Andrew E. Sundstrom, PhD

Computer Scientist | Computational Biologist | Applied Mathematician | Inventor
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PROFESSIONAL SUMMARY

Computational innovator and R&D leader with a PhD from NYU Courant, postdoc and faculty appointments at the Icahn School of Medicine at Mount Sinai, and 20+ years of experience across top-tier industrial (Siemens, IBM Research) and financial (Morgan Stanley) institutions, as well as entrepreneurial ventures in AI factory control (Nanotronics) and fintech (7 Chord). Expert in the intersection of **AI and advanced industrial manufacturing**, applying modern AI models and methods for defect detection & intervention, predictive maintenance, autonomous factory control, and IT/OT cybersecurity. Deep **computational biology** investigations into cancer, neuronal, and whole-cell computational modeling. Strong publishing record, with **9 high-impact peer-reviewed articles**. Expert in **IP strategy and patent portfolio management**, with **36 U.S. patents** and a proven leader of **cross-functional and interdisciplinary teams** capable of aligning complex R&D initiatives with high-stakes business objectives.

PROFESSIONAL EXPERIENCE

SIEMENS | Princeton, NJ, USA | **Research Scientist, Physics-Informed AI R&D** | October 2022 – Present

- **Co-founded the Industrial AI Lab** at the Princeton R&D facility, serving as a hub for co-creation and rapid prototyping for global industrial customers.
- **Individual Contributor & Project Manager:** applying physics-informed AI to optimize complex industrial manufacturing workflows.
- **AI Governance Advisor:** Serve as the U.S. threat and risk assessment lead for Generative AI and LLM implementation across diverse business units.

7 CHORD | New York, NY, USA | **Chief Science Officer** | September 2021 – June 2022

- **Directed Data Science & Engineering teams** in the development of PriceDroid, a high-precision AI ensemble learning system for bond price prediction.
- **Orchestrated MLOps Transformation:** Migrated client-facing data infrastructure to GCP BigQuery/CloudSQL, ensuring model scalability, and implemented rigorous software engineering best practices.
- **Engineered Multi-Agent Systems:** Deployed a population of 400 pricing agents utilizing online learning to address concept drift in real-time streaming data.

NANOTRONICS | Brooklyn, NY, USA | **Senior R&D Scientist & Manager** | October 2018 – August 2021

- **Managed three cross-functional R&D teams** investigating automated factory control, cybersecurity, and anomaly detection and correction using deep reinforcement learning and imitation learning, resulting in three high-impact publications.
- **Patent Portfolio Leadership:** Directed research resulting in 35 U.S. patents across 10 distinct invention areas within three years.
- **AI Research:** Leveraged deep learning, reinforcement learning, and computer vision for real-time video analysis, synthetic data generation, and error correction during manufacturing processes.

ICAHN SCHOOL OF MEDICINE AT MOUNT SINAI | New York, NY, USA | **Assistant Professor / Postdoctoral Research Fellow** | September 2014 – October 2018

- **Biochemical Dynamical Systems Modeling:** Developed large-scale ODE models to simulate cAMP-calcium pathway interactions, identifying critical network motifs that perform computation in the presence of neuromodulators.
- **Awarded NIH NIDA T32 Postdoctoral Research Fellowship**
- **Whole-Cell Computational Modeling:** Researched H1 human embryonic stem cell (hESC) cycles to analyze developmental trajectories.
- **Awarded NIH/NIGMS and NSF INSPIRE grants** as a key contributor to whole-cell modeling initiatives.

COURANT INSTITUTE OF MATHEMATICAL SCIENCES, NYU | New York, NY, USA | **Senior Research Scientist / PhD Researcher** | September 2008 – August 2014

- **Dissertation Research:** Developed computational solutions to the **inverse problem of hypoxia in metabolically heterogeneous cancer populations**.
- **Engineered image analysis pipeline and 4D computational modeling** for histological characterization of chronic tumor hypoxia, resulting in two high-impact *PLoS ONE* publications.
- **Developed AFM image analysis pipeline** to estimate biomolecule lengths with high precision, securing a U.S. Patent for DNA/RNA property measurement, and resulting in a master's thesis and two high-impact publications.
- **Awarded NYU Henry M. MacCracken and NSF IGERT Fellowships**

MORGAN STANLEY | New York, NY, USA | **Associate / Lead Software Engineer** | September 1998 – March 2007

- **Algorithmic Trading & NLP:** Developed electronic trading tools and real-time sentiment analysis systems for news feeds.
- **Regulatory Compliance:** Engineered trade surveillance tools to ensure firm-wide adherence to SEC, NASDAQ, and NYSE regulations.
- **Legacy System Migration:** Led the firm's transition from mainframe-based batch processing to a modern, distributed, event-driven microservices architecture.

