M5

THE M5 CONFERENCE: ADVANCES IN FORECASTING

Machine Learning Methods Applied to Hierarchical Retailed Data

VIRTUAL

DECEMBER 6th

NEW YORK	9:30am – 4:30pm
EET	4:30pm – 11:30pm
LONDON	2:30pm – 9:30pm
TOKYO	11:30pm – 9:00am (+1)

DECEMBER 7th

NEW YORK	9:00am – 2:30pm
EET	4:00pm – 9:30pm
LONDON	2:00pm – 7:30pm
TOKYO	11:00pm – 4:30am (+1)

Organizers:

UNIVERSITY of NICOSIA

INSEAD — The Business School for the World®

MOFC — Learn. Forecast. Compete. Disseminate. Excel.

FORECASTING & STRATEGY UNIT

Why Attend

Why you must attend the M5 Conference

The findings of the M5 Competition, one of the largest forecasting competitions of all time, will be presented and analysed at length over the course of the two-day M5 Conference. In this respect, the Conference will elaborate on the winning methods, their practical applications and broader implications, as well as how they can benefit business and other organizations.

The M5 Conference Agenda includes distinguished speakers from the major software/technology companies (Google, Kaggle, Walmart, Microsoft, Amazon, Facebook, SAS and Target), as well as leading academics from top-tier universities. It features the presentation of the three most accurate methods of the M5 Competition by the developers themselves who will also discuss how their methods can be implemented by others. Their code will be available for free on GitHub. The Conference covers all critical aspects of forecasting, including combining methods and introducing judgmental adjustments, paying special emphasis on the comparison of Machine Learning and Statistical forecasting methods as well as the assessment of uncertainty. Additionally, the Conference provides an excellent opportunity for networking and discussing the latest advances in forecasting by world-renowned experts.

Finally, Nassim Nicholas Taleb will deliver a keynote address discussing uncertainty in forecasting and Spyros Makridakis will present the major findings of the M5 Competition and discuss how organizations can benefit by such findings in order to improve the accuracy of their predictions and assess their uncertainty more realistically.

Who should attend the M5 Conference?

- Professionals working in companies or non-profit organizations in jobs that involve preparing forecasts and estimating uncertainty
- Financial managers who prepare budgets and the financial requirements for their firms
- Government officials requiring to predict receipts and expenses
- Hedge fund and other related managers who need to predict stock and other market variables
- Production managers requiring forecasts for their production planning activities
- Inventory managers who must predict the demand for a large number of items to figure out optimal inventory levels and reordering points
- Logistics and transportation managers whose scheduling tasks need forecasts
- Academics teaching forecasting and related courses
- Students interested in forecasting for their courses or for their research

The M5 Competition

The M5 was the biggest and most ambitious of all M Competitions to date. It ran from 2 March to 30 June 2020 and differed from the previous four ones in six important ways, some of which were suggested by the discussants of the M4 Competition.

- It used hierarchical sales data, generously made available by Walmart, starting at the item level and aggregating to that of departments, product categories and stores in three geographical areas of the US: California, Texas, and Wisconsin.
- Besides the time series data, it also included explanatory variables such as price, promotions, day of the week, and special events (e.g. Super Bowl, Valentine's Day, and Orthodox Easter) that affect sales which are used to improve forecasting accuracy.
- The distribution of uncertainty was assessed by asking participants to provide information on four indicative prediction intervals and the median.
- The majority of the more than 42,840 time series display intermittency (sporadic sales including zeros).
- Instead of a single competition to estimate both the point forecasts and the uncertainty distribution, there were two parallel tracks using the same dataset, the first requiring 28 days ahead point forecasts and the second 28 days ahead probabilistic forecasts for the median and four prediction intervals (50%, 67%, 95%, and 99%).
- For the first time, it focused on series that display intermittency, i.e., sporadic demand including zeros.

Aim

The M5, the fifth expanded iteration of the highly-regarded Makridakis (or M) Competitions, returned in service of advancing the theory and practice of Forecasting, in line with its enduring aim since the early 1980s.

In this respect, the aim of the M5 Competition was similar to the previous four: that was to identify the most appropriate method(s) for different types of situations requiring predictions and making uncertainty estimates. Its ultimate purpose was to advance the theory of forecasting and improve its utilization by businesses and non-profit organizations. Its other goal was to compare the accuracy/uncertainty of ML and DL methods vis-à-vis those of standard statistical ones, and assess possible improvements versus the extra complexity and higher costs of using the various methods.

The competition was a huge success with over 100,000 entries from forecasters from over 100 counties competing for the $100,000 in cash prizes. The Accuracy Challenge currently stands as Kaggle's 6th most popular competition of all time in terms of the number of participating teams.

