Pieter Barkema

Research Scientist | ML Engineer London, UK • pieterbarkema.netlify.app • github.com/PBarkema • linkedin.com/in/pieter-barkema-nl

PROFESSIONAL SUMMARY

Research Scientist & Engineer nearing completion of a PhD in Computational Neuroscience, with industry experience in LLM data pipelines at Google. Specializes in Uncertainty Quantification (UQ), Bayesian Inference, and Scalable ML Infrastructure. Architected distributed research platforms (PCNportal) and translated biological theories of hallucination into computational models. Seeking to apply deep expertise in probabilistic modeling and experimental design to AI Alignment, Safety, and Interpretability at Anthropic.

TECHNICAL SKILLS

Core ML & DL: PyTorch, HuggingFace, Scikit-Learn, NumPy, OpenCV, Deep Learning (CNNs, Transformers).

Scientific Computing: Uncertainty Quantification (UQ), Bayesian Statistics (PyMC3), Manifold Learning.

Engineering & DevOps: Python (Expert), Docker, Git/CI-CD, Flask, HPC (Slurm/Torque), SQL, Bash.

Research Domains: Mechanistic Interpretability, Generative Models, Psychophysics, Experimental Design.

RESEARCH & ENGINEERING EXPERIENCE

PhD Researcher – Computational Neuroscience | University College London (Queen's Institute of Neurology) | London, UK May 2023 – May 2026

Focus: Bayesian modelling of uncertainty and generative hallucinations in biological neural networks.

• **Project Management:** Managed a £400K research scope end-to-end, supervising three junior researchers and coordinating data collection for 300+ participants.
• **Probabilistic Modelling:** Developed a Hierarchical Bayesian and Deep Learning model to investigate how the hippocampus quantifies **environmental uncertainty**, providing theoretical inspiration for **Introspective Awareness** in LLMs.
• **Hallucination Research:** Formulated and published a new computational theory on the generative mechanisms of audio-visual hallucinations in the brain, directly relevant to **mitigating model fabrication** in Generative AI.
• **Science Communication:** Selected to deliver a 90-minute public lecture at the Royal Institution (Sept 2025) on "Human vs. Machine Perception," translating complex AI alignment concepts for a lay audience.

Scientific Programmer | Donders Center for Cognitive Neuroimaging | Netherlands Jan 2022 – Aug 2023

• **Scale:** Lead Architect for an online distributed Machine Learning platform (Flask/Docker/Bash/Python) for hosting Big Data models trained on **60,000+ brain scans** across HPC clusters, integrated with transfer learning functionality.
• **Impact:** Democratized complex Bayesian modelling, enabling **75+ neuropsychiatry researchers** to run reproducibility studies for free without low-level coding.

Associate Linguist (RLHF / Data Quality) | **Google & Lionbridge |** London, UK Oct 2019 – Aug 2020

• **Model Alignment:** Worked in a high-throughput **RLHF-style environment**, evaluating model outputs to align LLM responses with user intent and safety guidelines.
• **Data Integrity:** Identified and resolved >100 systematic bugs, directly improving language generation and understanding model performance.

Research Intern (NLP & Psychiatry) | Utrecht University Medical Center | Netherlands Jan 2018 – Jul 2018

• Analyzed patient speech with LLMs (Python, **word2vec**) & unsupervised clustering.

KEY TECHNICAL PROJECTS

DeepCount-UQ | *Lead Developer* | [https://github.com/PBarkema/DeepCount-UQ]

AI Safety: Engineered a probabilistic CNN (PyTorch) for action counting in unconstrained video, moving beyond binary classification to **confidence-aware predictions**,

Architecture: Implemented temporal convolution and channel attention to explicitly flag low-confidence outputs, translating theoretical **Uncertainty Quantification (UQ)** into deployable safety features for out-of-distribution detection.

CCI Analysis Pipeline | *Inventor & Lead Developer*

Innovation: Invented the *Cross-Category Information* (CCI) metric to quantify information from noise in high-dimensional neural time-series data (MEG).
Math & Optimization: Used Manifold Learning and Subspace Alignment to prove noise in the brain is not a bug but a feature, optimizing the pipeline for multi-terabyte processing on **HPC grids**.

EDUCATION

MSc Neuroscience, King's College London (2021) **|** *Thesis:* developed new metric for analyzing uncertainty in neural representations and showed this uncertainty is informative for object recognition.

BSc Artificial Intelligence | Utrecht University (2019) **|** *Specialization:* Intelligent Agents & Machine Learning.
Achievement: First place in Tencent AI team competition at Tsinghua University (2019).

LEADERSHIP & COMMUNITY ENGAGEMENT

Royal Institution 90-minute Public Talk (2025)
Delivered an invited 90-minute public talk 'How Real is our Reality?' at the historic Royal Institution (1.5M+ YouTube followers). 200+ tickets sold for my demo-rich talk on human and machine perception.

Academic Committee – Goodenough College (2024 – 2025)
Organized and hosted talks for global leaders. I interviewed, for example, Nobel Prize laureate Sir Paul Nurse, Chief Scientist Dame Angela McLean, and President of Royal Society Sir Adrian Smith, to connect students with thought leaders.

Bayesian Study Group – University College London (2025 – 2026)
Initiated a Study Group of fifteen scientists to learn Bayesian Computing (pyMC3, R, Python) with a practical and theoretical session every week, leading to proficiency in these skills.

FUNDING & AWARDS

5/2023 – 5/2026	**Three-year full doctoral research funding by European Research Council** (£90,000.00 GBP)
9/2015 – 5/2016	**Fulbright Scholarship program** ($26,750.00 USD) at Wittenberg University (USA)

SELECTED PUBLICATIONS

Barkema, P., et al. (2025). Deep layers of primary visual cortex encode postdictive perception. Talk at Visual Science Society (VSS).

Barkema, P., et al. (2023). PCNportal: instant online access to research-grade normative models. Wellcome Open Research. [Infrastructure Paper]

Rutherford, S., Barkema, P., et al. (2023). Evidence for embracing normative modeling. eLife. [Statistical Methodology]

Full publication list available on Google Scholar.