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.

CEMI
Centre for Excellence in Mining Innovation

SNOLAB

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

SUPPORTED BY

canadamining innovationcouncil

Ontario
Northern Ontario Heritage Fund Corporation
Société de gestion du Fonds du patrimoine du Nord de l'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

The CEMI Team

VERN DRYLIE
R&D PROGRAM DIRECTOR OF ENVIRONMENT & SUSTAINABILITY

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VICE-PRESIDENT - GEOSCIENCE & GEOTECHNICAL R&D UDMN THEME LEADER

COURTNEY FOLZ
COMMUNICATIONS COORDINATOR

SHERRY GREASLEY
VICE PRESIDENT - OPERATIONS

BRIAN JONES
VICE PRESIDENT - BUSINESS INNOVATION

SHANNON KATARY
DIRECTOR OF MARKETING AND COMMUNITY RELATIONS

NATALIE LAFLEUR-ROY
FINANCE AND OPERATIONS

DIANE LEPAGE
UDMN ADMINISTRATIVE COORDINATOR

ERIC MAAG
UDMN COMMERCIALIZATION DIRECTOR

DOUGLAS MORRISON
PRESIDENT AND CEO UDMN NETWORK DIRECTOR CHAIR IN HOLISTIC MINING PRACTICES

CHARLES NYABEZE
DIRECTOR OF BUSINESS DEVELOPMENT
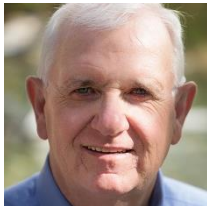
HARVEY PARSONS
EMERITUS TECHNICAL ADVISOR

MIKE RICHER
IT ADMINISTRATOR
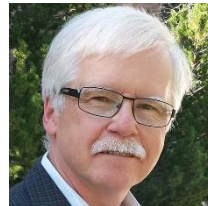
KIRK RODGERS
VICE PRESIDENT – MINE PRODUCTIVITY

MARCUS THOMSON
DIRECTOR, INNOVATION AND PROSPERITY OFFICE
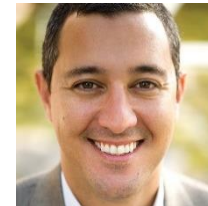
BORA UGURGEL
UDMN MANAGING DIRECTOR

DAVID VITONE
PROJECT MANAGER

CEMI

Develop new mines

Sustain existing mines,

& Improve environmental performance.

FindMine

DeepMine

ValueMine

SustainMine

BizMine

The Innovation Process
Research - Development - Implementation - Commercialization

Universities & Colleges

Demonstration & Implementation

Industrial Producers

Small Business Innovators

Innovation Gap

Commercialization Gap

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We close the Gaps!

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CEMI's PARTNERS IN INNOVATION
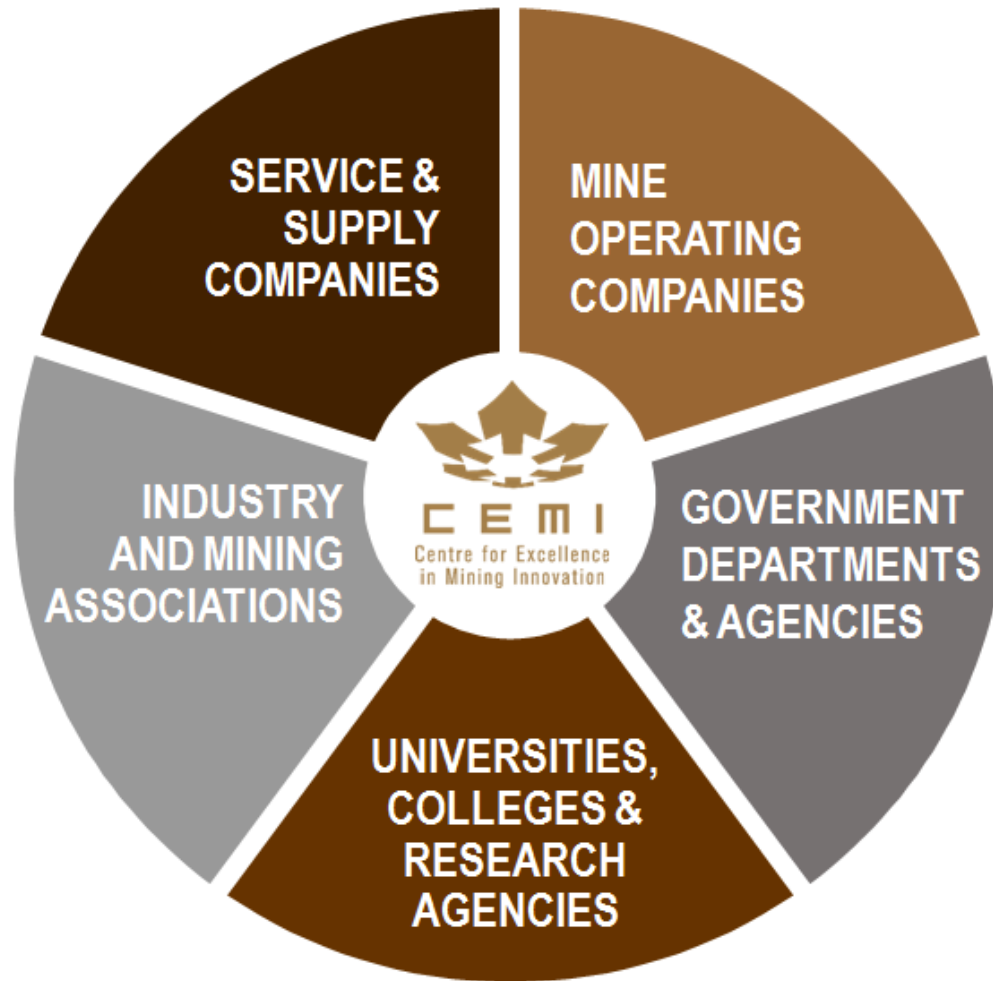
CEMI's COLLABORATORS IN INNOVATION