IBM THOMAS J. WATSON RESEARCH CENTER | Yorktown Heights, NY, USA | **Research Associate / Senior Staff Programmer** | February 1996 – August 1998

- **Speech Recognition & Computational Linguistics:** Developed novel data structures for compressed language models and trained Hidden-Markov Models (HMMs) on massive corpora.
- **Computer Vision:** Managed a 12-person research team to develop "Video Vista," a real-time video query workstation.

EDUCATION

PhD in Computational Biology | Courant Institute of Mathematical Sciences, NYU | 2013
Dissertation: "Toward a computational solution to the inverse problem of how hypoxia arises in metabolically heterogeneous cancer cell populations."

MS in Computer Science | Courant Institute of Mathematical Sciences, NYU | 2008
Thesis: "Measuring biomolecules: an image processing and length estimation pipeline using atomic force microscopy."

BA in Computer Science | Cornell University | 1993

TECHNICAL SKILLS

- **AI/ML Models:** physics-informed AI, physics-informed neural networks (PINNs), graph neural networks (GNNs), AI surrogate models, foundation models (time series, geometry, manufacturing), generative AI, large language models (LLMs), computer vision (CV), natural language processing (NLP), deep learning (DL), reinforcement learning (RL), supervised/unsupervised learning, causal inference, MLOps.
- **Mathematical Modeling:** dynamical systems, ODE/PDE, graph theory, game theory, statistical mechanics.
- **Computational Modeling:** whole-cell systems modeling, Gillespie algorithm (SSA), Fokker-Planck & Langevin equations, agent-based modeling (ABM), cellular Potts modeling (CPM), center-based modeling (CBM), coarse-grained (CG) simulations, flux balance analysis (FBA), cellular automata (CA) modeling, finite element modeling (FEM).
- **IP & Leadership:** IP strategy, patent portfolio management, cross-functional & interdisciplinary team leadership, AI governance & risk mitigation, grant writing.
- **Data Science & Scripting:** Python, Perl.
- **Functional & Symbolic AI:** Common Lisp, Scheme.
- **Systems & Low-Level:** C/C++, assembly.
- **Typesetting & Publishing**: LaTeX, Overleaf.
- **AI & Scientific Computing:** PyTorch, TensorFlow, scikit-learn, XGBoost, SciPy, NumPy, JAX, pandas, matplotlib, OpenCV, Fiji/ImageJ, Virtual Cell, ITK, MATLAB (and many toolkits), SageMath.
- **Data & Cloud:** GCP (BigQuery, CloudSQL), PostgreSQL, MySQL, MongoDB, NoSQL, Redis, Neo4j, distributed microservices.
- **Software Engineering:** git (GitHub, GitLab), CI/CD, TDD, code review, Docker, Kubernetes, Agile/Atlassian methodologies.

SELECTED PEER-REVIEWED ARTICLES (SEE ALL 9)

- **Sundstrom, A., et al.** "Securing industrial production from sophisticated cyberattacks." *Proc. 6th Int'l Conf. on Information Systems Security and Privacy (ICISSP)*. 2020. doi: 10.5220/0009148206630670.
- **Sundstrom, A., et al.** "A computational model for decision-making and assembly optimization in manufacturing." *Proc. American Control Conference* (2020).
- **Sundstrom, A., Bar-Sagi, D., et al.** "Simulating heterogeneous tumor cell populations." *PLoS ONE*, 11(12) (2016).
- **Sundstrom, A., Bar-Sagi, D., et al.** "Histological image processing features induce a quantitative characterization of chronic tumor hypoxia." *PLoS ONE*, 11(4). 2016. doi: 10.1371/journal.pone.0153623.
- **Sundstrom, A., et al.** "Image analysis and length estimation of biomolecules using AFM." *IEEE Transactions on Information Technology in Biomedicine*, 16(6). 2012. doi: 10.1109/TITB.2012.2206819.

SELECTED ISSUED U.S. PATENTS (SEE ALL 36)

- **12,153,414:** Imitation Learning in a Manufacturing Environment (2024).
- **12,153,668:** Securing Industrial Production from Sophisticated Attacks (2024).
- **12,111,922:** Intelligently Emulating Factory Control Systems (2024).
- **11,675,330:** System and Method for Improving Assembly Line Processes (2023).
- **9,995,766:** Methods and Systems for Measuring a Property of a Macromolecule (2018).

