

## **Erdem Karaköylü**

University Park, MD

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### **Data Scientist | Bayesian Modeling & Machine Learning Specialist**

Data scientist specializing in Bayesian modeling, uncertainty-aware machine learning for decision optimization. Experienced in developing and evaluating probabilistic models in high-stakes domains including defense, remote sensing, and environmental prediction. Strong track record of applying principled statistics to improve system performance and experimental design.

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#### **Core Skills**

##### **Bayesian & Statistical Modeling**

Hierarchical Modeling (Regression & Classification) · Bayesian Additive Regression Trees (BART) · Probabilistic Programming · A/B Testing

##### **Emerging Interests**

Causal Inference (incl. do-calculus in PyMC) · Bayesian Decision Theory

##### **Technical Stack**

Python · PyMC · Scikit-learn · XGBoost · PyTorch · Pandas · Git · Matplotlib · Seaborn · ArviZ · XArray · SQL

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### **Experience & Research Highlights**

#### **Freelance Data Scientist – Marine Remote Sensing and Ecological Forecasting**

*Bayesian modeling and machine learning for environmental data*

- Developed Bayesian Additive Regression Tree (BART) and hierarchical models to estimate marine optical properties and chlorophyll concentrations from satellite radiance data.
- Built predictive XGBoost models to infer phytoplankton community structure, outperforming baseline approaches.
- Used probabilistic ODE parameter estimation to analyze nonlinear dynamics in marine ecological systems.
- Published reproducible Bayesian modeling workflows as open-source Jupyter notebooks for environmental science.

#### **Data Scientist – Research Innovations Inc. (Alexandria, VA)**

*DOD and DOJ-focused machine learning and NLP systems*

- Contributed to the development of a Retrieval-Augmented Generation (RAG) system that improved information retrieval for military planners.
- Led Bayesian A/B testing to optimize system components and refine model selection for production environments.

- Built and iteratively refined an active-learning image classification pipeline to reduce manual annotation requirements.
- Supported targeted sentiment analysis using fine-tuned large language models for sensitive domains.

**Machine Learning Researcher – NASA Goddard Ocean Biology Processing Group / SAIC**

*Earth observation and probabilistic modeling for ocean color remote sensing*

- Developed Bayesian models to predict satellite-derived ocean color products, improving chlorophyll and particulate property estimates.
- Conducted Monte Carlo simulations to quantify uncertainty and error propagation in remote sensing reflectance (Rrs) data.
- Created climate data visualizations and analysis pipelines supporting scientific reports and satellite mission deliverables.
- Advocated for probabilistic approaches and led internal discussions on Bayesian methods for biogeophysical modeling.

**Researcher – UC San Diego / Scripps Institution of Oceanography**

*Thesis: Foraging Sorties Hypothesis – Inferring Behavioral Rhythms in Marine Primary Consumers*

- Adapted a planar laser-induced fluorescence imaging system to quantify real-time feeding states in individual marine zooplankton.
- Captured high-resolution time series of gut pigment dynamics to infer behavioral state transitions (feeding, digestion, resting).
- Built an individual-based model linking physiological state to vertical foraging behavior under environmental constraints.
- Calibrated imaging measurements against chemical extraction to ensure accuracy and repeatability across individuals.
- Follow-up research conducted on temperature effects on feeding behavior and gut dynamics.

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**Education**

**Ph.D.** – Biological Oceanography & Marine Ecology

*Scripps Institution of Oceanography, UC San Diego*

**B.Sc.** – Oceanography

*Florida Institute of Technology*

**Languages**

- **English** – Native/Trilingual
- **French** - Native/Trilingual
- **Turkish** – Native/Trilingual
- **Spanish** – Advanced