1. Overview

The Center for Applied Optimization at the University of Florida is an interdisciplinary center which encourages joint research and applied projects among faculty from engineering, medicine, mathematics and business. It also encourages increased awareness of the rapidly growing field of optimization through publications, conferences, joint research and student exchange. It was founded in September 1992. During the last five years, we have collaborated with other university centers, institutes, and large projects.

- We are part of a larger PRISMA-P (Precision and Intelligent Systems in Medicine) project, funded by NIH, since its inception from 2013.
- We are part of a newly funded NSF IUCRC (Industry and University Cooperative Research Center) program at the University of Florida: Center for Big Learning, whose goal is to push further the research, tech transfer and application of deep learning technologies.
- We have been collaborating with the UF Informatics Institute since 2016. We co-organized the Conference on Computational Biomedicine for the past three years (CBM 2016, CBM 2017 & CBM 2018).
- We are collaborating with the UF Brain Institute & the UF Genetics Institute.
- P.M. Pardalos is a permanent member of DIMACS. Next year, we are co-organizing an International Computational Challenge on vehicle routing problems (funded by NSF).

The Center promotes collaboration with researchers at other universities through visitors and student exchange. The Center has an international reputation as reflected by invitations to deliver invited lectures, participate in international award committees (Kyoto Prize Committee, MacArthur award committee), and co-organize international conferences. With the Elizabeth Wood Dunlevie Honors Term Professorship for 2013-2014, Dr. Pardalos created and taught the course Data Mining in Industrial Engineering. Students from this class (under Dr. Pardalos’ supervision) initiated the Data Science Informatics student organization (http://www.dsiufl.org/) which is one of the most active student organizations at the University of Florida.
2. Faculty and key personnel associated with the Center

**Industrial and Systems Engineering:**

- Ravindra K. Ahuja. Ph.D. (Indian Institute of Technology), Combinatorial Optimization, Logistics and Supply-Chain management, Airline Scheduling, Heuristic Optimization, Routing and Scheduling
- Roman Belavkin, Ph.D. (The University of Nottingham), Optimal Decision-making, Estimation, Learning and Control; Geometric Theory of Optimal Learning and Adaptation; Evolution as an Information Dynamic System.
- Oleg P. Burdakov, Ph.D. (Moscow Institute of Physics and Technology), Numerical methods for optimization problems and systems of nonlinear equations, Inverse problems, multilinear least-squares, nonsmooth optimization and equations, monotonic regression, hop-restricted shortest path problems.
- Pando G. Georgiev, Ph.D., D.Sci. (Sofia University), Optimization, Machine Learning, Data Mining, Variational Analysis.
- J. Cole Smith. Ph.D. (Virginia Polytechnic Institute and State University), Integer programming and combinatorial optimization, network flows and facility location, heuristic and computational optimization methods, large-scale optimization due to uncertainty or robustness considerations.
- Donald Hearn, Ph.D. (Johns Hopkins), Operations Research, Optimization, Transportation Science
- Guanghui (George) Lan, Ph.D. (Georgia Institute of Technology), Theory, Algorithms and Applications of Convex Programming and Stochastic Optimization; Modeling and Solution Approach of Bio-fuel Engineering.
- Petar Momcilovic, Ph.D. (Columbia University), Applied Probability, Service Engineering.
- Panos Pardalos, Ph.D. (Minnesota), Combinatorial and Global Optimization, Parallel Computing
- R. Tyrrell Rockafellar, Ph.D. (Harvard), Nonlinear Optimization, Stochastic Optimization, Applications in Finance
- H. Edwin Romeijn, Ph.D. (Erasmus University, Rotterdam, The Netherlands), Operations research, optimization theory and applications to supply chain management, planning problems over an infinite horizon, industrial design problems, and asset/liability management. Analysis of Integrated Supply Chain Design and Management Models; Design and Analysis of Algorithms.
Yaroslav D. Sergeyev, D.Sc. (Moscow State University), Ph.D. (Gorky State University), Global Optimization, Infinity Computing and Calculus, Set Theory, Number Theory, Space Filling Curves, Parallel Computing, Interval Analysis, Game Theory.

Stanislav Uryasev, Ph.D. (Glushkov Institute of Cybernetics, Ukraine), Stochastic Optimization, Equilibrium Theory, Applications in Finance, Energy and Transportation.

Jun Pei, Ph.D. (Hefei University of Technology), Production scheduling, Healthcare operations, Internet of Things, Coordinated optimization in manufacturing.

Xiang Zhong, Ph.D. (University of Wisconsin-Madison), Stochastic modeling and control in healthcare and service systems, Data analytics in healthcare.

Mathematics:

- William Hager, Ph.D. (MIT), Numerical Analysis, Optimal Control,
- Bernhard Mair, Ph.D. (McGill), Inverse Analysis
- Athanasios Migdalas, Ph.D. (Linköping Institute of Technology), Combinatorial Optimization, Discrete Mathematics, Numerical Analysis, Network Optimization
- Andrew Vince, Ph.D. (Michigan), Combinatorics, Graph Theory, Polytopes, Combinatorial Algorithms, Discrete Geometry
- David Wilson, Ph.D. (Rutgers), Image Processing
- Panos Nastou, Ph.D., Department of Mathematics, Aegean University

Civil Engineering

- Kirk Hatfield, Ph.D. (Massachusetts), Water Quality Modeling, Optimization in Environmental Modeling
- Lily Elefteriadou, Ph.D. (Polytechnic University, New York), Traffic Operations, Highway Capacity, Traffic Simulation, Signal Control Optimization
- Stamatina Th. Rassia, Ph.D. (University of Cambridge), Sustainable Environmental Design in Architecture, Cities for Smart Environmental and Energy Futures, Spatial Design Modeling and Assessment

Electrical & Computer Engineering:

- Jose C. Principe, Ph.D. (University of Florida), Digital Signal Processing, Brain Dynamics Learning, Brain Machine Interfaces, Information Theoretic Learning, LoFlyte Simulators, Neural Networks

Mechanical and Aerospace Engineering:
• Raphael Haftka, Ph.D. (UC San Diego), Structural and Multidisciplinary Optimization, Genetic Algorithms

Decision & Information Sciences:
• Harold Benson, Ph.D. (Northwestern), Multi-criteria Optimization, Global Optimization
• Selcuk Erenguc, Ph.D. (Indiana), Optimal Production Planning

Computer & Information Science & Engineering:
• Petraq Papajorgji (CV), Ph.D. (University of Tirana, Albania), Software Engineering, Data Mining, Business Modeling, Information Systems
• Gerhard X. Ritter, Ph.D. (Wisconsin), Computer Vision, Image Processing, Pattern Recognition, Applied Mathematics,
• My T. Thai, Ph.D. (Minnesota), Networks, Combinatorial Optimization, Algorithms, Computational Biology.

Chemical Engineering:
• Oscar D. Crisalle, Ph.D. (UC Santa Barbara), Process Control Engineering, Modeling and Optimization

Medical School:
• Paul Carney, M.D. (University of Valparaiso) Computational Neuroscience, Data Mining in Medicine
• Azra Bihorac, M.D., Anesthesiology, Medicine, and Surgery

Research Institutes
• Marco Carvalho, Florida Institute for Human & Machine Cognition. Machine Learning applied to tactical networks and biological-inspired security
• Mario Rosario Guarracino, Consiglio Nazionale delle Ricerche Machine learning methods for computational biology.
• Vitaliy A. Yatsenko, Institute of Space Research, Optimization, bilinear control systems, intelligent sensors, and biomedical application.

Food & Res. Econ.:
• Charles Moss, Ph.D. (Purdue University)
• Georgios Vlontzos, Ph.D. (University of Thessaly)
• Xenophon Markantonatos, Ph.D. (The Pennsylvania State University)
• Ioannis Ampatzidis, Ph.D. (Aristotle University of Thessaloniki), Precision Irrigation, UAV, Smart Systems, Internet of Things, Mechatronics-Robotics, Automation, Precision Farming, Sensors/Sensing, Smart Machinery, Machine Vision, Artificial Intelligence
Industry:

- Alkis Vazacopoulos, Ph.D. (Carnegie Mellon University, Combinatorial Optimization, Linear and Integer Programming, Logistics and Supply-Chain management, Airline Scheduling, Heuristic Optimization, Routing and Scheduling, Jobshop Scheduling)

3. Publications

(the bold-faced references involve joint authorship between associated members of the Center)

PANOS M. PARDALOS

BOOKS AUTHORED:

PAPERS IN REFEREED JOURNALS:


50. “Characteristics of Spatial Synchronization of Encephalograms in Left and Right-handed Subjects in Resting State and During Cognitive Testing: A Graph-theory


64. “Reinforcement Learning in Video Games Using Nearest Neighbor Interpolation and Metric Learning” (Matthew S. Emigh, Evan G. Kriminger, Austin J. Brockmeier, Jose C. Principe and Panos M. Pardalos) IEEE Transactions on Computational Intelligence and AI in Games, 8(1), pp. 56-66 (2016).


84. “Intelligent virtual reference feedback tuning and its application to heat treatment electric furnace control” (Ling Wang, Haoqi Ni; Ruixin Yang; Panos M. Pardalos; Li Jia; Minrui Fei) Engineering Applications of Artificial Intelligence Vol 46 (2015), pp. 1-9.


125. “Quantification of networks structural dissimilarities (Tiago A. Schieber, Laura Carpi, Albert Daz-Guilera, Panos M. Pardalos, Cristina Masoller and Martín G. Ravetti), Nature Communications 8, online, Article number: 13928 (2017).

126. “Traffic congestion and the lifetime of networks with moving nodes” (Xianxia Yang, Jie Li, Cunlai Pu, Meichen Yan, Rajput Ramiz Sharafat, Jian Yang,


138. “Minimizing average lead time for the coordinated scheduling problem in a two-stage supply chain with multiple customers and multiple manufacturers” ( Omer Faruk Ylmaz, Panos M. Pardalos), Computers & Industrial Engineering, Volume 114, December 2017, Pages 244-257
139. “A new game of information sharing and security investment between two allied firms”, (Xiaofei Qian, Xinbao Liu, Jun Pei & Panos M. Pardalos), International Journal of Production Research, published online http://dx.doi.org/10.1080/00207543.2017.1400704


PAPERS IN REFEREED BOOKS:


17. “Raman Spectroscopy Using a Multiclass Extension of Fisher-Based Feature Selection Support Vector Machines (FFS-SVM) for Characterizing In-Vitro Apoptotic Cell Death Induced by Paclitaxel” (Michael B. Fenn, Mario Rosario Guarracino, Jiaxing Pi, Panos M. Pardalos), In Lecture Notes in Computer Science 8426, Springer 2014, pp. 306-323.


21. “Construction of Pairs of Reproducing Kernel Banach Spaces” (Pando G.
22. “High Dimensional Data Classification” (Vijay Pappu and Panos M. Pardalos), In Clusters, Orders, and Trees: Methods and Application (F. Aleskerov et al. Editors), Springer 2014, pp. 119-150.


32. “Tolerance-Based vs. Cost-Based Branching for the Asymmetric Capacitated Vehicle Routing Problem” (M. Batsyn, B. Goldengorin, A. Kocheturov, P.M.
PANDO G. GEORGIEV

JOSEPH GEUNES


J. COLE SMITH


VLADIMIR BOGINSKI


GUANGHUI LAN


PETAR MOMCILOVIC


JEAN-PHILIPPE P. RICHARD


STAN URYASEV


R. TYRELL ROCKAFELLAR


DONALD HEARN


ILIAS S. KOTSIREAS


11. A class of cyclic (\(v; k_1; k_2; k_3; \lambda\)) difference families with \(v = 3 \mod 4\) a prime. Dragomir Z. Djokovic, Ilias S. Kotsireas, Special Matrices 4 (2016), Art. 29.