M5 Competition Prize Sponsors:

IIF International Institute of Forecasters · Google · kaggle · Walmart · Uber

Prof. Spyros Makridakis

The Makridakis Open Forecasting Center

Spyros Makridakis is a pioneer in the field and one of the foundational figures of Forecasting. He is a Professor at the University of Nicosia, where he serves as a Director of its Institute For the Future (IFF), and is the Founder of the Makridakis Open Forecasting Center (MOFC). In 1970 he joined INSEAD as a Professor. He has authored, or co-authored, twenty-seven books and special issues and more than 360 articles. His book "Forecasting Methods for Management, 5th ed. (Wiley)", has been translated in 12 languages and sold more than 120,000 copies, while his book "Forecasting: Methods and Applications, 3rd ed. (Wiley)", has received more than 6,000 citations. Professor Makridakis was the Founding Editor-in-Chief of the Journal of Forecasting and the International Journal of Forecasting.

Professor Makridakis is the Organizer of the renowned M (Makridakis) Competitions, the premier academic forecasting competition in the world, which have fundamentally influenced the theory and practice of forecasting for the past four decades. His numerous papers and citations can be found in his Google scholar profile: scholar.google.com/citations?user=hPpgXPMAAAAJ&hl=en
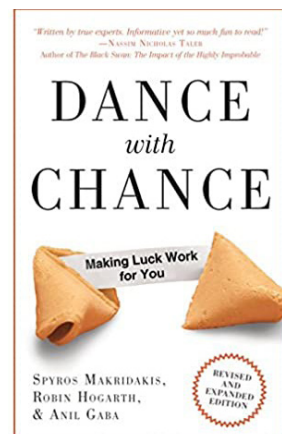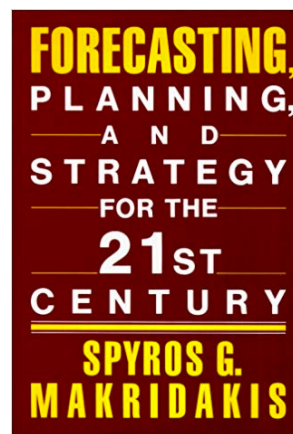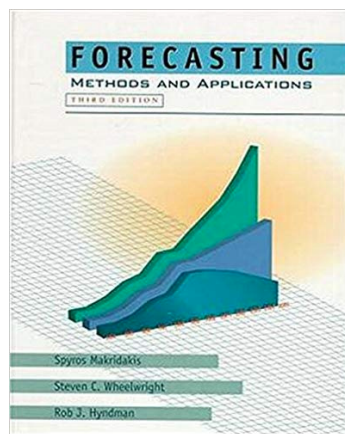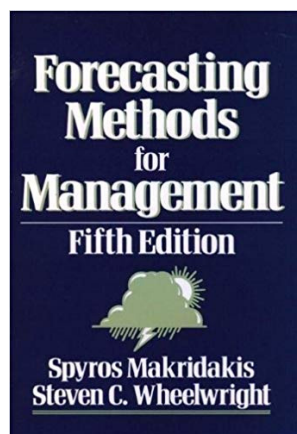
MOFC

Learn. Forecast. Compete. Disseminate. Excel.

Forecasts are essential for practically all business decisions: from setting up appropriate inventory or service levels and credible budgets to evaluating long-term, strategic investments. The first objective of the expanding field of forecasting is to offer accurate predictions contributing to the success of such decisions. Its second, equally important goal is to provide precise estimates of the uncertainty inherent in all predictions and how to be able to deal with the resulting risks.

The Makridakis Open Forecasting Center (MOFC) is one of the leading academic forecasting centers in the world. It conducts cutting-edge research on Forecasting, assisting organizations make accurate predictions, estimate levels of uncertainty, and rationally manage ensuing risks through training, research, technology development, and consulting.

Ultimately, MOFC aims to expand the utilization and value of Forecasting among business firms, by identifying their needs, suggesting the most appropriate way of fulfilling them, demonstrating its benefits in reducing costs and/or improving profits, while also avoiding untested practices.

M5 Competition
Award Winners & the Prizes

Prizes

Prizes	Description	Amount
1A	Most accurate point forecast	$25,000
2A	Second most accurate point forecast	$10,000
3A	Third most accurate point forecast	$5,000
4A	Fourth most accurate point forecast	$3,000
5A	Fifth most accurate point forecast	$2,000
6A	Most accurate student point forecasts	$5,000
	Total: M5 Forecasting Competition – Point Forecasts	**$50,000**
1B	Most precise estimation of the uncertainty distribution	$25,000
2B	Second most precise estimation of the uncertainty distribution	$10,000
3B	Third most precise estimation of the uncertainty distribution	$5,000
4B	Fourth most precise estimation of the uncertainty distribution	$3,000
5B	Fifth most precise estimation of the uncertainty distribution	$2,000
6B	Most precise student estimation of the uncertainty distribution	$5,000
	Total: M5 Forecasting Competition – Uncertainty Distribution	**$50,000**
	Total: M5 Competition	**$100,000**

