ASSET MANAGEMENT 4.0

LIVE VIRTUAL TRAINING

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RADIATING KNOWLEDGE

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C-MORE

UNIVERSITY OF TORONTO

Dr. Ali ZUASHKIANI

Dr. Ali Zuashkiani has many years of practical experience combined with a strong scientific background in optimizing asset management decisions. He is CEO of PAMCO (a Canadian Consulting Company in the field of maintenance and reliability with projects across the globe).A graduate from Harvard Kennedy School of Policy, Said Business School of Oxford, Wits Business School in South Africa, and INCAE business school in Costa Rica, and PhD from University of Toronto, Ali has been the Director of Educational Programs at C-MORE at the University of Toronto for 13 years. C-MORE is funded by organizations from Canada, the United Kingdom and the United States of America. He is a RCM2 practitioner working with the Aladon Network and is responsible for RCM implementation in the Middle East region.

Dr. Ali has more than 20 years of consulting experience in different areas of asset management. He has more than 20 years of practical experience combined with scientific rigor in optimizing asset management decisions in more than 200 plants in 30+ countries in different industries such as Petrochemicals, Oil and Gas, utility and gas distribution, Car Manufacturing, Mining, Alumina, Electricity generation, transmission, and distribution, etc. Dr. Ali has experience in working in different parts of the world including North America, Middle East, New Zealand, and South America. His areas of expertise spans over many fields such as Advanced Reliability Techniques (quantitative and qualitative), Root Cause Analysis, Performance Management, Spare Parts Management, Life Cycle Costing, Cultural Change Management, Maintenance Management Assessment, Computerized Maintenance Management Systems and Developing Maintenance Strategies.

Dr. Ali is the author of Expert Knowledge Based Reliability Models and is a frequent global speaker on different subjects in asset management. He has been the Chair of the International Physical Asset Management Conference for the last 14 years.

Dr. Ali is also a Chair of educational programs at the Institute of Asset Management from UK and he is responsible for developing the body of knowledge for various roles in the field of maintenance and asset management.

In 2008, Dr. Ali was invited by Asia Society to attend its gathering in Tokyo as one of the world's most dynamic young leaders. The Asia Society was founded in 1956 by John D. Rockefeller III; among its supporters are former UN Secretary-General Kofi Annan, Henry Kissinger, and Rupert Murdoch.

In 2013, World Economic Forum in Davos, Switzerland, selected Dr. Ali as a Young Global Leader of 2013.

WE ALSO RECOMMEND

Dr. Janet LAM

EXPERT TRAINER

Dr. Janet Lam has a PhD in Industrial Engineering from the University of Toronto and currently serves as the Assistant Director at the Centre for Maintenance Optimization and Reliability Engineering (C-MORE). Her research interests are using maintenance and failure data to develop statistical models that optimize replacement and inspection scheduling decisions.

With over 10 years of experience in maintenance and reliability, her expertise lies in bridging the academic-industry gap, enabling practitioners to benefit from cutting-edge research in academia. As a MITACS accelerate researcher, she worked with Ontario Clean Water Agency from 2010 to 2012 on centrifuge maintenance.

Janet is also a respected instructor with six years of experience teaching undergraduate and professional students. She served as a Teaching Specialist for first year engineering students at Michigan State University from 2016 to 2017. She has given several workshops in teaching and education. In 2017, she was a Fellow of the National Effective Teaching Institute.

James REYES-PICKNELL

EXPERT TRAINER

James Reyes-Picknell is the author of Uptime: Strategies for Excellence in Maintenance Management (2015) and Reliability Centered Maintenance – Reengineered (2017). He is a Mechanical Engineer (University of Toronto 1977) and has worked for over 40 years in the areas of reliability, maintenance, and asset management.

James is widely regarded as a subject matter expert in ensuring the delivery of value from physical assets. His experience spans a wide range of industries, in both public and private sectors, all dependent on physical assets for their success. His career includes naval service (Canada), petro-chemicals, aerospace, shipbuilding, project management, software implementation, management consulting, and training delivery.

James is a professional engineer (PEng), certified management consultant (CMC), certified maintenance and reliability professional (CMRP), maintenance management professional (MMP), certified asset management assessor (CAMA), and certified blockchain professional (CBP). He is the 2016 recipient of Canada's prestigious Serio Guy Award for outstanding contributions to the profession.