H. EDWIN ROMEIJN


2. Optimizing global liver function in radiation therapy treatment planning, Victor W Wu, Marina A Epelman, Hesheng Wang, H Edwin Romeijn, Mary Feng, Yue Cao, Randall K Ten Haken, Martha M Matuszak, Physics in Medicine & Biology 61 (17), 6465 (2016).


WILLIAM HAGER

ATHANASIOS MIGDALAS

14. Scheduling jobs on a single serial-batching machine with dynamic job arrivals and multiple job types, J Pei, X Liu, W Fan, PM Pardalos, A
15. A hybrid clonal selection algorithm for the location routing problem with
stochastic demands, Y Marinakis, M Marinaki, A Migdalas, Annals of
Mathematics and Artificial Intelligence 76 (1-2), 121-142 (2016)
16. Nash type games in competitive facilities location, A Karakitsiou, A Migdalas,
International Journal of Decision Support Systems 2 (1-3), 4-12 (2016)
19. Future Research on Multiobjective Coordinated Scheduling Problems for
Discrete Manufacturing Enterprises in Supply Chain Environments, J Pei, X
Liu, W Fan, A Migdalas, PM Pardalos, Supply Chain Management and
20. Optimization, Control, and Applications in the Information Age, A Migdalas, A
21. A generic column generation principle: derivation and convergence analysis, T
22. A Tree Neighborhood Topology Particle Swarm Optimization Algorithm for the
Vehicle Routing Problem with Stochastic Travel and Service Times, Y Marinakis,
M Marinaki, A Migdalas, World Congress on Global Optimization: 22/02/2015-
25/03/2015 (2015)
23. Discrete bi-level facility models with competing customers, A Karakitsiou, A
Migdalas, World Congress on Global Optimization: 22/02/2015-25/03/2015
(2015)
24. Multi-Objective Optimization and Multi-Attribute Decision Making for a
Novel Batch Scheduling Problem Based on Mould Capabilities, J Pei, A
Migdalas, W Fan, X Liu, Optimization, Control, and Applications in the
Information Age, 275-297 (2015)
25. Adaptive Tunning of All Parameters in a Multi-Swarm Particle Swarm
Optimization Algorithm: An Application to the Probabilistic Traveling Salesman
Problem, Y Marinakis, M Marinaki, A Migdalas, Optimization, Control, and
Applications in the Information Age, 187-207 (2015)
26. Multiobjective Particle Swarm Optimization for a Multicast Routing Problem. Y
Marinakis, A Migdalas, Examining Robustness and Vulnerability of Networked
Systems, 161-175 (2014)
27. Minimizing the Fuel Consumption of a Multiobjective Vehicle Routing Problem
Using the Parallel Multi-Start NSGA II Algorithm, ID Psychas, M Marinaki, Y
Marinakis, A Migdalas, International Conference on Network Analysis, 69-88
(2014)
28. A hybrid clonal selection algorithm for the vehicle routing problem with
stochastic demands, Y Marinakis, M Marinaki, A Migdalas, International
Conference on Learning and Intelligent Optimization, 258-273 (2014)
29. Adaptive Tunning of All Parameters in a Multi-Swarm Particle Swarm
Optimization Algorithm: An Application to the Probabilistic Traveling Salesman
Problem, Y Marinakis, M Marinaki, A Migdalas, Conference on Optimization
Control and Applications in the Information Age: Organized in honor of the 60th birthday of Professor Panos M. Pardalos 15/06/2014-20/06/2014 (2014)


36. Greedy randomized adaptive search for a location, K Holmqvist, A Migdalas, PM Pardalos, Developments in Global Optimization, 301-313 (2013)


MARCO CARVALHO

1. Formal Assurance for Cooperative Intelligent Autonomous Agents, S Bhattacharyya, TC Eskridge, NA Neogi, M Carvalho, M Stafford, NASA Formal Methods Symposium, 20-36, 2018

2. Optimal Trajectory and Schedule Planning for Autonomous Guided Vehicles in Flexible Manufacturing System, A Mahdavi, M Carvalho, 2018 Second IEEE International Conference on Robotic Computing (IRC), 167-172, 2018

3. Effect of luting agent on the load to failure and accelerated-fatigue resistance of lithium disilicate laminate veneers, MMM Gresnigt, M Özcan, M Carvalho, P Lazari, MS Cune, P Razavi et al, Dental Materials 33 (12), 1392-1401, 2017

4. High fidelity adaptive cyber emulation, S Mammadov, D Mehta, E Stoner, MM Carvalho, Computational Intelligence (SSCI), 2017 IEEE Symposium Series on, 1-8, 2017

5. A hybrid approach to improving program security, F Nembhard, M Carvalho, T Eskridge, Computational Intelligence (SSCI), 2017 IEEE Symposium Series on, 1-8, 2017