Winners

Rank	Competition	Team Name	Name
1	Accuracy	YJ_STU	YeonJun In
2	Accuracy	Matthias	Matthias Anderer
3	Accuracy	mf	Yunho Jeon and Sihyeon Seong
4	Accuracy	monsaraida	Masanori Miyahara
5	Accuracy	Alan Lahoud	Alan Lahoud
1	Uncertainty	Everyday Low SPLices	Russ Wolfinger and David Lander
2	Uncertainty	GoodsForecast - Nick Mamonov	Nikolay Mamonov
3	Uncertainty	Ouranos	Ioannis Nasios and Christos Iraklis Tsatsoulis
4	Uncertainty	Marisaka Mozz	Mori Masakazu
5	Uncertainty	IHiroaki	Hiroaki Ikeshita
6	Uncertainty	Ka Ho_STU	Ka Ho Tsang

M5 Conference Speakers

SPYROS MAKRIDAKIS
University of Nicosia

Spyros Makridakis is a Professor at the University of Nicosia, where he is a Director of its Institute For the Future (IFF) and the Founder of the Makridakis Open Forecasting Center (MOFC). In 1970 he joined INSEAD as a Professor. He has authored, or co-authored, twenty-seven books and special issues and more than 360 articles. His book "Forecasting Methods for Management, 5th ed. (Wiley)", has been translated in twelve languages and sold more than 120,000 copies while his book "Forecasting: Methods and Applications, 3rd ed. (Wiley)", has received more than 6,000 citations. Professor Makridakis was the Founding Editor-in-Chief of the Journal of Forecasting and the International Journal of Forecasting and is the Organizer of the renown M (Makridakis) competitions, that for the last 40 years have fundamentally influenced the theory and practice of forecasting. His numerous papers and citations can be found in his Google scholar profile: scholar.google.com/citations?user=hPpgXPMAAAAJ&hl=en

NASSIM NICHOLAS TALEB
New York University

Nassim Nicholas Taleb spent more than 20 years as a derivatives trader before starting a full-time career in research in the field of risk management and applied probability. Taleb has been involved in risk-based policy making, advising the IMF, and the UK Prime Minister on model error and the detection and mitigation of tail exposures. He has also been hired the RAND corporation and various branches of the U.S government and has testified twice for the United States Congress.

Taleb holds a PhD from the University of Paris and an MBA from the Wharton School. He is the author of the Incerto, a 4-volume essay on uncertainty (Antifragile, The Black Swan, Fooled by Randomness, The Bed of Procrustes), and Dynamic Hedging (1997), a technical clinical book on derivatives, in addition to Silent Risk, a freely available technical book (and reexpression of the Incerto) in applied probability theory.

ADDISON HOWARD
Google Cloud AI

Addison Howard is a Competitions Program Manager at the Google Cloud AI group Kaggle, the home of data science. By matching organizations stepping into the world of Machine Learning for the first time, or by partnering with companies looking to deepen their roots in the data science community, Kaggle provides that partnership and opportunity for cutting edge technology to rise to the top through crowdsourced competition solutions. Addison has helped run dozens of supervised machine learning competitions across a wide variety of disciplines. He has Bachelor's degrees in Mathematics, Economics, and Accounting, and a Master's degree in Accounting

ANIL GABA
INSEAD

Anil Gaba received his Ph.D. in Decision Sciences at Duke University in the United States. He is currently the Orpar Chaired Professor of Risk Management and Professor of Decision Sciences at INSEAD. He is also the Academic Director of Centre on Decision Making and Risk Analysis at INSEAD. He was Dean of Faculty INSEAD in 2006-2009, and Dean of Faculty and Research Asia Campus in 2002-2006.

His research is in the area of assessment and use of subjective information, and analysis of decisions under risk and uncertainty. His research has appeared in several academic journals such as Management Science, Operations Research, Marketing Science, and Journal of Risk and Uncertainty. He is a co-author (with S. Makridakis and R. Hogarth) of the book, Dance with Chance: Making Luck Work For You.

He teaches courses on Uncertainty, Data, and Judgment (MBA), Probability and Statistics (PhD), and Bayesian Analysis (PhD). In addition, he teaches modules on Judgments & Decision Making and Risk Management in several executive development programmes all over the world including Europe, United States, China, Singapore, India, and the Middle East. He has won the Outstanding Teacher Award INSEAD MBA Core Course (Uncertainty, Data, and Judgment) fourteen times. He also directs the International Directors Program (for Board of Directors) at INSEAD.

He is a regular consultant and keynote speaker at various multinationals in areas of judgments & decision making and risk management.

ANTONIS POLEMITIS
University of Nicosia

Mr. Polemitis currently serves as the Chief Executive Officer of the University of Nicosia and EDEX, as a Board member of EDEX and UNICAF, and as a member of the Council of the University of Nicosia. The University of Nicosia (UNIC) serves over 14,000 students, along with over 18,000 additional students in its affiliated academic institutions. UNIC is the largest university in Cyprus and is the largest English language university in southern Europe.

