

Nusret Ipek

Ph.D. Bioscience Engineering:
Mathematical Modelling



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About Me



I’m a PhD candidate in Bioscience Engineering with a passion for blending machine learning, programming, data science, and computer vision to solve real-world challenges. With a strong foundation in mathematical modeling, I’ve worked on a range of projects, from improving customer satisfaction through data-driven solutions to enhancing statistical models for government institutions.

Most recently, my research focuses on developing algorithms to characterize hierarchical structures based on pair-wise interaction data, with a primary focus on animal studies. In addition to this core work, I also apply my expertise in AI to pharmaceutical quality control; developing innovative approaches to ensure the safety and precision of pharmaceutical processes using computer vision technology. Driven by curiosity and a commitment to excellence, I’m always looking for new ways to apply data and machine learning to push the boundaries of bioscience and engineering. I have worked with a range of different technologies and frameworks and I am always looking for opportunities to work with something new. The things that I currently have the most experience working with are: `Python`, `PyTorch`, `C`, `C++`, `R`, `Julia`, `Java`, `SAS`, `QGIS`, `ArcGIS`, `git` and `AMPL`.

Education

Ghent University

Ph.D. in Bioscience
Engineering: Mathematical
Modelling
2021-2025 (ongoing)

Concentrated in computer vision and machine learning. My research focuses on inferring behavior from videos and developing algorithms to characterize hierarchical structures based on pair-wise interaction data, primarily in animal studies. Additionally, I apply AI-driven techniques to pharmaceutical quality control, leveraging computer vision to ensure precision and safety in pharmaceutical processes.

KU Leuven

MSc in Statistics and Data
Science (Magna Cum Laude)
2019 - 2021

Concentrated in European Master Official Statistics (EMOS). The degree provided a solid theoretical and practical background in areas such as machine learning, time-series, inference, statistical modeling, and GIS.

Arizona State University, Tempe

BSE in Engineering
Management
(Summa Cum Laude)
2013 - 2017

Concentration in Business Analytics. Received `Moeur Award` for exceptional academic achievement.

Experience

Euthority Project

Text Mining and Machine
Learning
2019 - 2021

Developed machine learning models for analyzing legal documents, scrapping domestic and supranational court documents, and applying deep learning techniques to extract insights from legal text.

Ozel Fittings LTD

Project Management
Specialist
2017 - 2018

Led projects to improve customer satisfaction and developed cost-reductive solutions within the distribution network.

ASU Admission Services

Student Worker
2013 - 2014

Managed sensitive personal data while assisting the administration in resolving student-related issues. Provided direct support to prospective students via phone and email.

Projects

VaderSentiment.jl

github.com/nusretipek/VaderSentiment.jl



A lexicon and rule-based sentiment analysis tool adapted for the Julia programming language.

VaderSentiment.jl is a port of the original VADER sentiment analysis tool implemented in Python. It is designed to analyze sentiment in text, particularly in social media, and provides nuanced sentiment scores based on contextual elements.

Flemish Statistical Authority (VSA)

Data Specialist Intern

2020

Utilized big data from Flemish business websites and applied natural language processing techniques to develop cost-effective official statistics on innovation.

EUROSTAT Coding Labs

Data Analyst Intern

2020

Developed a spatial model to predict population distribution using mobile network operator data, with a focus on applications in Belgium.

Treasures 4 Teachers, USA

Student Intern

2017

Focused on system design improvements for a non-profit organization, utilizing Six Sigma methodology to optimize processes.

Publications

Quantifying agonistic interactions between group-housed animals to derive social hierarchies using computer vision: a case study with commercially group-housed rabbits

<https://www.nature.com/articles/s41598-023-41104-6>

This study develops a computer vision-based pipeline for detecting agonistic interactions between group-housed farm animals, specifically breeding rabbits, achieving 77% precision and 85% recall. The method enables the construction of socio-matrices and the derivation of dominance hierarchies with minimal human intervention.

Ipek, N., Van Damme, L. G., Tuytens, F. A., & Verwaeren, J. (2023). Quantifying agonistic interactions between group-housed animals to derive social hierarchies using computer vision: a case study with commercially group-housed rabbits. *Scientific Reports*, 13(1), 14138.

Automated particle inspection of continuously freeze-dried products using computer vision

<https://www.sciencedirect.com/science/article/pii/S0378517324008639>

This paper presents the use of computer vision in the pharmaceutical industry for the automated inspection of freeze-dried products. The YOLOv7 model achieved a particle detection precision of up to 88.9%, significantly outperforming manual inspection, with a processing time under 1 second per vial.

Herve, Q., **Ipek, N.**, Verwaeren, J., & De Beer, T. (2024). Automated particle inspection of continuously freeze-dried products using computer vision. *International Journal of Pharmaceutics*, 664, 124629.

A deep learning approach to perform defect classification of freeze-dried products

<https://www.sciencedirect.com/science/article/pii/S0378517324013619>

This study utilizes deep learning to classify cosmetic defects in freeze-dried products using high-resolution images. The best model achieved perfect precision and recall for critical defects, with a prediction time under 50 ms, improving the efficiency of quality control in the pharmaceutical industry.

Herve, Q., **Ipek, N.**, Verwaeren, J., & De Beer, T. (2025). A deep learning approach to perform defect classification of freeze-dried products. *International Journal of Pharmaceutics*, 670, 125127.

Cage enrichment to minimize aggression in part-time group-housed female breeding rabbits

<https://www.frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2024.1401021/full>

This study investigates the effect of cage enrichment on reducing aggression in group-housed female breeding rabbits. The results show that alfalfa blocks, with or without wooden panels, slightly reduce the number of injured does compared to controls, though the challenge of minimizing aggression remains significant in part-time group housing.

Van Damme, L. G., **Ipek, N.**, Verwaeren, J., Delezie, E., & Tuytens, F. A. (2024). Cage enrichment to minimize aggression in part-time group-housed female breeding rabbits. *Frontiers in Veterinary Science*, 11, 1401021.

Certifications

- **2017:** Lean Green Belt Certificate
- **2017:** Six Sigma Green Belt Certificate
- **2022:** Alibaba Cloud Computing Associate (ACA)