6. Malware classification using static analysis based features, M Hassen, MM Carvalho, PK Chan, Computational Intelligence (SSCI), 2017 IEEE Symposium Series on, 1-7, 2017
7. Recommended practices for the specification of multi-agent systems requirements, K Silhoub, M Carvalho, W Bond, Ubiquitous Computing, Electronics and Mobile Communication Conference (UEMCON), 2017 IEEE 8th Annual, 2017
9. Formal Assurance for Cognitive Architecture Based Autonomous Agent, S Bhattacharyya, T Eskridge, N Neogi, M Carvalho, 2017
10. An autonomous resiliency toolkit-needs, challenges, and concepts for next generation cyber defense platforms, M Atighetchi, F Yaman, B Simidchieva, M Carvalho, Military Communications Conference, MILCOM 2016-2016 IEEE, 1-6, 2016
17. Personal identity matching, MH Al-Shuaili, Florida Institute of Technology, 2016
20. Interactive visualization of netflow traffic, TC Eskridge, M Carvalho, F Nembhard, H Thotempudi, PJ Polack, Intelligence and Security Informatics Conference (EISIC), 2015 European, 188-188, 2015
21. Attack Surface Reasoning (ASR), Mr Nathaniel Soule, Borislava Simidchieva, Fusun Yaman, Ronald Watro, Joseph Loyall, Mr Michael Atighetchi, Marco Carvalho, Thomas Eskridge, David Last, David Myers, Capt Bridget Flatley, 2015
22. MIRA: a support infrastructure for cyber command and control operations, M Carvalho, TC Eskridge, K Ferguson-Walter, N Paltzer, Resilience Week (RWS), 2015, 1-6, 2015
23. Quantifying & minimizing attack surfaces containing moving target defenses, Nathaniel Soule, Borislava Simidchieva, Fusun Yaman, Ronald Watro, Joseph Loyall, Michael Atighetchi, Marco Carvalho, David Last, David Myers, Bridget Flatley, Resilience Week (RWS), 2015, 1-6, 2015
25. Transfer schemes for deep learning in image classification= Esquemas de transferência para aprendizado profundo em classificação de imagens, MC Carvalho, 2015
26. A significant improvement for anti-malware tests, R Ford, M Carvalho, Anti-malware Testing Research (WATER), 2014 Second Workshop on, 1-4, 2014
27. Statistical learning approach for robust melanoma screening, M Fornaciali, S Avila, M Carvalho, E Valle, Graphics, Patterns and Images (SIBGRAPI), 2014 27th SIBGRAPI Conference, 2014
31. Performance evaluation of static frequency reuse techniques for OFDMA cellular networks, BM Hambebo, MM Carvalho, FM Ham, Networking, Sensing and Control (ICNSC), 2014 IEEE 11th International Conference, 2014
36. 88 Last Word, Lee Garber, Susan Landau, George Candea, Prabir Bhattacharya, Li Yang, Minzhe Guo, Kai Qian, Ming Yang, Vehicular Networking, David Eckhoff, Christoph Sommer, Protecting Me, Richard Ford, Marco Carvalho, Sergey Bratus, Trey Darley, Michael Locasto, Meredith L Patterson, Daniel E Geer Jr, 2014
38. A comparison of community identification algorithms for regulatory network motifs, D Oliveira, M Carvalho, Bioinformatics and Bioengineering (BIBE), 2013 IEEE 13th International Conference, 2013
41. A combined discriminative and generative behavior model for cyber physical system defense, McCusker, S Brunza, M Carvalho, D Dasgupta, S Vora, Resilient Control Systems (ISRCS), 2013 6th International Symposium on, 144-149, 2013
44. Cooperation models between humans and artificial self-organizing systems: Motivations, issues and perspectives, GZ Rey, M Carvalho, D Trentesaux, Resilient Control Systems (ISRCS), 2013 6th International Symposium on, 156-161, 2013
45. Domain and location specific modeling of mobile users online Interests, S Moghaddam, M Carvalho, A Helmy, Wireless Communications and Mobile Computing Conference (IWCMC), 2013
49. A layered approach to understanding network dependencies on moving target defense mechanisms, S Crosby, M Carvalho, D Kidwell, Proceedings of the Eighth Annual Cyber Security and Information Intelligence Research Workshop, 2013
50. A human-agent teamwork command and control framework for moving target defense (MTC2), Marco M Carvalho, Thomas C Eskridge, Larry Bunch, Jeffrey M Bradshaw, Adam Dalton, Paul Feltovich, James Lott, Daniel Kidwell, Proceedings of the Eighth Annual Cyber Security and Information Intelligence Research Workshop, 2013

MARIO ROSARIO GUARRACINO


MAURICIO G.C. RESENDE


MY T. THAI

5. A. Kuhnle, T. N. Dinh, N. P. Nguyen, and M. T. Thai, Vulnerability of Clustering under Node Failure in Complex Networks, Social Network Analysis and Mining (SNAM), 2017


AZRA BIHORAC

1. Acute Kidney Injury Following Exploratory Laparotomy and Temporary Abdominal Closure, Shock, 2017
4. Recovery After Acute Kidney Injury, American Journal of Respiratory and Critical Care Medicine, 2017
9. Long-Term Outcomes for Different Forms of Stress Cardiomyopathy After Surgical Treatment for Subarachnoid Hemorrhage, Anesthesia and Analgesia, 2016
13. A Detailed Characterization of the Dysfunctional Immunity and Abnormal Myelopoiesis Induced By Severe Shock and Trauma in the Aged, Journal of Immunology, 2015
15. Tissue Inhibitor Metalloproteinase-2 (Timp-2)Igf-Binding Protein-7 (Igfbp7) Levels Are Associated With Adverse Long-Term Outcomes in Patients With Aki, Journal of the American Society of Nephrology, 2015
17. Human Myeloid Derived Suppressor Cells Induce Immune Suppression After Severe Sepsis, Shock, 2015
21. The Lung Neutrophil Transcriptome After Trauma Influences the Worse Outcomes of the Old To Pneumonia, Critical Care Medicine, 2014
22. Gram Stain Can Be Used To Safely Discontinue Vancomycin Therapy for Early Pneumonia in the Trauma Intensive Care Unit, American Surgeon, 2014
23. Insurance Status Is Associated With Treatment Allocation and Outcomes After Subarachnoid Hemorrhage, Plos One, 2014
24. Genomic Analysis of Individual Leukocyte Populations After Severe Trauma, Shock, 2014
28. Development of a Genomic Metric That Can Be Rapidly Used To Predict Clinical Outcome in Severely Injured Trauma Patients, Critical Care Medicine, 2013
30. Discovery and Validation of Cell Cycle Arrest Biomarkers in Human Acute Kidney Injury, Critical Care, 2013
GEORGE VLONTZOS