Mr. Polemitis helped found the world-leading Digital Currency / Blockchain Initiative at the University of Nicosia, co-taught the first university cryptocurrency course in the world, and is regularly quoted as an expert on cryptocurrency issues. He was a member of the national committee that designed the blockchain strategy for Cyprus.

Mr. Polemitis is the managing partner of Ledra Capital where he led early-stage investments in, or software development of, Software-as-a-Service platforms in the areas of higher education, cryptocurrency, online video publishing and legal research. Mr. Polemitis was previously a principal at ACG Capital, a privately held multi-billion dollar investment firm and a partner based in New York and London in the private equity practice of Mercer Management Consulting (now Oliver Wyman), one of the world's leading strategy consultancies.

BRIAN SEAMAN
Walmart

Brian Seaman is a Senior Director of Data Science at Walmart. While at Walmart, he has led data science teams across many domains including sales forecasting, algorithmic pricing, financial analytics, marketing optimization, image processing and data extraction.

Brian has a demonstrated history of working in the retail industry. He is a strong research professional, skilled in Data Science, Scalability, and Distributed Systems. He has a Bachelor's degree in Physics and mathematics from Rowan University and a PhD in Physics from the University of Colorado Boulder.

M5 Conference Speakers

CHRIS FRY
Google

Chris Fry is a Senior Staff Data Scientist at Google, where he leads data science efforts dedicated to driving efficient utilization of Google's datacenter infrastructure. He has worked in the field of forecasting for over 25 years, and has developed forecasts and built forecasting systems for companies across a wide range of industries including energy, pharmaceuticals, travel, apparel, grocery retail, advertising, and computer systems. Chris served as an Advisor on the M5 Forecasting Competition, contributing ideas to the design of the competition, and helping to bring the competition onto Kaggle. He has a Bachelor's degree in Operations Research and Industrial Engineering from Cornell University, and a Master's degree in Management Science and Engineering from Stanford.

DAN GOLDSTEIN
Microsoft

Dan Goldstein is Senior Principal Researcher at Microsoft Research in New York City. He was previously President of the Society for Judgment and Decision Making, a Professor at London Business School and he taught or researched at Yahoo Research, Wharton, Columbia, Stanford, Harvard, and Germany's Max Planck Institute, where he was awarded the Otto Hahn Medal in 1997. He has degrees in Computer Science and Cognitive Psychology and received his PhD in 1997 from the University of Chicago.

ELLEN BONNELL
TrendSavants

Ellen Bonnell is a Principal Consultant for TrendSavants. Ellen works with global clients to improve software, methods and measurements for the sales, financial and supply forecasts that drive Sales & Operations Planning. Ellen specializes in highly accurate short-frequency forecasts that drive labor and inventory models. Ellen has also held positions as Head of Global Statistical Forecasting for Hilti and Chief Operating Officer for Candela. Ellen has a Bachelor's degree in Business Economics from Indiana University and Master's degree in Supply Chain Management from the University College Dublin, Michael Smurfit Graduate School of Business. Ellen is currently a Board Member of the FORESIGHT Practitioner Advisory Board.

EVANGELOS SPILIOTIS
National Technical University of Athens

Evangelos Spiliotis is a Research Fellow at the Forecasting & Strategy Unit, National Technical University of Athens (NTUA), where he also serves as Coordinator. He graduated from the School of Electrical and Computer Engineering, NTUA (National Technical University of Athens) 2013, and got his PhD from the same School on Forecasting Support Systems in 2017. His research interests include time series forecasting, decision support systems, machine learning, and optimisation. He was part of the M4 and M5 teams, organising the respective forecasting competitions.

ENNO SIEMSEN
University of Wisconsin-Madison

Enno Siemsen is the Patrick A Thiele Distinguished Chair in Business at the Wisconsin School of Business, University of Wisconsin-Madison. He serves as the Associate Dean for MBA and Masters Programs, and teaches courses in Sales & Operations Planning as well as Project Management. His expertise is in the fields of predictive analytics, demand forecasting, sales & operations planning, operations and supply chain strategy, and project management. His research currently focuses on forecast model selection, as well as on the use of augmented reality in manufacturing. Siemsen has been published in leading outlets such as Management Science, Organization Science, Journal of Operations Management, Production & Operations Management, Strategic Management Journal and Manufacturing & Service Operations Management. His work has also been featured in the Harvard Business Review and the California Management Review. He is the author of 'Demand Forecasting for Managers', a book on forecasting and organizational decision making. He currently serves as a department editor for the Decision Sciences Journal, and as an associate editor for the Journal of Operations Management, Production & Operations Management and the Journal of Supply Chain Management."

GEORGE ATHANASOPOULOS
Monash University

George Athanasopoulos is a Professor, Deputy Head and Director of Education at the Department of Econometrics and Business Statistics at Monash University, Australia, and is the President of the International Institute of Forecasters. He received his PhD in Econometrics from Monash University in 2007. A large body of his research has a strong focus on forecasting large collections of time series with particular interest in forecasting and modelling tourism demand. He is Associate Editor for the International Journal of Forecasting and on the Editorial Board for the Journal of Travel Research. George has co-authored with Professor Rob J. Hyndman, Forecasting: Principles and Practice a free online textbook, which is also available in Korean and Chinese.