Canada's Ultra-Deep Mining Network

UDMN
ULTRA DEEP MINING NETWORK

TO HELP THE MINING
INDUSTRY TO ADOPT
COMMERCIALLY VIABLE R&D
PROJECT RESULTS, AND
ACCELERATE THE
DEPLOYMENT OF PROVEN
INNOVATIVE TECHNIQUES
AND TECHNOLOGIES.

Government of Canada
Networks of Centres
of Excellence

Gouvernement du Canada
Réseaux de centres
d'excellence

ROCK STRESS RISK REDUCTION

ENERGY REDUCTION

**MATERIAL TRANSPORTATION
& PRODUCTIVITY**

**IMPROVED HUMAN HEALTH
& EFFECTIVENESS**

27
projects

45
network
members

$35
million in private
and public funds

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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**
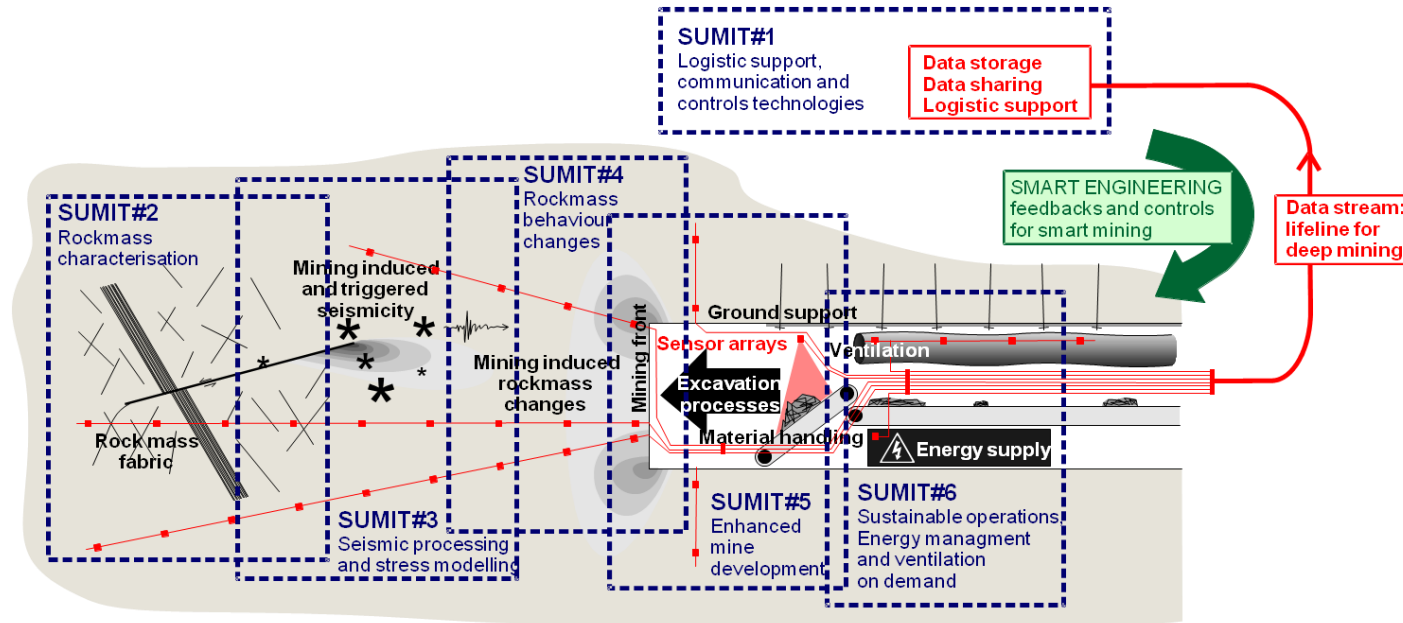
- Research is more effective when data is properly inputted into a common data management platform.

