

# SEAN GRIMES

## PERSONAL INFORMATION

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## RESEARCH INTERESTS

My research centers on biologically inspired approaches to collective intelligence and predictive classification. Drawing on principles from neuroscience and ethology, I develop multi-agent swarm systems in which simple, modular agents, each trained on a distinct subset of available data, interact socially to produce emergent, crowd-sourced predictions. This work positions swarm intelligence as a computationally efficient, interpretable, and modular alternative to traditional deep neural networks, with demonstrated applications in healthcare classification and real-world prediction tasks. My foundational interest lies in how biological collectives, from neural circuits to social insects, achieve robust cognition, and how those mechanisms can be instantiated in artificial systems.

## EDUCATION

*Ph.D.*                    2016–2023            Drexel University  
*Computer Science*  
**College:** College of Computing and Informatics  
**Research Interests:** Swarm Intelligence, Biologically Inspired A.I., Multi-Agent Systems

*M.S.*                    2015–2018            Drexel University  
*Computer Science*  
**College:** College of Computing and Informatics

*B.S.*                    2008–2012            Ursinus College  
*Neuroscience*  
**Related Coursework:** Behavioral Neuroscience, Cognitive Neuroscience, Cellular Neurobiology, Neuroanatomy  
**Activities:** Varsity Baseball

## ACADEMIC APPOINTMENT

*Department of  
Computer Science*                    2022–Present            Asst. Teaching Professor, DREXEL UNIVERSITY

Full-time teaching-track faculty in the Department of Computer Science, College of Computing and Informatics. Primary responsibilities include undergraduate and graduate instruction, curriculum design and course coordination, graduate student mentorship, and capstone program administration across AI/ML and software engineering sequences.

**Comcast Corporate Partnership:** Serving as primary faculty instructor for an established college-level corporate education partnership with Comcast. Responsible for curriculum development and delivery of two graduate courses for working engineers and managers, sustained as an ongoing institutional partnership.

## COURSE COORDINATION

<i>Department of Computer Science</i>	2025–Present	Current, DREXEL UNIVERSITY
	Responsible for curriculum design, syllabus development, assessment strategy, and instructional oversight for the following undergraduate and graduate courses. <b>CS3510 / CS5510</b> · Principles of Artificial Intelligence <b>CS3570 / CS5570</b> · Neurosymbolic Collective Intelligence <b>CS4510 / CS6515</b> · Embodied AI <b>CS4550 / CS6550</b> · Modern AI Application Development <b>CS7950</b> · AI/ML Capstone <b>SE7910</b> · Software Studio (SE Capstone) <b>SE310</b> · Software Architecture I (since 2023) <b>CS-T680-686</b> · AI/ML Industry Practicum (Comcast) <b>CS-T680-684</b> · SE Leadership (Comcast)	
<i>Department of Computer Science</i>	2023–2025	Previous, DREXEL UNIVERSITY
	<b>SE181/SE201</b> · Introduction to Software Engineering and Development	

## COURSES TAUGHT

<i>Department of Computer Science</i>	Undergraduate, DREXEL UNIVERSITY	
	2022–2024	<b>SE181/SE201</b> · Introduction to Software Engineering and Development · <b>SE310</b> · Software Architecture I · 2022–Present <b>CS380</b> · Artificial Intelligence · 2023–Present <b>CS432</b> · Interactive Computer Graphics · 2024–Present <b>CS472</b> · Computer Networks · 2023–Present
<i>Department of Computer Science</i>	Graduate, DREXEL UNIVERSITY	
	2024–Present	<b>CS500</b> · Databases · 2024 <b>CS510</b> · Introduction to Artificial Intelligence · 2024–Present <b>CS610</b> · Advanced Artificial Intelligence · 2024–Present <b>CS645</b> · Network Security · 2023 <b>CS591/CS592/SE691</b> · Graduate Capstone · 2025–Present <b>CS-T680-686</b> · AI/ML Industry Practicum (Comcast) · 2025–Present <b>CS-T680-684</b> · SE Leadership (Comcast) · 2025–Present

