



**COLLEGE OF ENGINEERING  
AND COMPUTER SCIENCE**  
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

## **Konstantinos Tountas**

for the degree of Doctor of Philosophy (Ph.D.)

### **“Connected Multi-domain Autonomy and Artificial Intelligence: Autonomous Localization, Networking, and Data Conformity Evaluation”**

**November 13, 2020, 1:30p.m.**

**Virtual Dissertation**

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**DEPARTMENT:**

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**ABSTRACT OF DISSERTATION**

Connected Multi-domain Autonomy and Artificial Intelligence: Autonomous Localization, Networking, and Data Conformity Evaluation

The objective of this dissertation work is the development of a solid theoretical and algorithmic framework for three of the most important aspects of autonomous/artificial-intelligence (AI) systems, namely data quality assurance, localization, and communications. In the era of AI and machine learning (ML), data reign supreme. During learning tasks, we need to ensure that the training data set is correct and complete. During operation, faulty data need to be discovered and dealt with to protect from -potentially catastrophic- system failures. With our research in data quality assurance, we develop new mathematical theory and algorithms for outlier-resistant decomposition of high-dimensional matrices (tensors) based on L1-norm principal-component analysis (PCA). L1-norm PCA has been proven to be resistant to irregular data-points and will drive critical real-world AI learning and autonomous systems operations in the future. At the same time, one of the most important tasks of autonomous systems is self-localization. In GPS-deprived environments, localization becomes a fundamental technical problem. State-of-the-art solutions frequently utilize power-hungry or expensive architectures, making them difficult to deploy. In this dissertation work, we develop and implement a robust, variable-precision localization technique for autonomous systems based on direction-of-arrival (DoA) estimation theory, which is cost and power efficient. Finally, communication between autonomous systems is paramount for mission success in many applications. In the era of 5G and beyond, smart spectrum utilization is key. In this work, we develop physical (PHY) and medium-access-control (MAC) layer techniques that autonomously optimize spectrum usage and minimizes intra and internetwork interference.

**BIOGRAPHICAL SKETCH**

Born in Athens, Greece

Engineering Diploma, Technical University of Crete, Chania, Greece, 2014

M.S., Technical University of Crete, Chania, Greece, 2016

Ph.D., Florida Atlantic University, Boca Raton, Florida, 2020

**CONCERNING PERIOD OF PREPARATION**

**& QUALIFYING EXAMINATION**

**Time in Preparation: 2017 – 2020**

**Qualifying Examination Passed: Spring 2018**

**Published Papers:**

- G. Sklivanitis, K. Tountas, N. Thawdar, M. J. Medley, and D. A. Pados, "Unsupervised Training Dataset Curation for Deep-Neural-Net RF Signal Classification", to appear in Asilomar Conference on Signals, Systems, and Computers, 2020.
- K. Varma, L. Nyman, K. Tountas, G. Sklivanitis, A. R. Nayak, and D. A. Pados, "Autonomous Plankton Classification from Reconstructed Holographic Imagery by L1-PCA-assisted Convolutional Neural Networks", IEEE OCEANS, 2020.
- G. Sklivanitis, K. Tountas, N. Tsagkarakis, D. A. Pados, and S. N. Batalama, "Optimal Joint Channel Estimation and Data Detection by L1-norm PCA for Streetscape Mobility," International Conference on Acoustics, Speech, and Signal Processing (ICASSP,) 2020.
- K. Tountas, D. G. Chachlakis, P. P. Markopoulos, and D. A. Pados, "Iteratively Re-weighted L1-PCA of Tensor Data," Asilomar Conference on Signals, Systems, and Computers, 2019.
- K. Tountas, G. Sklivanitis, D. A. Pados, and M. J. Medley, "Tensor Data Conformity Evaluation for Interference-Resistant Localization," Asilomar Conference on Signals, Systems, and Computers, 2019.
- K. Tountas, G. Sklivanitis, D. A. Pados, "Beacon-assisted Underwater Localization by L1-norm Space-Time Tensor Subspaces," IEEE OCEANS, 2019.
- G. Sklivanitis, Y. Li, K. Tountas, B. Ouyang, J. Thomas, T. C. Su, and D. A. Pados, "Design and Experimental Evaluation of an Active Underwater Inflatable Co-Prime Sonar Array," IEEE OCEANS, 2019.
- Y. Liu, K. Tountas, D. A. Pados, S. N. Batalama, and M. J. Medley, "L1-Subspace Tracking for Streaming Big Data," Elsevier Journal of Pattern Recognition, 2019.
- K. Tountas, D. A. Pados, and M. J. Medley, "Conformity evaluation and L1-norm principal-component analysis of tensor data," SPIE Big Data: Learning, Analytics, and Applications Conf., SPIE Defense and Commercial Sensing, 2019.
- E. G. M. Verzegnassi, K. Tountas, D. A. Pados, and F. Cuomo, "Data Conformity Evaluation: A Novel Approach for IoT Security," IEEE World Forum on Internet of Things, 2019.
- K. Tountas, G. Sklivanitis, and D. A. Pados, "Dynamic Joint PHY-MAC Waveform Design for IoT Connectivity," IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2019
- K. Tountas, G. Sklivanitis, and D. A. Pados, "Directional Space-Time Waveform Design for Interference-Avoiding MIMO Configurations," IEEE International Workshop on Antenna Technology (iWAT), 2019.
- K. Tountas, G. Sklivanitis, D. A. Pados, and S. N. Batalama, "All-spectrum Digital Waveform Design via Bit Flipping," IEEE Global Communications Conference (GLOBECOM), 2018.
- G. Sklivanitis, A. Gannon, K. Tountas, D. A. Pados, S. N. Batalama, S. Reichhart, M. Medley, N. Thawdar, U. Lee, J. Matyjas, S. Pudlewski, A. Drozd, A. Amanna, F. Latus, Z. Goldsmith, and D. Diaz, "Airborne Cognitive Networking: Design, Development, and Deployment," IEEE Access, 2018.
- G. Sklivanitis, J. Ashdown, K. Tountas, and D. A. Pados, "Sparse Waveform Design for Secure LPD/LPI Underwater Acoustic Communications," IEEE Oceans, 2018.
- G. Sklivanitis, K. Tountas, D. A. Pados, and S. N. Batalama, "Small-Sample-Support Channel Estimation for Massive MIMO Systems," IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2018.