- 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

RACK #03

RACK #04

CISCO

KVM3

OPEN

DELL

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/

- 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

- 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

Trudeau Announces New Pan-Canadian Artificial Intelligence Strategy

March 31, 2017   Laura Steiner   Canada   0

Prime Minister Justin Trudeau announces federal funding for Artificial Intelligence initiative

"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 Institue
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)

Edmonton

Montréal

Toronto-Waterloo

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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 |
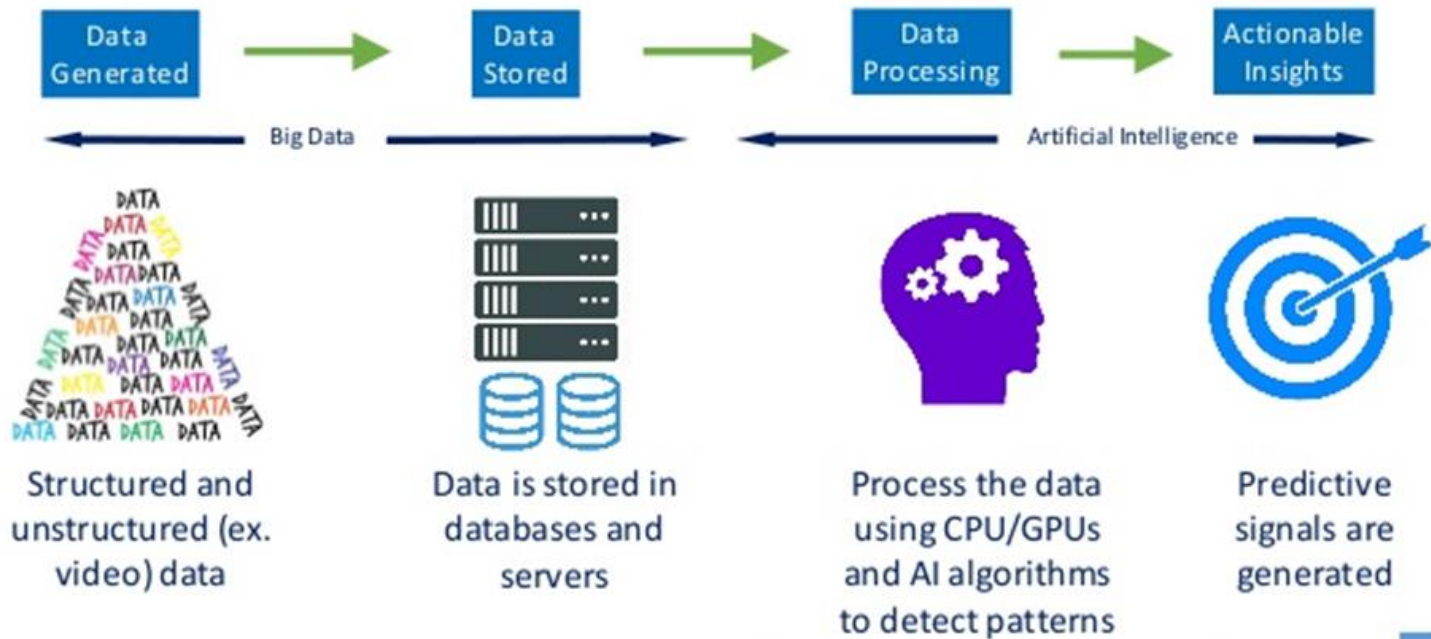
Central Processing Unit (CPU)/ Graphics Processing Unit (GPU)

5

The IoT Technology Stack

Applications

- Apps
- Analytics and bus. intelligence tools

- Applications running on real-time data, providing recommendations to users, built with common components

Data, analytics and application middleware

- 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)

- Enables rapid, efficient development of analytics

- Aims to provide 80% of the capabilities required for applications

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

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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
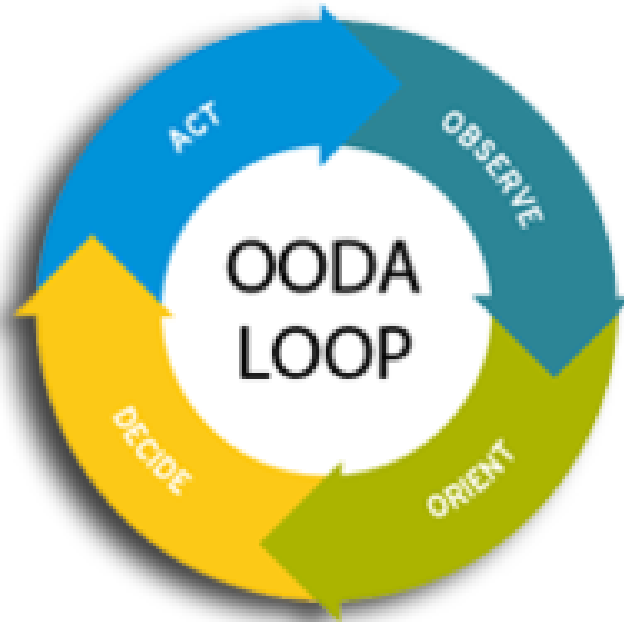 - Televiewer data, 3D laser face profiling, and edge detection
  - Discrete fracture network algorithms.
  - Correlations from fragmentation analysis, vibration, seismicity and noise to inform drill patterns and scheduling.
  - Automation of drill plans, leveraging machine learning tools to ensure optimal 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