% of the capabilities required for applications

Data, analytics and application middleware

Connectivity middleware
- Security, ID management
- Connected device management
- Communications network
- Machine apps
- Gateway

- Provides the series of technologies required to connect machines to the internet

Machines
- Machines

- Physical assets instrumented with sensors, actuators and computers
Plan: Smart Mining Demonstration Program
Smart Mining Demonstration Program

• Thanks to a contribution from the Government of Canada
• Give mines a reason to implement world-class sensors, connectivity, data management, and analytics: economic use cases based on short-term data-driven OODA loops
Smart Mining Demonstration Program

• Drill and Blast Output/Cost Optimization
  • Geotechnical modelling
  • Televiwer data, 3D laser face profiling, and edge detection
  • Discrete fracture network algorithms.
  • Correlations from fragmentation analysis, vibration, seismicity and noise to inform drill patterns and scheduling.
• Automation of drill plans, leveraging machine learning tools to ensure optimal drilling placement and angles
• Machine learning technologies relating drill sensors to sampling output and geometallurgical data analysis

Estimated value: 5% cost reduction, 5% improvement in grade through increased ore recovery versus dilution -- $10+ million/year
Resources for Small to Medium Enterprises

Provide the incentive for an AI expert to focus his/her attention on the mining industry.

A program for that provides:

• Leveraged funding for product development
• Technical advisory (mining and digital)
• Development tools and resources for a discount or free
• Clean, AI-ready data sets from operational mines
• Demonstration sites for technology commercialization

This type of program accelerates results for all other ecosystem partners.
Strategy for MODCC

Funding

SME Collaboration and Support

Clean Mining Data

MINING

Productivity

SME Jobs and Growth

Academic Engagement

Benefits to Canada

MODCC