Andrew E. Sundstrom, PhD: Technical Addendum

PEER-REVIEWED ARTICLES

Popular Press

- **Sundstrom, A.** "A Computational Model for Intelligent Manufacturing." *Industry Today*. Jan 21, 2021.

Refereed Articles

- **Limoge, D., Sundstrom, A., Pinskiy, V., Putman, M.** "Defending industrial production using AI process control." *Proc. IEEE/NDIA/INCOSE Systems Security Symposium (SSS)*. 2020. doi: 10.1109/SSS47320.2020.9197727.
- **Sundstrom, A., Kim, E-S., Limoge, D., Pinskiy, V., Putman, M.** "A computational model for decision-making and assembly optimization in manufacturing." *Proc. American Control Conference (ACC)*. 2020. doi: 10.23919/ACC45564.2020.9147715.
- **Sundstrom, A., Limoge, D., Pinskiy, V., Putman, M.** "Securing industrial production from sophisticated cyberattacks." *Proc. 6th Int'l Conf. on Information Systems Security and Privacy (ICISSP)*. 2020. doi: 10.5220/0009148206630670.
- **Sundstrom, A., Bar-Sagi, D., Mishra, B.** "Simulating heterogeneous tumor cell populations." *PLoS ONE*, 11(12). 2016. doi: 10.1371/journal.pone.0168984.
- **Sundstrom, A., Grabocka, E., Bar-Sagi, D., Mishra, B.** "Histological image processing features induce a quantitative characterization of chronic tumor hypoxia." *PLoS ONE*, 11(4). 2016. doi: 10.1371/journal.pone.0153623.
- **Jee, J., Sundstrom, A., Massey, S. E., Mishra, B.** "What can information-asymmetric games tell us about the context of Crick's 'frozen accident'?" *Journal of the Royal Society Interface*, 10(88). 2013. doi: 10.1098/rsif.2013.0614.
- **Sundstrom, A., Cirrone, S., Paxia, S., et al.** "Image analysis and length estimation of biomolecules using AFM." *IEEE Transactions on Information Technology in Biomedicine*, 16(6). 2012. doi: 10.1109/TITB.2012.2206819.
- **Reed, J., Hsueh, C., Lam, M-L., Kjolby, R., Sundstrom, A., et al.** "Identifying individual DNA species in a complex mixture by precisely measuring the spacing between nicking restriction enzymes with atomic force microscope." *Journal of the Royal Society Interface*, 9(74). 2012. doi: 10.1098/rsif.2012.0024.
- **Wu, H., Kim, K. J., Mehta, K., Paxia, S., Sundstrom, A., et al.** "Copy number variant analysis of human embryonic stem cells." *Stem Cells*, 26(6). 2008. doi: 10.1634/stemcells.2007-0993.

ISSUED U.S. PATENTS

Total: 36 Patents across 11 Invention Areas

1. Imitation Learning in Manufacturing

- **12,153,414:** Imitation Learning in a Manufacturing Environment (2024).

2. Systems and Media for Manufacturing Processes

- **12,039,750 / 12,066,818 / 12,073,584 / 12,117,799** (2024).
- **12,117,812 / 12,125,236 / 12,153,401 / 12,153,408 / 12,165,353** (2024).

3. Cybersecurity for Industrial Production

- **12,039,040 / 12,072,973 / 12,118,081 / 12,153,668** (2024).

4. Assembly Line Process Improvement

- **11,675,330:** System and Method for Improving Assembly Line Processes (2023).

5. Automated Defect Detection

- **11,416,711** (2022).
- **12,205,360** (2025).

6. Assembly Error Correction

- **11,209,795** (2021).
- **11,703,824** (2023).
- **12,140,926** (2024).

7. Factory Control Emulation & Simulation

- **11,086,988** (2021).
- **11,663,327** (2023).
- **12,111,922** (2024).

8. Dynamic Monitoring and Cybersecurity (Category A)

- **11,100,221** (2021).
- **11,693,956** (2023).
- **11,989,288 / 12,026,251 / 12,072,972 / 12,111,923** (2024).

9. Dynamic Monitoring and Cybersecurity (Category B)

- **11,063,965** (2021).
- **12,034,742 / 12,120,131 / 12,155,673** (2024).

10. Dynamic Training for Assembly Lines

- **10,481,579** (2019).
- **11,156,982** (2021).

11. Macromolecule Measurement Systems

- **9,995,766:** Methods and Systems for Measuring a Property of a Macromolecule (2018).