3. Assess and Prognosticate Operational and Environmental Efficiency of Primary Sectors of EU Countries, G Vlontzos, PM Pardalos, Driving Agribusiness With Technology Innovations, 1, 2017
4. Is Binge Drinking Prevalent in Greece after the Emergence of the Economic Crisis? Assessment of This Idea Using the Theory of Planned Behavior, G Vlontzos, MN Duquenne, S Niavis, Beverages 3 (1), 3, 2017
5. Assessing the drivers of traditional and local products consumption in Europe. Are there any contradictions? 3, G Vlontzos, L Kyrgiakos, MN Duquenne, tradition 8, 59, 2017
7. Data mining and optimisation issues in the food industry, G Vlontzos, PM Pardalos, International Journal of Sustainable Agricultural Management and Informatics, 2017
10. To eat or not to eat? The case of genetically modified (GM) food, G Vlontzos, MN Duquenne
13. Using a lethality index to assess susceptibility of Tribolium confusum and Oryzaephilus surinamensis to insecticides, P Agrafioti, CG Athanassiou, TN Vassilakos, G Vlontzos, FH Arthur, PloS one 10 (11), e0142044, 2015
14. Assess the impact of traditional and localized food under economic recession, G Vlontzos, MN Duquenne, S Niavis, Know your food: Food ethics and innovation, 420-427, 2015
15. Investigation and Evaluation of the Applicable European Environmental Policy in Rural Area from the Urban Population (Greece). E Kokkinou, G Vlontzos, HAICTA, 957-966, 2015
17. A DEA approach for estimating the agricultural energy and environmental efficiency of EU countries, G Vlontzos, S Niavis, B Manos, Renewable and Sustainable Energy Reviews 40, 91-96, 2014
26. Efficiency and productivity change in the Greek dairy industry, G Vlontzos, A Theodoridis, Agricultural Economics Review 14 (2), 14, 2013

**VITALIY YATSENKO**

JUN PEI


23. Chang Fang, Xinbao Liu, Jun Pei, Panos M. Pardalos. Optimization for a three-stage production system in the Internet of Things: Procurement, production and product recovery, and acquisition. International Journal of


XIANG ZHONG


4. Awards and other indicators of national/international recognition of the Center’s activities.

Panos M. Pardalos

- **2017** University of Florida Chapter Sigma Xi Senior Faculty Research Award
- **2016** Fellow of the American Institute for Medical and Biological Engineering (AIMBE): The College of Fellows is comprised of the top two percent of medical and biological engineers in the country. The most accomplished and distinguished engineering and medical school chairs, research directors, professors, innovators, and successful entrepreneurs, comprise the College of Fellows.
- **2015** Elected EUROPPT Fellow July 2015
- **2014** Distinguished International Professor by the Chinese Minister of Education
- **2014** Paul and Heidi Brown Preeminent Professor in Industrial and Systems Engineering: First Engineering Chair from Preeminence Initiative Awarded to ISE Professor
- **2013** Constantin Carathéodory Prize, (July 2013): The Carathéodory Prize is awarded biannually to an individual (or a group) for fundamental contributions to theory, algorithms, and applications of global optimization. The prize is awarded for outstanding work that reflects contributions that have stood the test of time. The criteria include scientific excellence, innovation, significance, depth, and impact.
- **2013** EURO Gold Medal (EGM) (July 1, 2013): The EURO Gold Medal (EGM) is the highest distinction within OR in Europe. The award is conferred on a prominent person or team or institution, for an outstanding contribution to the OR science.
- **2013** Honorary Professor of Anhui University of Sciences and Technology, China (July 2013).
- **2013** Award from the International Conference “Numerical Computations: Theory and Algorithms” for outstanding scientific achievements in the field of Optimization, Italy
- **2013** Elizabeth Wood Dunlevie Honors Term Professor for 2013-2014, University of Florida.
- **2013** Medal (in recognition of broad contributions in science and engineering) of the University of Catania, Italy.
5. Graduate students supported by the Center

**PhD Students**
- Seonho Park, Summer 2021 (expected).
- George Adosoglou, Summer 2021 (expected).
- Farnaz Babaie Sarijaloo, Fall 2020 (expected).
- Arsenios Tsokas, Summer 2019 (expected).
- Anton Kocheturov, Summer 2018 (expected).
- Jiaxing Pi, Summer 2016, Big Data Scientist at Siemens Corporate Technology, Princeton, NJ.
- Xueqi He, Summer 2016, Senior Systems Engineer at Optym, Gainesville, FL.
- Ximing Wang, Summer 2015, Senior Data Scientist at Conviva, Foster City, CA.
- Chrysafis Vogiatzis, Summer 2014, Assistant Professor at North Carolina A&T State University.
- Jose L. Walteros, Summer 2014, Assistant Professor at University at Buffalo.
- Vijay Pappu, Fall 2013, Lead Data Scientist at JP Morgan Chase, New York, NY.
- Dmytro Korenkevych, Summer 2013, Reinforcement Learning Engineer, Toronto, Canada.
- Syed N. Mujahid, Summer 2013, King Fahd University of Petroleum and Minerals, Saudi Arabia.
- Michael B. Fenn, Summer 2013, Assistant Professor, Florida Institute of Technology.