Dr. Chi-Guhn LEE

Dr. Chi-Guhn Lee is a Professor of Industrial Engineering and the Director of the Centre for Maintenance Optimization and Reliability Engineering (C-MORE) at the University of Toronto. Dr. Lee received a Ph.D. in Industrial and Operations Engineering at the University of Michigan, Ann Arbor, USA in 2001 and has been active in the areas such as Markov decision processes, reinforcement learning and deep learning applied to maintenance optimization, supply chain management and production systems. He has worked closely with private firms including LG, Nestle, IBM, General Motors, Magna International, State Grid Corp of China to name a few. He has played various roles in the academic community as well.

He served as a co-chair of Workshop on Quantitative Finance and Risk Management 2012, a cluster-chair of Financial Engineering for Canadian Operational Research Society (CORS) Annual Meeting 2012 and 2013, and president of the Association of Korean-Canadian Scientists and Engineering (AKCSE) from 2013 to 2015. He served as a member of the Scientific Committee for the INFORMS MSOM 2015 conference, a member of the Technical Committee of the 26th International Conference on Flexible Automation and Intelligent Manufacturing 2016, a member of Program Committee for the Field Institute Workshop on Financial Optimization and Risk Management 2013 and 2015, a member of Steering Committee for the Field Institute Workshop on Optimization and Artificial Intelligence in Finance 2018, and a member of Program Committee for Spring World Congress on Engineering and Technology 2012.

Prof. Lee has served as an associate editor for two academic journals: Enterprise Information Systems (a journal by Taylor and Francis Group with an impact factor 1.683) and International Journal of Industrial Engineering: Theory, Applications and Practice (homed at Simon Fraser University with a SCIE Impact Factor 0.537). He also served as a guest editor of Annals of Operations Research (a journal by Springer with an impact factor 1.864) from 2012 to 2015.

KEY TAKEAWAYS

- Describe the main components of Industry 4.0, their key benefits and drawbacks
- Identify potential applications of machine learning in maintenance and reliability problems
- Discern asset management processes and strategies, and identify those most relevant to your organization
- Evaluate suitability of different machine learning algorithms' suitability for a variety of applications
- Understand the concepts and the workings of various machine learning algorithms.
- Implement some basic machine learning algorithms in Python

BENEFITS OF LIVE VIRTUAL TRAINING

- **SIMPLE SET-UP** – easy registration through email
- **INTERACTIVE** - Live video interaction among participants and instructors. In-built chat to exchange messages individually or with the group.
- **ENGAGING** - Knowledge retention with in-session Activities
- **LIVE BROADCASTING** - Students see PowerPoint slides in a split-screen to follow along with the instructor.
- **COURSE CONTENT SHARING** - Learning materials and additional reading resources, case studies and exercises available for all participants as PDF.
- **CONVENIENCE** - Attendees can join training sessions from their mobile or desktop device.
- **TECH SUPPORT** – dedicated host to ensure that everything runs smoothly

ACCREDITED BY:

C-MORE

The Centre for Maintenance Optimization and Reliability Engineering (C-MORE) is directed by Professor Chi-Guhn Lee, with the support of Project Director Dr. Dragan Banjevic, the internationally recognized maintenance optimization expert. C-MORE operates within the Department of Mechanical and Industrial Engineering at the University of Toronto.

C-MORE's research is driven by close interactions with industry, in particular with MORE consortium members and with researchers at universities world-wide.

Our focus is on real-world research in engineering asset management in the areas of condition-based maintenance, spares management, protective devices, maintenance and repair contracts, and failure-finding intervals. These strong industry connections not only benefit the companies we work with, but also our graduate students, who find work in maintenance divisions of industry leaders after graduation.

We apply our research with prototype software tools that obtain valuable information from data in corporate databases. Two of these tools are now commercially available through the Ontario-based C-MORE spin-off company OMDEC.

COURSE OVERVIEW

3705 - Machine Learning & AI Applications in Physical Asset Management

Managing physical assets in today's digitized, networked environments can be readily improved through data science. In this five-day course, you'll learn how to analyze operational and maintenance data from a variety of sources. You'll examine asset-management processes and strategies and identify those most relevant to your organization. You'll probe applications of machine learning and artificial intelligence, evaluate their suitability, and implement basic machine learning algorithms in Python. You'll emerge better prepared to lead your organization through the Industry 4.0 revolution.

THE EXTRAORDINARY VALUE OF THIS PROGRAM

The five-day Machine Learning & AI Applications in Physical Asset Management Program is offered in partnership with the Faculty of Science and Engineering at the University of Toronto, which has been designated the #1 Engineering school in Canada.