JIM HOOVER
University of Florida

Jim Hoover, Professor and Director of Artificial Intelligence and Business Analytics Center, University of Florida. He is the Chairman of the Foresight Advisory Board. Following a career in Operations Research for the U.S. Navy, Jim became a Managing Director within Accenture Federal Services, with a focus on supply-chain analytics. Jim received his Doctorate of Business Administration from the University of Florida in 2017 and joined the faculty there in 2019, where he is now a Professor in the Marketing Department focused on AI and Business Analytics. Jim initially served Foresight as Software Editor and authored several articles on tracking forecast performance.

JOANNES VERMOREL
Lokad

Joannes Vermorel, based in France, is the Founder, majority shareholder and CEO at Lokad since February 2008. Lokad is a software company that specializes in predictive supply chain optimization. Mr. Vermorel runs a series of live public supply chain lectures, emphasizing a modern quantitative perspective. He taught software engineering at the Ecole Normale Superieure (ENS Paris) for 6 years. Mr. Vermorel is an alumnus of the Ecole Normale Superieure and an engineer of the Corps des Mines France. He started his career at the AT&T Labs in New Jersey, before pursuing a career in academia in France which he interrupted to create his current company.

M5 Conference Speakers

JONATHON KARELSE
NorthFind Management

Jonathon Karelse, is the CEO of NorthFind Management. Jonathon Karelse is a global leader in S&OP, demand planning and operations. He is leading the conversation that Behavioral Economics represents the next big idea for decision making and planning in most companies. He believes that by understanding the causes of biases and heuristics in planning, organizations can make rapid improvements in real-world forecasting performance. He is a graduate of the MIT Sloan School of Management, a member of the 2019 Management Excellence cohort at Harvard Business School, and is a member of the Harvard Business Review's Advisory Council.

PETER COTTON
Intech Investments

Chief Data Scientist at Intech Investments and an open-source developer. Previously headed J.P. Morgan's crowd-sourcing, privacy-preserving computation, and algorithmic trading efforts in credit markets. Co-founded Benchmark Solutions sold to Bloomberg in 2012 and began his career at Morgan Stanley in 2001 where he led the development of correlation trading analytics.

MAHDI YOUSEFI
Target

Mahdi Yousefi received his PhD in Electrical Engineering from Texas A&M in 2013, focusing on optimal and stochastic control, systems biology and cancer genomics. He has done extensive research on reproducibility issues in small-sample classification, clustering and error estimation problems, which are common in medical sciences. After his PhD, he spent four years at The Ohio State University as a Research Professor. He joined WalmartLabs in 2017, where he spent more than one and a half year as the science/tech lead of the Walmart eCommerce inventory optimization team and later the demand forecasting team. He joined Target in 2019 and has been with its enterprise demand forecasting team since then. His time-series forecasting algorithm was ranked 4th in the NN3 2006/07 Forecasting Competition for Neural Networks & Computational Intelligence.

MARIA MICHAILIDIS
University of Nicosia

Maria P. Michailidis is a Professor at the Management and MIS department and the Director of the Markidakis Open Forecasting Center (MOFC) of the Institute For the Future (IFF), of the University of Nicosia, Cyprus. She has served as the Dean of the School of Business from 2012-2017 and Head of the Management and MIS from 2008-2012. She has been educated in the USA where she obtained her Doctorate from the University of Massachusetts. She specializes in Management, Social and Clinical Psychology, Educational Leadership. She is Psychotherapist in the Person-Centered Approach (PCA). She is the author and editor of numerous journal articles and book chapters. In addition, she possesses a considerable industrial and teaching experience from work she has done in the United States and Cyprus. Her research interests include topics related to industrial organizational psychology and her work has been supported by European grants, including projects such as Leonardo da Vinci, Socrates/Erasmus Thematic Networks and Grundtvig Multilateral Projects and COST Actions. She is a member of the Board of Directors of the Elpida Foundation for children with cancer and leukemia and of the A.G. Leventis Foundation Scholars Association.

MICHAEL GILLILAND
SAS

Michael Gilliland is Marketing Manager for SAS forecasting software, and serves as Treasurer on the IIF Board of Directors. Prior to SAS, Mike held forecasting and supply chain positions in the food, consumer electronics, and apparel industries. He is Associate Editor of IIF's practitioner journal Foresight, author of The Business Forecasting Deal (2010), and Principal Editor of Business Forecasting: Practical Problems and Solutions (2015) and Business Forecasting: The Emerging Role of Artificial Intelligence and Machine Learning (2021).

