ANDREAS MENTZELOPOULOS

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EDUCATION

Massachusetts Institute of Technology - MIT   *2020 – pres. (2025)*
PhD Mechanical Engineering and Computation, minor in Finance (pursuing)   .
SM Computer Science (pursuing)   *2022 – pres.*
SM Mechanical Engineering   *2020 – 2022*
GPA: 4.9 / 5.0

RESEARCH INTERESTS & BIO

Deep Learning, Generative Modeling, Time-series Forecasting, Machine Learning in finance.

I am an impact driven professional with a strong quantitative acumen who leverages computational techniques to solve hard problems. I have a strong background in **mathematical modeling, algorithms, machine learning, optimization, programming, statistics, and numerical methods**. I primarily code in **Python** (**PyTorch**). My PhD research focuses on **time-series forecasting using deep learning** and **generative modeling for time-series** and **high-resolution ultra-realistic images**. I have experience working in finance (quant trading research), technology (software), and engineering.

RELEVANT COURSEWORK

Machine Learning	Finance	Mathematics
1. Machine Learning (6.7900)	1. Advanced Data Analytics and Machine Learning in Finance (Natural language processing with applications in Finance - 15.S08)	1. Numerical Methods for Partial Differential Equations (6.7330)
2. Deep Learning (6.S898)		2. Stochastic Systems (2.122)
3. Parallel Computing & Scientific Machine Learning (6.7320)		3. Numerical Fluid Mechanics (2.29)
4. Computer Vision (6.8300)	2. Financial Engineering (15.456)	4. Dynamics (2.032)
5. Nonlinear Optimization (6.7220)	3. Managerial Finance (15.041)	5. Marine Hydrodynamics (2.20)
6. Intro to Machine Learning (6.036)		

RESEARCH EXPERIENCE

Tow Tank & Stochastic Analysis and Nonlinear Dynamics Lab, MIT   *09/2020 – pres.*
Graduate Student Research Assistant, PI: Prof. Michael Triantafyllou, Prof. Themis Sapsis

1. **Time-series forecasting using deep-learning**: I am developing the first digital twin for risers – long, flexible underwater pipelines – vibrating constantly under the excitation of stochastic hydrodynamic loads. Given sparse noisy measurements, I am leveraging transformers (and other Deep Learning architectures) to model and continuously forecast the vibrations (nonlinear, nonstationary dynamics) in real time. Deployment of the twin assists in performance and safety monitoring while considerably cutting down operating costs and collecting data used to estimate/extend an asset's service life.

2. **Generative modeling for high-resolution image synthesis**: I am leading LOBSTgER (Learning Oceanic Bioecological Systems Through gEnerative Representations), an effort dedicated to generating ultra-realistic high-resolution underwater images by developing latent diffusion models. Generated images push the boundaries of current state-of-the art resolution exceeding 1024 pixels in one dimension. LOBSTgER has attracted the attention of the Museum of Science in Boston where a public exhibition is currently under development to raise awareness about local ocean habitats in Massachusetts and the Gulf of Maine and to educate the public about generative-AI technologies.

3. **Generative modeling for multivariate time-series**: I am developing novel generative-AI algorithms to generate multivariate time-series (for VIV) using Wasserstein GANs (wGANs), Variational Autoencoders (VAEs), and Denoising-Diffusion probabilistic models (DDPMs). Generated data can be obtained for cheap and can potentially rival computational fluid dynamics simulations, allowing users to cut down on experimental expenses while speeding up design and research.

SELECTED PUBLICATIONS (for full list reference google scholar)

1. **Mentzelopoulos, A.,** Fan, D., Sapsis, T., Triantafyllou, MS, "Variational autoencoders and transformers for multivariate time-series generative modeling and forecasting: Applications to vortex-induced vibrations". Ocean Engineering, 2024
2. **Mentzelopoulos, A.,** Prele, E., Fan, D., del Aguila Ferrandis, J., Sapsis, T., Triantafyllou, MS, "Reconstructing flexible body vortex-induced vibrations using machine-vision and predicting the motions using semi-empirical models informed with transfer learned hydrodynamic coefficients". Journal of Fluids and Structures, 2024
3. **Mentzelopoulos, A.** Ferrandis, J.d.A., Rudy, S., Sapsis, T., Triantafyllou, M.S, Fan, D., "Data driven prediction and study of vortex induced vibrations by leveraging hydrodynamic coefficient databases learned from sparse sensors", Ocean Engineering, 2022.

WORK EXPERIENCE

CITIC Securities CLSA, Quantitative Trading Strategies, Intern, New York, NY   *06 – 08/2024*

Responsible for developing the *deep learning branch* of the firm's statistical arbitrage trading strategies targeting alternative investment markets. Delivered a fully functional framework which outperformed internal strategies in terms of returns, Sharpe ratio, and portfolio turnover back-tested over the past 10 years.

1. Market neutral statistical arbitrage strategies using deep learning.
2. Model back-testing in the alternative markets of Southeast Asia.
3. Trading software development and optimization.

MathWorks, Engineering Development Group, Intern, Natick, MA   *06 – 08/2023*

Responsible for quality engineering of the simscape multibody and simscape fluids products. Wrote extensive test suites ensuring that any software updates in the internal code do not affect the performance of internal modules or any customer-facing example models. Additionally updated the customer-facing forklift example model which went public with MATLAB R2024a.

1. Test suite development for the Gas, Moist Air, and Isothermal Liquid libraries.
2. Design and deployment of hydraulic and control components for the customer-facing forklift example model (2024a).
3. Test suites for 10 simscape example models.

American Bureau of Shipping, Offshore Equipment Group, Intern, Houston, TX   *06 – 08/2020*

Reviewed the design of pressure vessels per safety regulations and assisted in the classification of chemical tankers and BP's Mad Dog phase 2 – Argos semi-submersible offshore drilling platform.

1. Full engineering reviews for pressure vessel designs as per ASME Section VIII Div. 1.
2. Classification of BP's Mad Dog phase 2 – Argos semi-submersible (reviewed 340+ drawings).
3. Allowable chemical cargo lists for 12 chemical tankers according the IBC Code effective January 2021.

SELECTED HONORS & AWARDS (for full list reference personal website)

1. *Onassis Foundation Scholarship*, Onassis Foundation (most prestigious graduate scholarship awarded to Greek students globally)	*12/2022*
2. *MathWorks Fellowship*, MathWorks (awarded to 20 MIT students)	*09/2022*
3. *Society of Naval Architecture and Marine Engineering Award*, MIT (awarded to 1 student affiliated with Ocean Engineering at MIT)	*05/2021*
4. *William M. Kennedy Scholarship*, Society of Naval Architects & Marine Engineers (most prestigious SNAME scholarship awarded to 1 student globally)	*04/2021*
5. *MIT SMA2 Fellowship*, MIT (awarded to 1 graduate student at MIT)	*09/2020*
6. *Undergraduate Scholarship*, Society of Naval Architects & Marine Engineers (awarded to 4 undergraduate students globally)	*07/2019*
7. *ABS Scholarship*, American Bureau of Shipping	*05/2018*

SKILLS

Computer languages   Python (PyTorch), MATLAB, C++, Julia