The program is taught by world-class instructors who bring a wealth of experience to the classroom:

- A mastery of the subject matter;
- The ability to relate theory and practice;
- Real-world experience with corporations and organizations;
- The ability to deliver material in an engaging and clear manner.

Participants will receive five full days of instruction over the course of one week, which includes a wide range of case studies demonstrating how key principles have been successfully and applied. You will come away equipped with detailed notes on the program material, and an unparalleled learning experience to take you to the next level in Asset Management.

WHO SHOULD ATTEND

This year marks the nineteenth year that the Physical Assent Management (PAM) program has run, and the first time we have offered our exciting advanced-level Machine Learning & AI Applications in Physical Asset Management program. Managers from all corners of the globe, and from a wide variety of industrial and governmental organizations, have attended our PAM sessions.

Attendees have included line managers responsible for the maintenance of their machinery and equipment, reliability specialists who must recommend effective maintenance practices, asset managers responsible for their organizations' maintenance strategies, and plant managers who seek excellent and proven strategies that give them competitive advantage over their competitors. If your responsibilities or interests include any aspect of managing physical assets in relation to Machine Learning, you can expect to gain a competitive edge with this exceptional learning opportunity.

COURSE DETAILS

Delivery type	Live Virtual Training
Prerequisites	None
Level	Advanced Training

PROGRAM TIMINGS

- Morning / Afternoon live online presentation throughout the week
- Learning materials and additional reading resources, case studies and exercises available for all participants as PDF.

IN-HOUSE

If interested to run this course in-house please contact Val Jusufi at:

+971 4 447 5711
in-house@leoron.com

DAY 1

Introduction to Asset Management in the 21st Century

We will introduce some of the international standards commonly used in Asset Management (AM), such as ISO 55000 standards, GMAM documents, the AM anatomy developed by the Institute of Asset Management, the International Infrastructure Management Manual, and the latest products of the Asset Management Council of Australia. We will explain how they apply to you and your organization.

Then we will discuss how to define and set the right policies in asset management, including how to set SMART goals for your organization and for your specific assets and how to mark your progress towards those goals over time to achieve world class performance.

Finally, we turn to questions of leadership and cultural change. How can we manage all this new technology and its potential applications, and what will it mean for our people? We will still need people to perform tasks and managers to define performance requirements. How will this work in our field, as AM advances into an increasingly technological world?

Background to Asset Management (AM)

- Why we need AM
- What AM intends to achieve
- International standards, documents, and frameworks, including ISO 55000, GFMAM, AM framework, IAM AM anatomy, IIMM, etc.
- AM program structure and components

Asset Management Policy and Strategy

- How policy and strategy work together
- Defining organizational goals
- Transforming goals into action through strategy

Asset Management Objectives

- Objectives vs. goals
- Using the AM strategy as a basis for long term implementation and sustainment

Asset Management Plans

- What are the various life cycle AM processes, and are they all relevant to you?
- Defining how to manage the various life cycle AM processes
- Applying processes and implementing strategy in each asset class using technologies and various tactical approaches

Leadership and Cultural Change

- What technology and its applications mean for the workers in an organization
- How to manage change, including organizational culture

Performance based contracts

- The significance of performance-based contracts

DAY 2

Basic Concepts in PAM

We will review the foundational concepts that enable the use of maintenance and condition monitoring data to make optimal asset management decisions, potentially saving companies millions of dollars. We will explain the use of probability distributions (and the Weibull distribution in particular) as powerful tools to describe and predict asset health over time.

We will also offer some detailed procedures for using limited data to make optimal replacement decisions.

Another dimension of asset management is inspecting the asset or collecting condition monitoring data and using those readings to detect pending expensive failures and make appropriate actions to manage them proactively. For protective devices, it is necessary to periodically inspect them to ensure there are no hidden failures, and they will function in the case of an emergency to prevent costly consequences of multiple failures. With assets equipped with sensors or those with regular condition monitoring measurements, the data can be used to provide information on the health of the asset; this, in turn, is a critical tool for capital replacement planning or fit for service analysis.

Basic Concepts of PAM

- Analysis of component failure data
- Component replacement procedures
- Reliability improvement through inspection
- Life cycle costing management

Basic Conceptions in Machine Learning

The course will cover some of the most fundamental machine learning methods. C-MORE has actively applied machine learning methods to interesting real-world problems, such as the categorization of power generation units according to reliability characteristics and anomaly detection in linear assets to optimize required maintenance actions. Specific topics include types of machine learning three perspectives, steps in machine learning project, foundations of machine learning covering probability, optimization and information theory. Finally, the class will discuss how to evaluate the performance of machine learning model, pitfalls and some of remedies.