**MSc Students**
- Yaqi Luo, Spring 2018 (expected).
- Manqi Wu, Spring 2018 (expected).
- Manik Goomer, Fall 2017, Operations & Analytics Professional at University of Florida.
- Venkat Narayanan Veerasekar, Fall 2017, Supply Chain Analyst at Lazydays.
- Manu Dixit, Summer 2016, Quantitative Analyst at Guzman & Company, Miami, FL.
- Anil Singh, Summer 2015.
- Ioannis Pappas, Fall 2014, Student at University of Cambridge, Cambridge, United Kingdom.
- Paul Francis Thottakkara, Fall 2013, Data Scientist at Aureus Analytics, Mumbai, India.
- Saravanan Natarajan, Fall 2013.
- Orestis Panagopoulos, Summer 2013, Assistant Professor at California State University Stanislaus.
External and Internal Funding Sources

Panos M. Pardalos

- NSF 2010-2013, Quantifying Causality in Distributed Spatial Temporal Brain Networks (with J. Principe), $550,000.
- DTRA 2010-2013, Mathematical Approaches to WMD Defense and Vulnerability Assessments on Dynamic Networks (with C. Smith and M. Thai), $632,407 Extended to 2015.
- “A Probabilistic Model In The Study Of Match - Fixing Schemes For Multi-Contestant Games,” Joint project with the National Research Foundation of Korea in cooperation with the Korea National Sport University (2014-2017, $120,000).
- 2016-2019, NIH-NIGMS RO1 “Precision and Intelligent Systems in Medicine Partnership” (Co-PI with A. Bihorac, A. Li, P. Rashid, W. Hogan, P. Momcilovic, T. O. Basanti, D. Z. Wang, G. Lipori and M. Downey), $2,7M.

My T. Thai

- FC2 2017-2018, Resilient Smart Grid Control for Load Switching Cyber Attacks, (collaborate with Z. Miao)
- FC2 2016-2017, Nonlinear Model-Based Cyber Attack-Resilient Smart Grid Control, (collaborate with Z. Miao)
- NSF 2015-2018, EARS: Collaborative Research: Laying the Foundations of Social Network-Aware Cellular Device-to-Device Communications, (collaborate with W. Saad and Z. Han)
- NSF 2014-2017, Collaborative Research: RIPS Type 2: Vulnerability Assessment and Resilient Design of Interdependent Infrastructures, (Lead PI: Thai, co-PI: V. Boginski, Y. Yin, C. McCarty, A. Sarwat)
- NSRI 2014-2015, Efficient Protection Schemes towards Load-Redistribution Attacks, (sole PI)
• DTRA 2010-2015, Mathematical Approaches to WMD Defense and Vulnerability Assessments on Dynamic Networks (co-PI with C. Smith and P. Pardalos)
• DTRA 2009-2014, YIP: C-WMD: Models, Complexity, and Algorithms in Complex Dynamic Evolving Networks (sole PI)
• NSF 2010-2015, CAREER: Optimization Models and Approximation Algorithms for Network Vulnerability and Adaptability (sole PI)
• ETRI 2013-2014, Efficient DPI Methods in SCADA Smart Grid System (sole PI)
• NSF 2010-2015, Sequencing Gators: Building a Genome Science Curriculum at the University of Florida and Beyond (co-PI with E. Triplett, V. Crecy, and T. Kahveci)

William Hager

• “Collaborative Research: Fast TV-Regularized Large-Scale and Ill-Conditioned Linear Inversion with Application to PPI,” National Science Foundation, September 15, 2011, to September 14, 2014, $241,579 (with Yunmei Chen).
• “Innovations in Large-Scale Sparse Optimization and Applications,” Office of Naval Research (Mathematics), March 1, 2015, to February 28, 2018, $479,869 (with Anil Rao).

Other grants


• CAREER: Optimization Models and Approximation Algorithms for Network Vulnerability and Adaptability, NSF, 400,000 01/01/10 - 12/31/14 (M. Thai)
7. If applicable, please also provide a listing of the following items:

(a) Funded/proposed teaching/training grants in area of focus

Panos M. Pardalos:
- Elizabeth Wood Dunlevie Honors Term Professor for 2013-2014, University of Florida.
- Teaching Honors class:
  - “Honor Read Ignorance”.
  - “Honor Read The Music of Pythagoras”.

(b) Funded/proposed research project grants in area of focus

“A Probabilistic Model In The Study Of Match - Fixing Schemes For Multi-Contestant Games,” Joint project with the National Research Foundation of Korea in cooperation with the Korea National Sport University (2014-2017, $120,000).

(c) Investment of Center funds in generating pilot data for grants

Not applicable.

(d) Promotion and funding of seminars with Center funds (not customary department seminars)

Regular seminars by students and visitors of the CAO.

(e) Promotion and funding of major conferences in area of focus

The Center has promoted collaboration between faculty and students, organizing the following series of conferences in the last 5 years.

- The Third International Workshop on Machine Learning, Optimization and Big Data (MOD 2017), September 14-17, 2017, Volterra, Tuscany, Italy. Organizing Committee: Giovanni Giuffrida, Giuseppe Nicosia, Panos Pardalos.

• Fourth International Conference on Computational Biomedicine (CBM 2017), February 16-17, 2017, Gainesville, FL, USA. Organizing Committee: Panos M. Pardalos, George Michailidis.


• The Second International Workshop on Machine Learning, Optimization and Big Data (MOD 2016), August 26-29, 2016, Volterra, Tuscany, Italy. Organizing Committee: Giuseppe Nicosia, Panos M. Pardalos.

• Deucalion (Δευκαλίων) Summer Institute for Advanced Studies in Optimization, Mathematics, and Data Sciences, August 10-20, 2016, Drossato, Argithea, Greece. Organizing Committee: Panos M. Pardalos.


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• Learning and Intelligent OptimizatioN Conference LION 8, February 16-21, 2014 Gainesville, FL. Organized by Panos M. Pardalos. Local Organizers: Chrysafis Vogiatzis, and Jose L. Walteros.


• 2nd International Conference on Computational Biomedicine, January 24-26, 2013.
(f) Educational Core or Elective Courses offered in area of focus

Not applicable.

(g) Funding for graduate students from Center funds

See Section 5.

(h) Funding for travel for students from Center funds

Not applicable.

(i) Core lab support provided for research of members

Not applicable.