PAUL GOODWIN
University of Bath

Paul Goodwin is Emeritus Professor of Management Science at the University of Bath, UK. He has a PhD from Lancaster University and his research has focussed on methods for incorporating management judgment into forecasts to improve accuracy. He has provided forecasting advice to many organizations and in 2013 he was elected as an Honorary Fellow of the International Institute of Forecasters. Until 2015 he was an Editor of the International Journal of Forecasting and, since 2007, he has written the Hot New Research column in Foresight: The International Journal of Applied Forecasting. His books include Forewarned: A Sceptic's Guide to Prediction (Biteback Publishers) and Profit from your Forecasting Software (Wiley).

PIERRE PINSON
Technical University of Denmark

Pierre Pinson is a Professor of Operations Research at the Technical University of Denmark (DTU, Dept. of Technology, Management and Economics). He is an IEEE Fellow and an ISI/Clarivate highly-cited researcher (2019 & 2020). He is the Editor-in-Chief of the International Journal of Forecasting. His main focus areas cover forecasting, optimization and game theory, with application within energy, logistics. He has published in leading journals in Meteorology, Power Systems Engineering, Statistics and Operations Research. He has been a visiting Researcher at the University of Oxford, the University of Washington in Seattle, the European Center for Medium-range Weather Forecasts (ECMWF, UK), a visiting Professor at École Normale Supérieure (Rennes, France) and a Simons fellow at the Isaac Newton Institute (Cambridge, UK)."

ROBERT L. WINKLER
Duke University

Robert L. Winkler is James B. Duke Professor in the Fuqua School of Business and Professor in the Department of Statistical Science at Duke University. His primary research areas include decision analysis, Bayesian statistics, forecasting, and risk analysis, and he has published extensively in these areas. He was awarded the Frank P. Ramsey Medal for significant contributions to decision analysis. Recent work involves probability forecasting, combining forecasts, decision modeling, stochastic dominance, sequential decision making, and multiattribute utility.

M5 Conference Speakers
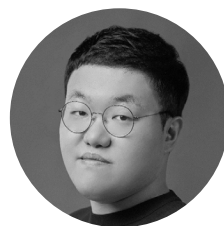
SIHYEON SEONG
mofl Inc

Sihyeon Seong is a CEO and AI researcher of mofl Inc. His primary research area is the optimization of extremely high-dimensional spaces. He received his Ph.D. in Electrical Engineering from the Korea Advanced Institute of Science and Technology (KAIST) in 2019 and B.S. Electrical Engineering and Bio and Brain Engineering from KAIST.

YEON JUN IN
Kyung Hee University

Yeon Jun In is an undergraduate student in the Department of Environmental Engineering and the Department of Industrial and Management Systems Engineering at Kyung Hee University (KHU). He has a patent on time series demand forecasting. He is an enthusiastic AI researcher, and Kaggler. His research interests include machine learning, deep learning, and time series data analysis in Industrial domain.

SLAWEK SMYL
Facebook

Slawek Smyl is a Data Scientist specializing in forecasting, currently with Facebook. He holds Master's degree in Physics from Jagiellonian University, Poland, and the M.Eng. degree in Information Technology from RMIT University, Australia. He won the Computational Intelligence in Forecasting International Time Series Competition 2016, got a third place in the Global Energy Forecasting Competition in 2017, and won the M4 Forecasting Competition in 2018.

YUNHO JEON
mofl Inc

Yunho Jeon is a CTO and AI researcher of mofl Inc. He received a B.S. degree in mathematics and an M.S. degree in computer science from Seoul National University in 2006 and 2008, respectively. From 2008 to 2019, he worked at the Agency for Defense Development, Korea. He received his Ph.D. degree in Electrical Engineering from the Korea Advanced Institute of Science and Technology (KAIST) in 2019. He also worked at SK telecom, Korea, as a Research Scientist in 2019. His research interests include computer vision, deep learning, and time series forecasting.

TIM JANUSCHOWSKI
Amazon AI Labs

Tim Januschowski is a Machine Learning Science Manager in Amazon AI Labs. He has worked on forecasting since starting his professional career. At Amazon, he has produced end-to-end solutions for a wide variety of time series analysis problems. In forecasting, from demand forecasting to server capacity forecasting and in anomaly detection in the context of DevOps and business metrics. Tim's personal interests in forecasting span applications, system, algorithm and modeling aspects and the downstream mathematical programming problems. He studied Mathematics at TU Berlin, IMPA, Rio de Janeiro, and Zuse-Institute Berlin and holds a PhD from University College Cork.

YAEL GRUSHKA-COCKAYNE
University of Virginia

Yael Grushka-Cockayne is an Altec Styslinger Foundation Bicentennial Professor of Business Administration, a Senior Associate Dean for Professional Degree Programs, at Darden School of Business at the University of Virginia. She teaches courses on Decision Analysis, Project Management, and Data Science in Business. Her research and teaching activities focus on decision analysis, data science, business analytics, forecasting, forecast aggregation and the wisdom of crowds, decision analysis, project management, and behavioral decision-making. While visiting Harvard Business School, Yael taught Technology and Operations Management and Applied Business Analytics. Yael worked in San Francisco as a Marketing Director of an ERP company and as a Consultant to international firms. Yael is an Associate Editor at Management Science, Operation Research, and Decision Analysis. She has a Bachelor's degree from Ben-Gurion University; Master's, from the London School of Economics and a Ph.D., MRes, from the London Business School.