Introduction to Machine Learning

- Computing and Big Data
- Data science, AI, Machine learning and deep learning
- History of AI and Big Data
- ML in Practice

Taxonomy of Machine Learning

- Tasks
- Main Theories
- Underlying Models

Steps in Machine Learning

- Data acquisition and preprocessing
- Algorithm selection
- Training and Evaluation

Optimization, Probability and Information Theory

- Random variables and probability distributions
- Common probability distributions
- Baye's rule
- Gradient-based optimization
- Information theory

Performance Evaluation

- Error measures
- Bias-variance trade-off
- Cross-validation
- Over-fitting and under-fitting

DAY 3

Supervised Machine Learning and Ensemble Methods

The course will cover some of the most fundamental machine learning methods. The algorithms will be discussed in three categories: supervised learning, unsupervised learning and advanced machine learning. The first two categories will be covered in Day 2, and span over methods such as linear regression, logistic regression, decision trees, naïve bayes, clustering, among many. C-MORE has actively applied machine learning methods to interesting real-world problems, such as the categorization of power generation units according to reliability characteristics and anomaly detection in linear assets to optimize required maintenance actions.

Therefore, we will share a few of our case studies to allow students to experience how machine learning methods can be used in MRO (maintenance, reliability and operations).

Supervised Learning

- Linear regression
- Logistic regression
- Linear discriminant analysis
- Decision tree
- Random forest
- Naive Bayes
- Programming activities

Unsupervised Learning

- Principle component analysis
- k-means clustering + programming activity
- Soft clustering and expectation maximization
- Association rules
- Programming activities

DAY 4

Advanced Machine Learning

The success of machine learning in the past decade or two has been mainly driven by deep learning. Deep learning is a branch of machine learning that relies on a specific computational architecture called artificial neural network, and has allowed end-to-end machine learning system. Therefore, the majority of Day 4 will

be dedicated to deep learning and multiple projects done at C-MORE using deep learning will be presented. The other main topic of Day 4 is another main branch of machine learning, called reinforcement learning, which is about decision making under uncertainty. This particular type of machine learning has gained keen attention when AlphaGo defeated human champion in the ancient game of Go, and when Deep Q-Net (DQN) by DeepMind showed performance exceeding human level in many Atari video games.

Deep Learning

- Multi-Layer Perceptron (MLP)
- Regularization
- Convolutional Neural Network (CNN)
- Recurrent Neural Network (RNN)
- Programming activities

Reinforcement Learning

- Dynamic decision making
- Monte Carlo simulation
- Basic RL algorithms: Q-Learning, SARSA
- Advanced RL algorithms: DQN
- RL in action

DAY 5

The Future of PAM

What is trending in the field of asset management and what lies ahead in the fourth Industrial Revolution? What new technologies are likely to influence decisions today and tomorrow? What new demographic and social considerations do we need to make? To answer these questions, we will look at a few of the technologies in more detail: artificial intelligence (AI), deep learning, Industrial Internet of Things (IIoT), smart contracts, and blockchain.

Finally, we will discuss the new technology driving industry 4.0 and future trends, including augmented reality, autonomous robots, machine simulation, cloud computing, horizontal and vertical system integration, additive manufacturing, Big Data and machine learning, resiliency vs reliability, cyber security, dependency and interdependency and more.

How You Will Learn

The five intensive, day-long classroom sessions are the centerpiece of your experience at the Machine Learning & AI Applications in Physical Asset Management. However, much more is provided, creating an overall package that will engage you while you're here, and deliver long-lasting results that will pay off when applied within your organization.

Industrial Internet of Things (IIoT)

- Sensors and data
- Does it make sense to instrument and connect everything?
- What can we do with all the data?
- How can we store, transmit and make decisions with so much data?
- "Data distracted" or "informed"?

Smart Contracts and Blockchain

- Definition and applications of blockchain technology
- Definition and applications of smart contracts
- Do these cutting-edge technologies have a role in AM?

Other Emerging Technologies

Augmented reality, autonomous robots, machine simulation, cloud computing, horizontal and vertical system integration, additive manufacturing, big Data and machine learning, resiliency vs reliability, cyber-security, dependency and interdependency, etc.

What is Asset Management 4.0?