(j) Mentoring activities directed at junior faculty

Not applicable.

(k) Fundraising accomplishments

Not applicable.

(l) Public programs and results of those programs

Not applicable.

(m) National or international recognition received

See Section 4.

(n) Exchanges, agreements or planning initiated
(o) Outside activities and/or conflicts of interests for Center participants relevant to the Center’s mission.

Not applicable.
8. Additional information

The Center promotes collaboration between faculty and students by organizing weekly seminars every semester: on Biomedical Data Analysis and for Network Optimization Problems and energy applications. The Center has several international visitors and has plans to accept many new ones. The visitors contribute to the collaboration with the students and with other members of CAO. Plans for major activities in the future include: continuing organizing 3-4 conferences per year, writing and submitting proposals for external funding, inviting eminent scholars, writing and publishing papers, books and developing patents.

Research Topics During the Last Five Years

Global Optimization

Global optimization has been expanding in all directions at an astonishing rate during the last few decades. At the same time, one of the most striking trends in optimization is the constantly increasing interdisciplinary nature of the field. Dr. Pardalos is working on all aspects of global optimization with several PhD students: theory (including, complexity, optimality, and robustness) algorithm and software development, and applications.

Optimization in Biomedicine

In the last few years Dr. Pardalos has been working on applying optimization in medical problems (brain disorders, data mining in biomedicine, etc.). There are many interesting optimization problems in that area. As an example, in predicting epileptic seizures we globally solve multiquadratic 0-1 problems and maximum clique problems. We developed a novel data mining technique called biclustering based on the solution of large mixed fractional integer optimization problems. For our work on epilepsy we received the "William Pierskalla award" for research excellence in health care management science, from the Institute for Operations Research and the Management Sciences (INFORMS). In addition, several patents have been issued related to our research in brain disorders.

Analysis of Massive Data Sets

The proliferation of massive data sets brings with it a series of special computational challenges. The "data avalanche" arises in a wide range of scientific and commercial applications. With advances in computer and information technologies, many of these challenges are beginning to be addressed. A variety of massive data sets (e.g., the web graph and the call graph) can be modeled as very large multi-digraphs with a special set of edge attributes that represent special characteristics of the application at hand.
Understanding the structure of the underlying digraph is essential for storage organization and information retrieval. Our group was the first to analyze the call graph and to prove that it is a self-organized complex network (the degrees of the vertices follow the Power law distribution). We extended this work for financial and social networks. Our research goal is to have a unifying theory and develop external memory algorithms for all these types of dynamic networks.

**Analysis of Approximation Algorithms**

In my recent joint work of Du, Graham, Wan, Wu and Zha, we introduced a new method which can analyze a large class of greedy approximations with non-submodular potential functions, including some long-standing heuristics for Steiner trees, connected dominating sets, and power-assignment in wireless networks. There exist many greedy approximations for various combinatorial optimization problems, such as set covering, Steiner tree, and subset-interconnection designs. There are also many methods to analyze these in the literature. However, all the previously known methods are suitable only for those greedy approximations with submodular potential functions. Our work will have a lasting impact in the theory of approximation algorithms.

**Design and Analysis of Algorithms for Multicast Networks**

Multicast networks have been proposed in the last years as a new technique for information routing and sharing. This new technology has an increasing number of applications in diverse fields, ranging from financial data distribution to video-conferencing, automatic software updates and groupware. In multicast networks, the objective is to send information from a source to multiple users with a single send operation. This approach allows one to save bandwidth, since data can be shared across network links. Multicast network applications often require the solution of difficult combinatorial optimization problems. Most of these problems are NP-hard, which makes them very unlikely to be solved exactly in polynomial time. Therefore, specialized algorithms must be developed that give reasonable good solutions for the instances found in practice. The intrinsic complexity of these problems has been a technological barrier for the wide deployment of multicast services. We have developed efficient algorithms for multicast routing problem and the streaming cache placement problem.

**Algorithms on Source Signal Extraction**

Biomedical signals recorded from body surfaces, without intrusion into the body, typically suffer from mixing. The objective under such scenarios is to extract the source signals from the information of mixed signals. The extraction problems are very critical and well known in the signal processing community and are studied under the preamble of blind signal separation problems. In this area, our contribution was to develop a hierarchical optimization-based source extraction method for the sparse signals. The hierarchical model
can be solved as a 0-1 integer programming problem. Furthermore, when an additional assumption regarding non-negativity of the sources is imposed into the extraction problem, the basic structure of the problem transforms into a convex optimization problem. For the special case (non-negative sources) we have developed efficient methods, based on the structure of the non-negative sources. This is an ongoing work, and we hope that our work will have a significant impact in the field of signal processing.

**Computational Neuroscience**

We designed a network model of a human brain to create computational tools for automated diagnosis of Parkinson's disease (PD). We constructed functional network models based on functional Magnetic Resonance Imaging (fMRI) data. The connections between the nodes were computed based on the associations between neural activity patterns from distinct brain regions. The associations were computed through wavelet coefficients correlation. In constructed networks we evaluated a range of network characteristics and showed that certain small world properties provide statistically significant distinction between PD patients and healthy individuals. We also used connectivity models to study the epileptic brain. This is part of our research to use Networks to study brain dynamics.

**Probabilistic Classifiers in Diagnostic Medicine**

We created a probabilistic model based on generalized additive models in order to predict in-hospital mortality in post-operative patients. The data set included categorical, continuous and time series features, such as age, gender, race, surgery type, blood tests. We incorporated time series data into the model by extracting a set of meta-features describing the most important aspects of the time series. The categorical features were modeled with the relative posterior probabilities for a patient to survive given the value of the feature. Our model exhibited a very high discriminative ability (ROC 0.93) together with high accuracy (Hosmer-Lemeshow p > 0.5). This research involved the UF Medical School.