Day 1 - Monday, 6 December

9:30am - 10:00am — **Welcome / Opening Remarks**
- Prof. Maria Michailidis, Director of the Makridakis Open Forecasting Center (MOFC), University of Nicosia
- Mr. Antonis Polemitis, CEO of the University of Nicosia
- Prof. Anil Gaba, The ORPAR chaired Professor of Risk Management Academic Director, Centre for Decision Making and Risk Analysis, INSEAD
- Prof. Spyros Makridakis, Founder of the Makridakis Open Forecasting Center, MOFC & Director of the Institute For the Future, University of Nicosia

10:00am - 10:30am — **Keynote Address**
Forecasting and the COVID-19 Pandemic
Nassim Nicholas Taleb, New York University

10:30am - 11:00am — **The Role of Judgment in Forecasting**
Dan Goldstein, Microsoft

11:00am - 11:10am — Break

11:10am - 11:40am — **A Collaborative and Market-based View of the Future of Forecasting**
Pierre Pinson, Technical University of Denmark & Editor-in Chief IJF

11:40am - 12:10pm — **My New Forecasting Projects at Facebook**
Slawek Smyl, Facebook

12:10pm - 1:00pm — Break

1:00pm - 1:50pm — **Assessment of Uncertainty for Decision-Making**
Anil Gaba, INSEAD | Robert L. Winkler, Duke University

1:50pm - 2:20pm — **The Most Precise Uncertainty M5 Methods. Summary of Findings**
Evangelos Spiliotis, National Technical University of Athens (NTUA)

2:20pm - 2:40pm — **The Role of Uncertainty in Supply Chain: Lessons from the M5 Competition**
Joannes Vermorel, Lokad

2:40pm - 2:50pm — Break

2:50pm - 3:20pm — **An Engineering Solution to the Problem of Defining Time-Series Anomaly**
Peter Cotton, Intech Investments

3:20pm - 3:50pm — **Judgmental Forecasts and Judgmental Adjustments to Statistical/ML Forecasts**
Paul Goodwin, Universty of Bath

3:50pm - 4:30pm — **Panel Discussion: Expanding the Use of Systematic Forecasting in Organizations and Improving its Value: The UFO Challenge**
- George Athanasopoulos, Monash University and President of IIF
- Ellen Bonnell, TrendSavants
- Yael Grushka-Cockayne, University of Virginia
- Jim Hoover, University of Florida

Day 2 - Tuesday 7 December

9:00am - 9:10am — **Opening Remarks**
Prof. Maria Michailidis, Director of the Makridakis Open Forecasting Center (MOFC), University of Nicosia

9:10am - 9:40am — **Will Artificial Intelligence Take Your Job?**
Addison Howard, Google Cloud AI

9:40am - 10:10am — **Keynote Address**
The Changing Role of Forecasting in the Age of Cloud Computing
Chris Fry, Google

10:10am - 10:20am — Break

10:20am - 11:20am — **The Most Accurate M5 Accuracy Methods**
Summary of Findings
- Enno Siemsen, University of Wisconsin-Madison
- Yeon Jun In, Kyung Hee University, South Korea (KHU), Winner of the Accuracy challenge, M5 Competition
- Sihyeon Seong & Yunho Jeon, MOFL Inc., South Korea, Third winner of the Accuracy challenge, M5 Competition

11:20am - 11:40am — **The Value and Applicability of the M5 Competition**
Jonathon Karelse, NorthFind Management

11:40am - 12:10pm — **Applicability of the M5 to Forecasting at Walmart**
Brian Seaman, Walmart

12:10pm - 12:40pm — **Forecasts that Users Trust: Lessons Learned from a Large Scale Demand Forecasting Project**
Mahdi Yousefi, Target

12:40pm - 1:00pm — Break

1:00pm - 1:30pm — **Deep Probabilistic Forecasting**
Tim Januschowski, Amazon AI Labs

1:30pm - 2:00pm — **M5 Competition: How Organizations can Benefit from its Findings**
Mike Gilliland, SAS

2:00pm - 2:30pm — **The Past and Future of Forecasting Competitions and the Forthcoming M6 Competition**
Prof. Spyros Makridakis, Founder of the Makridakis Open Forecasting Center, MOFC & Director of the Institute For the Future, University of Nicosia

	Ticket prices
Normal	**FREE**
Academic	**FREE**
Student	**FREE**

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Makridakis Open Forecasting Center (MOFC)
2021 Membership Opportunities

	MOFC Partner $60,000 (5 maximum)	MOFC Sponsor $25,000	MOFC Supporter $10,000
Seat on MOFC Governing Board	5 seats available for MOFC partners		
Corporate advisory services	3 Days (Director level)	3 Days (non-Director level)	
Complimentary Enrolments to Applied Forecasting Course	10	6	2
Complimentary M conference Tickets	10	6	2
Advert in M conference brochure	Full Spread	Full page	Half page
Logo on MOFC/conference website and all conference marketing materials	✓	✓	✓
Sponsors desk at the back of the room at the M Conference (plus 2 complimentary tickets for staff)	✓	✓	✓