- Industry 4.0 and Asset Management 4.0
- Trends in automation and data exchange in manufacturing technologies

Impact of trends on asset management

Future trends

- Trends in the field of asset management
- New technologies likely to influence future decisions
- Demographic and social consideration

REGISTRATION FORM

LIVE VIRTUAL TRAINING

ASSET MANAGEMENT 4.0

July 06-10, 2020 | LIVE VIRTUAL TRAINING

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	Job Title:	Nationality:
	E-mail:	ID No.
3	Name:	Phone:
	Job Title:	Nationality:
	E-mail:	ID No.

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Company:	Phone:	TRN:
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COURSE FEE: US$ 2490

SAVINGS & DISCOUNTS

GET US$400 DISCOUNT
if you Pay 2 months before the course

GET US$200 DISCOUNT
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GROUP DISCOUNTS*

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*please note that all group discounts are given on the original course fee
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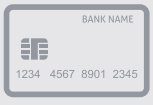

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TERMS & CONDITIONS

1. Payment Terms for LEORON Professional Development Institute (hereafter LEORON PDI)
   a. 100% payment of the amount in maximum 15 days upon the receipt of the invoice.
   b. The payment shall be conducted either in cash, credit/debit card, cheque or bank transfer.
   c. The stated amount is exclusive of Withholding Tax and other duties, taxes and transfer related charges which if applicable are payable by the client in addition to the stated amount.
2. Cancelation and Postponement Policy
   a. All cancelations and postponements shall be done in written form.
   b. In case of client cancelation:
      i. No cancelation fee if the cancelation takes place not less than 14 days prior to the beginning of the course,
      ii. 50% cancelation fee if the cancelation takes place between 7 days and 14 days prior to the beginning of the course,
      iii. 100% cancelation fee if the cancelation takes place less than 7 days prior to the beginning of the course,
   c. In case of client postponement,
      i. LEORON PDI issues a credit note which states that the paid amount can be used for participation in any of the company's courses which are scheduled in a period of 12 months from the date of the credit note.
      ii. A 25% postponement fee if the postponement takes place less than 10 days prior to the beginning of the course
   d. In case of LEORON PDI cancelation:
      i. A 100% refund shall be applicable if LEORON PDI decides to cancel the event - the client has an option to receive a credit note which can be used for any course for a period of 12 months.
      ii. In case of LEORON PDI postponement - the client may choose to participate on the same course at the later date or to be issued a credit note which states that the paid amount can be used for participation of any of the company's courses which are scheduled in a period of 12 months from the date of the credit note.
3. Selection of Trainer and Location
   Selection of the trainer and training location shall be at the discretion of LEORON PDI. Every effort shall be made to maintain continuity, but, if necessary, LEORON PDI can change the trainer and training location any time prior to commencement of the course.
4. Intellectual Property
   The copyright, intellectual property and design rights of the learning materials are property of LEORON PDI and its expert trainers. It cannot be copied, shared or reproduced without prior written consent of LEORON PDI.
5. Health and Safety
   The clients must conform to and comply with the Health and Safety Policy and Procedures as laid down by LEORON PDI or its partner organizations when the course is delivered in leased premises. Breaches of these policies and procedures may result with the client being suspended or excluded from the course and premises.
6. Complaints and Refunds Procedure
   a. LEORON PDI shall deem relevant the following types of complaints:
      i. If the contents of a course or the training materials are incorrect or inappropriate.
      ii. If the duration of the course is significantly different to that invoiced.
      iii. If the conduct or actions by the LEORON PDI trainer are inappropriate or offensive.
      iv. If the training delivery is not on a satisfactory level
   b. Enquiries and complaints shall be made in written form and have to contain sufficient detail to allow LEORON PDI to compile an official written response.
   c. All official enquiries and complaints shall be submitted electronically to Val Jusufi, Managing Director of LEORON PDI, at val@leoron.com
   d. LEORON PDI shall officially respond to the complaint no later than 7 days from the date of its reception.
7. Force Majeure
   LEORON PDI shall not be liable to the clients or be deemed to be in breach of any agreement it has concluded with them for any delay in performing or failure to perform any of the LEORON PDI's obligations in respect of the services if the delay or failure was due to any cause such as war, warlike activities, fire, storm, explosion, national emergency, labor dispute, strike, lock-out, civil disturbance, actual or threatened violence by any terrorist group, newly enacted law or regulation or any other cause not within the control of LEORON PDI.
8. Governing Law
   This contract shall be governed by and construed in accordance with the Laws and Regulations of the DMCCA Authority in Dubai, UAE.

☐ I have read and agreed to the following terms and conditions!

SUBMIT*

*Note: If your PDF reader is not able to submit this registration form, please save a local copy, attach it, and send it via Email to: register@leoron.com