Omar Ayyub

Washington, DC

Profile

Principal scientist with 10+ years in implantable medical device development. PhD in bioengineering. Independent research in mechanistic interpretability and behavioral steering of large language models, including novel methods for extracting steering vectors via Jacobian decomposition. Experience designing rigorous measurement and evaluation methodologies for safety-critical systems in FDA-regulated environments.

Projects and Continuing Education

Steering via Inter-Layer Jacobian Singular Vectors January 2026 – February 2026

- The interlayer jacobian right singular vectors provide a principled, cheap method for finding steering vectors
- The method is cheap enough to map entire models layer-to-layer effects
- Steering vectors found could induce chain-of-thought in base models, prevent refusal to dangerous prompts, and modify model corrigibility.

Steering Qwen3 Family Models via CAA December 2025 – January 2026

- Generated steering vectors via Contrastive Activation Addition (CAA) on Qwen3 model family (4B to 235B) to examine impact of model size on steering efficacy
- Found models are idiosyncratic in unpredictable ways not based in model size
- RL-trained models consistent steer at later layers than distilled models
- Logit-differences, a common evaluation of efficacy, doesn't always predict behavioral changes

Interpreting Transformer Model Decision Making May 2023 – May 2024

- Trained a transformer model to play tic tac toe using a probabilistic dataset generated from the minimax algorithm.
- Trained sparse autoencoder to discover gameboard state representations in model activations
- Utilized SVD to deconvolute attention head selection of specific player moves

Machine Learning Journal Club Nov 2022 – present

- Discussion of papers and coursework covering neural network training dynamics, linear algebra, statistics, and neural network decision making.
- Led discussions on paper outcomes, follow up experiments, as well as relevant coursework problem sets.

Professional Experience

Senseonics Nov 2022 – present | Germantown, MD

Principal Scientist

- Lead scientist utilizing data analytics, modeling, and materials science to improve performance of implanatable blood sugar monitors for diabetics.
- Led team of three scientists to discover material change resulting in 30% improvement in monitor performance and longevity.

- Led cross-functional effort between signal processing, supply chain, and manufacturing teams to utilize logistic regression and ROC curves to to improve manufacutirng yields by 40%.
- Produced data processing pipeline to calculate performance metrics and produce visualization on clinical data
- Developed drug release and diffusion models for combination drug/device to evaluate new designs and formulations

World Bank Group Dec 2021 – May 2022
Data Analyst
- Data processing and visualization of global COVID-19 pandemic data related to:
  - Infection fatality rate
  - New cases and deaths
  - Vaccination progress
  - Focus on specific geographic regions and countries
- Preparation of presentation to World Bank Group board on pandemic response
- 2022 HD VPU Team Award for "Board Technical Briefing on World Bank Response to COVID19"

Archimedes Bioengineering Aug 2016 – Dec 2022
Chief Scientific Officer
- Managed process development and transfer to contract manufacturers
- Determined regulatory pathways for developed point-of-care monitors
- Lead grant writing for NIH SBIR - Awarded Phase 1 NIH SBIR - turned down
- Secured $500,000 in angel funding
- Managed relationships with Key Opinion Leaders to establish market space, research strategy, and product viability for the point-of-care monitors

Asklepion Pharmaceuticals Jun 2020 – Nov 2022
Chemistry, Manufacturing, and Controls Lead
- Prepared figures and statistical analysis of small molecule clinical trial data by Wilcoxon rank sum t-test to provide regulatory team with recommendations and submission figures for FDA Type A meeting
- Chemistry, Manufacturing, and Controls for two drug product formulations and one drug substance

Children's National Medical Center Aug 2014 – Aug 2016
Biochemical Genetics Fellow
- Wrote and executed validation protocols for determination of medical diagnositcs statistical performance inclduing limit of detection, within day/run variability, accuracy, sensitivity, and mean-differences plots vs gold standard testing.
- Identified and published on negative measurement bias in standard clinical chemistry tests due to process delay.

Education

University of Maryland, College Park Aug 2010 – May 2014
Ph.D. in Bioengineering - Funded by NDSEG Fellowship

University of Maryland, College Park Aug 2006 – May 2010
B.S. Bioengineering