* All MOFC membership contributions or donations will be used to support the Centre's operation
(research, education, M competition & conference) to improve
our understanding and use of forecasting in organizations

The M6 US Stocks and International Assets Financial Forecasting Competition

A March 11, 2021, article in the WSJ entitled "Stock Pickers Trailed Market Again in Roller Coaster 2020: Some 60% of U.S. large-cap stock-picking funds lagged behind S&P 500 in 2020, marking 11th straight year of underperformance" exemplified the well-known finding that active, professional investment managers do not beat, on average, random stock selections. On the other hand, legendary investors like Warren Buffett, Peter Lynch and George Soros as well as celebrated firms as Bridgewater Associates, Renaissance Technologies, DE Shaw and several others have achieved phenomenal results, amassing returns impossible to justify by mere chance. It is the express purpose of the M6 competition to investigate this paradox by shedding as much light as possible to the following seven assertions:

1. The relationship between forecasting accuracy and investment returns.

2. The relationship between the perceived uncertainty around such accuracy and returns.

3. The contribution of judgment versus that of objective information in selecting stocks and assets.

4. How forecasting accuracy and uncertainty are assessed in making investment decisions.

5. The influence of judgmental biases in the way investment decisions are made.

6. The importance of a consistent investment strategy.

7. The role of luck in achieving consistent, above average returns.

The M6 competition is a duathlon consisting of two related challenges, involving two types of investments, both stocks and asset classes. The first category comprises 50 large capitalization US stocks and the second encompasses 50 broadly traded international ETFs (assets) covering international stocks, bonds, commodities, and currency markets. Competition participants would need to complete three tasks. First, rank the attractiveness of all 50 stocks and 50 ETFs on a scale from 1 to 5 and specify their level of certainty about such rank, second, choose the stocks/assets and the percentage they would like to invest in each and third provide information on how their selection was made. Consequently, they will be evaluated for (a) their forecasting performance, (b) their return on investment and (c) their combined achievement in (a) and (b), with prizes awarded to each of the three categories.

The M6 Financial Forecasting Competition will be organized and run in a similar way to the previous five competitions, attracting data scientists, statisticians, financial experts/analysts, economists, and related specialties from around the world, contending to win the substantial prizes being offered. M6 will be live, lasting a whole year, and open with all information about the competition and its results made available to anyone with an interest in the results. Moreover, once the competition is finished its findings, together with background material and commentaries will be published in a special issue of the International Journal of Forecasting (IJF) with the goal of learning as much as possible about financial forecasting and the related factors driving investment returns and how investors can improve the accuracy of their forecasts and mitigate the uncertainty associated with them in order to build robust portfolios and achieving consistent, above average returns.

The M6 competition will be live, lasting for twelve months, starting in February 2022, and ending a year later in 2023. It will consist of a single month trial run and 24 rolling origins for participants to provide their submissions and be evaluated when the actual data becomes available. The 24 rolling origins (4 weeks, repeated for six months) will be in alternate months, leaving the intervening periods to participants to evaluate the submitted results, assess their performance and if necessary, modify their strategy for the remaining period of the competition. The schedule of the competition as well as detailed guidelines for participation is available in an accompanying document that will be uploaded to the M6 website.

The M6 competition introduces the following innovations over the previous five ones:

- Being live instead of concealing part of the data to evaluate performance, will allow participants to:
  - Search for and use any available information that could improve forecasting performance and returns on investments.
  - Incorporate, in addition to numerical inputs, judgmental ones about the economy, the industry, and the firms that participants would invest to improve forecasting performance and returns on investments.
- In addition to measuring forecast performance, we capture decisions made based on these forecasts
  - We can therefore measure the extent to which portfolio construction decisions detract investment value, given the value of forecast performance
- Having 24 rolling origins to evaluate performance (instead of a single one) allows participants to learn from experience, improve their methodology and potentially achieve higher returns.

- Running a duathlon and asking for investment choices in stocks and financial assets, substantially enlarges the scope of the competition and what can be investigated and learned, including among others:
  - The relative forecasting performance between stocks universe versus the asset class universe
  - Differences in the Investment opportunity set (risk/return tradeoff) between of different classes of financial assets
  - The connection between forecasting accuracy and investment returns, split by asset class
  - The connection between the correct appreciation of uncertainty and investment returns
  - The role of judgment in forecasting performance by type of prediction
  - The role of judgment in investment returns by type of investment
  - The role of luck in achieving above average returns
  - The influence of fat tails in the evaluation of forecasting performance and investment returns

Package	Price	Number of packages available
Platinum	$100K	1
Gold	$50K	2
Diamond	$30K	3
Silver	$20K	5
Bronze	$10K	

M5

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