## MENTORSHIP &amp; STUDENT ADVISING

<i>Department of Computer Science</i>	2023–2025	Ph.D. Thesis Committee, DREXEL UNIVERSITY
	Adit Gupta · Served on dissertation proposal and final defense committee, with review of thesis document.	
<i>Department of Computer Science</i>	2023–2025	Senior Project Advisor, DREXEL UNIVERSITY
	Supervised four 9-month senior capstone projects: <b>2023</b> · <i>Inspiration, Part I</i> — Development of an internal plagiarism detection system (Drexel CS MOSS) <b>2024</b> · <i>Inspiration, Part II</i> — Alpha and beta deployment of Inspiration within Drexel CS <b>2024</b> · <i>Optic Bets</i> — Applied swarm classification research using scikit-learn for real-world prediction <b>2025</b> · <i>LLM Health Predictions</i> — Independent research applying large language models to health outcome prediction in outdoor contexts	
	2026	Independent Study Supervisor, DREXEL UNIVERSITY

Department of  
Computer Science

Supervised three concurrent independent study projects (one term each):  
Automated Card Grading · Deep Learning Cancer Research · LLM  
Storytelling

#### UNIVERSITY SERVICE

Department of  
Computer Science

2022–Present CS Capstone Program Coordinator, DREXEL  
UNIVERSITY

Department-level administration of the CS experiential learning capstone program. Responsibilities include stakeholder management, student placement, compliance oversight for external partnerships (including F-1/CPT regulatory compliance for international students), and faculty coordination across capstone sequences.

Department of  
Computer Science

2023–Present Faculty Committee Service, DREXEL UNIVERSITY

2025–Present · AI/ML Committee · Core Undergraduate Curriculum  
Committee · Faculty Senate  
2024–2025 · Academic Honesty Committee · AI/ML Committee  
2023–2024 · Academic Honesty Committee

#### RESEARCH EXPERIENCE

Geometric  
Biomedical  
Computing Group

2014–2022 Research Assistant, DREXEL UNIVERSITY

Individual and collaborative research in biologically inspired A.I. and swarm intelligence under Dr. David Breen. Work spans *C. elegans* behavioral modeling, chemotaxis-based self-organizing swarms, and the development of WoC-Bots: a multi-agent swarm system for binary classification combining wisdom-of-crowds theory, evolutionary agent diversity, and honeybee-derived swarm aggregation. Applied to real-world classification problems including breast cancer lymph node metastasis prediction, in collaboration with Dr. Mark Zarella (University of Pennsylvania / Thomas Jefferson University).

Bioengineering  
Department

Summer 2011 Research Intern, UNIVERSITY OF PENNSYLVANIA

Neuroscience research investigating the mechanical forces exerted by neurons on substrates during locomotion, using traction force microscopy.

Neuroscience  
Department

2010–2011 Research Assistant, URSINUS COLLEGE

Undergraduate research in cognitive neuroscience (synesthesia) and comparative neurobiology (brainstem neural networks in weakly electric fish).

#### PUBLICATIONS

Doctoral  
Dissertation

Apr. 2023 WoC-Bots: Swarms of Biologically Inspired  
Prediction Agents

This dissertation presents Wisdom-of-Crowds-Bots (WoC-Bots), biologically-inspired, simple, and modular agents which work together in a multi-agent environment to collectively make binary predictions. Building on the theoretical underpinnings of Wisdom of Crowds, WoC-Bots represent a knowledge-diverse crowd where each agent is trained on a subset of available information. A honeybee-derived swarm aggregation mechanism was developed to elicit a collective prediction with an associated confidence score. Due to the multi-agent architecture, WoC-Bots can be distributed across multiple compute nodes, reducing training and inference time. Importantly, this architecture demonstrates significant key advantages over traditional classification methods while maintaining comparable predictive performance. New and previously unknown input features can be included in an existing classification problem without retraining existing agents. Further development

led to a “meta-swarm”, enabling collaboration between institutions unable to share data externally.

**Citation:** Grimes, S. (2023). WoC-Bots: Swarms of Biologically Inspired Prediction Agents [Doctoral Dissertation, Drexel University].

Jan. 2023      A Multi-Agent Approach to Binary Classification Using Swarm Intelligence

*Future Internet,  
Modern Trends in  
Multi-agent  
Systems*

Wisdom-of-Crowds-Bots (WoC-Bots) are simple, modular agents working together in a multi-agent environment to collectively make binary predictions. The agents represent a knowledge-diverse crowd, with each agent trained on a subset of available information. A honey-bee-derived swarm aggregation mechanism is used to elicit a collective prediction with an associated confidence value. Due to their multi-agent design, WoC-Bots can be distributed across multiple hardware nodes, include new features without re-training existing agents, and the aggregation mechanism can incorporate predictions from external sources. We demonstrate competitive performance on three classification datasets and consistent return on investment applied to real-world sports prediction.