**Research on Energy**

Energy networks are undeniably considered as one of the most important infrastructures in the word. Energy plays a dominant role in the economy and security of each country. In our recent research we focus on several difficult problems in energy networks, such as hydro-thermal scheduling modeling, electricity network expansion, liquefied natural gas, and blackout detection in the smart grid. In addition to several edited handbooks in Optimization and Energy, Dr. Pardalos is the editor-in-chief (and Founding Editor) of the international Journal "Energy Systems" (published by Springer).
Development of Classification and Feature Selection Techniques for Breast Cancer Characterization using Raman Spectroscopy

Raman spectroscopy is an optical spectroscopic technique that has the potential to significantly aid in the research, diagnosis and treatment of cancer, with broad and highly valuable clinical translational applications over the next five to ten years. The information dense, complex spectra generate massive datasets in which subtle correlations often provide critical clues for biological analysis and pathological classification. Therefore, implementing advanced data mining techniques is imperative for complete, rapid and accurate spectral processing and biological interpretation. We have been focusing our investigations specifically on breast cancer, as we have continued to work on our collaborative project with several faculty from Biomedical Engineering and Clinical Oncology, which is funded by our 2011 UF Seed Fund Research Grant. We have developed a novel data mining framework optimized for Raman datasets, called Fisher-based Feature Selection Support Vector Machines (FFS-SVM). This framework provides simultaneous supervised classification and user-defined Fisher criterion-based feature selection, reducing over-fitting and directly yielding significant wavenumbers for correlation to the observed biological phenomena. Furthermore, this framework provides feature selection control over the nature of the feature input, and the number of features based on sample size in order to reduce variance and over-fitting during classification. We have a current article in press, in the Journal of Raman Spectroscopy, detailing the advantages of our framework compared to several of the most common data analysis methods currently in use. We achieve both high classification accuracy, as well as extraction of biologically relevant 'biomarker-type' information from the selected features using the original feature space for the in-situ investigative comparison of five cancerous and non-cancerous cell lines. The FFS-SVM framework provides comprehensive cell-based characterization, which is can also be used to study in-situ dynamic biological phenomena and it is hypothesized that this is the basis for the discovery of Raman-based spectral biomarkers for cancer. Our current work both in the laboratory and in the data analysis realm involves the development of multi-level/multi-class classification methods, employing SVM, Clustering and other techniques, as well as combing feature selection methods to further advance the information extracted from the increasingly complex experimental challenges of evaluating the effects of anti-cancer agents in-vitro. Our envisioned end goal is the development of the first Raman spectroscopic-based cell death classification assay capable of combined and simultaneous 'mechanism-of-action' elucidation for both cancer research and clinical application for rapid, real-time non-invasive diagnostic monitoring of various cancer treatment modalities.
April 15, 2013

MEMORANDUM

TO: Dr. Panos Pardalos, Director of Center for Applied Optimization

FROM: Jennifer S. Curtis
Associate Dean for Research and Facilities

SUBJECT: 2013 Five-Year Evaluation of the Center for Applied Optimization

The Center for Applied Optimization (CAO) at the University of Florida is an interdisciplinary center which encourages joint research and applied projects among faculty from engineering, mathematics and business. It also encourages increased awareness of the rapidly growing field of optimization through publications, conferences, joint research and student exchange. It was founded in September 1992. The CAO is directed by Dr. Panos Pardalos of the Department of Industrial and Systems Engineering. The Center website is located at http://www.ise.ufl.edu/cao/. Center affiliates include several members from Industrial and Systems Engineering, Civil Engineering, Mechanical and Aerospace Engineering, Computer and Information Science and Engineering, Chemical Engineering, Decision and Information Sciences, Mathematics, and Medicine, as well as from industry.

Individual and joint research projects include global, discrete and continuous optimization, optimization in biomedicine, analysis of massive data sets, analysis of approximation algorithms, design and analysis of algorithms for multicast networks, algorithms on source signal extraction, computational neuroscience, probabilistic classifiers in diagnostic medicine, development of classification and feature selection techniques for breast cancer characterization using Raman spectroscopy. Sponsors include the National Science Foundation, National Institutes of Health, Air Force, the Army Research Office, Center for Multimodal Solutions for Congestion Mitigation, and Florida Energy Systems Consortium.

The Center is interested in promoting collaboration with researchers at other universities through visitors and student exchange. It administers a program for visiting students.
from the Royal Institute of Technology (KTH) in Stockholm. Currently the Center hosts several visitors from China, Spain, Greece, and Russia, totaling approximately 18 for last year, this year and in the future.

The Center promotes collaboration between faculty and students by organizing weekly seminars every semester on biomedical data analysis, network optimization problems, and energy applications. Plans for major activities in the future include continuing organizing 3-4 conferences per year, writing and submitting proposals for external funding, inviting eminent scholars, writing and publishing papers, books and patents. The Center has successfully applied for many patents over the last few years, especially in the field of biomedical engineering.

The College of Engineering recommends continuation of the Center as it serves a useful purpose for the College and the University.

Please contact me if there are any questions.

JSC/mrh

cc: Dean Cammy Abernathy
    Dr. Joseph Hartman
July 13, 2011

Dear Dr. Pardalos,

It was a pleasure meeting you and your colleagues during our visit for the Center for Applied Optimization last Wednesday, June 29, 2011.

We enjoyed learning about the mission and activities of the CAO, including the collaboration initially between COE and CLAS when the Center first began its activities, and which has now evolved to include faculty members from Medicine and Business Administration in addition to a handful of industry members. We were pleased to hear about the breadth of research areas the Center is involved in, from data analysis and mining to optimization, covering sectors from defense and national security to energy and biomedicine. We sincerely hope you continue the hosting of exchange students and faculty visitors through your collaborators in Europe to further strengthen your industrial work overseas and add to your already high international visibility.

With this letter we want to thank you for your time and invite you to contact us in the future if we could be of any help to you and the Center for Applied Optimization.

Sincerely,

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