**Citation:** Grimes, Sean, and David E. Breen. 2023. “A Multi-Agent Approach to Binary Classification Using Swarm Intelligence” *Future Internet* 15, no. 1: 36. <https://doi.org/10.3390/fi15010036>

Dec. 2021      An agent-based approach to predicting lymph node metastasis status in breast cancer

*IEEE BIBM*

A flexible, multi-agent approach to predictive classification using simple, modular agents that interact and share information socially. Opinion aggregation via a honey-bee-derived optimization algorithm improves accuracy and reduces variance. Applied to 483 de-identified breast cancer patients, achieving 78.5% overall accuracy and 84.5% accuracy on high-confidence predictions (79.5% of cases).

**Citation:** Grimes, S., Zarella, M. D., Garcia, F. U., & Breen, D. E. (2021, December). In 2021 *IEEE International Conference on Bioinformatics and Biomedicine (BIBM)* (pp. 1315–1319). IEEE.

Oct. 2019      WoC-Bots: An Agent-Based Approach to Decision-Making

*MDPI Journal of  
Applied Sciences*

A flexible, robust approach to predictive decision-making using simple, modular agents (WoC-Bots) that interact socially and share information. WoC-Bots can be trained more quickly, incorporate new features more easily, and produce more interpretable predictions than traditional MLP networks, while achieving competitive predictive accuracy.

**Citation:** Sean Grimes & David E. Breen (2019) WoC-Bots: An Agent-Based Approach to Decision-Making, *MDPI Journal of Applied Sciences*, Vol. 9, Article 4653. DOI: 10.3390/app9214653.

June 2018      Directing chemotaxis-based spatial self-organisation via biased, random initial conditions

*International  
Journal of Parallel,  
Emergent and  
Distributed  
Systems*

An agent-based approach for self-organising shape formation inspired by cellular chemotaxis. We demonstrate that biased initial conditions with controlled statistical moments can robustly direct aggregating swarms to produce desired macroscopic configurations from stochastic initial states.

**Citation:** Sean Grimes, Linge Bai, Andrew W.E. McDonald & David E. Breen (2018). *International Journal of Parallel, Emergent and Distributed Systems*. DOI: 10.1080/17445760.2018.1469630.

Sept. 2017      Ortus: an Emotion-Driven Approach to (artificial) Biological Intelligence

*European  
Conference  
on Artificial Life*

Ortus is a simple virtual organism and initial framework for biologically based artificial intelligence. Implements excitatory and inhibitory chemical synapses, bidirectional gap junctions, and Hebbian learning. Demonstrates a cyclic

respiratory circuit and emotionally driven associative learning with respect to an input stimulus.

**Citation:** A. W. E. McDonald, S. Grimes, D.E. Breen. *Proc. European Conference on Artificial Life*, Vol. 14, pp. 537–544, 2017.

## PRESENTATIONS

*May 2021*      **WoC-bots: A Multi-agent Approach to Predicting Lymph Node Metastasis from Primary Breast Tumors**

*Pathology  
Informatics  
Summit*

Presented with Mark D. Zarella, Fernando U. Garcia, and David E. Breen.

## PRIOR EXPERIENCE

*2019–2022*      **Senior Teaching Assistant, DREXEL UNIVERSITY**

*Department of  
Computer Science*

Developed lecture and exam material, taught lectures, managed course logistics, and provided regular office hours in the CS help center.

*2015–2019*      **Teaching Assistant, DREXEL UNIVERSITY**

*Department of  
Computer Science*

Supported undergraduate CS courses through office hours, grading, and student advising.

*2015–2018*      **Co-Founder, ECODREN RESEARCH LLC**

*A.I. Startup*

Co-founded a custom A.I. solutions company with two fellow CS Ph.D. students. Developed an NLP-powered anonymous student feedback platform deployed at area universities.

*2013–2015*      **Co-Founder, IRREGEX LLC**

*Technology  
Startup*

Co-founded a technology startup focused on data mining, data analysis, and web/database systems. Responsible for network infrastructure and web development.

*2008–2013*      **Instructor, INDIVIDUAL BASEBALL COACHING**

*Baseball Instructor*

Group and one-on-one instruction for student athletes ages 9–18.

## AWARDS & HONORS

2023 · Computer Science Outstanding Graduate Research Award

2019 · CCI Teaching Excellence Award — Graduate

2019 · Upsilon Pi Epsilon Honor Society for the Computing and Information Disciplines

2019 · Sigma Xi, The Scientific Research Honor Society

April 24, 2026