Victor Obarafor, PhD

ML Research Engineer | Federated Learning | Distributed Optimization | Trustworthy ML

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Research Identity

ML Research Engineer specializing in federated optimization, parameter-efficient fine-tuning, and instability analysis in heterogeneous distributed ML systems. Build reproducible experimentation infrastructure for diagnosing convergence failure, client drift, geometry collapse, and personalization mismatch under non-IID training.

Research Engineering

FedGeoX — Geometry Dynamics and Instability in Federated LoRA
DistilBERT, LoRA/PEFT, GLUE, Federated NLP, Optimization Geometry

- Built federated PEFT experimentation systems for analyzing instability in heterogeneous LoRA fine-tuning, instrumenting alignment collapse, cosine degradation, conflict spikes, and update variance across MRPC, SST-2, and QQP.
- Demonstrated that federated LoRA failure is not random: early-round geometry strongly predicts downstream convergence behavior, with low alignment and high conflict separating stable training from collapse regimes under severe client heterogeneity.
- Engineered reproducible multi-seed evaluation pipelines and geometry-aware aggregation variants (FedGeo) to characterize robustness limits, instability scaling, and optimization pathology under non-IID distributed training.

Client-Specific Personalization Depth in Federated Learning
Adaptive Routing, Non-IID Personalization, Representation Adaptation

- Built large-scale personalization-depth benchmarks spanning 5 datasets, multiple heterogeneity regimes, repeated seed sweeps, and post-FedAvg adaptation policies to study how much of a shared model different clients should personalize.
- Showed that no fixed personalization strategy dominates across datasets or regimes: head-only, partial, and full fine-tuning win under different client distributions, exposing personalization depth as a fundamentally client-dependent optimization problem.
- Quantified oracle routing headroom and selector-policy disagreement, demonstrating that lightweight metadata and probe-based routing strategies fail to reliably recover available client-level adaptation gains.

Drift-Aware Adaptive Aggregation (DAA)
FedAvg, FedProx, CIFAR-10, Client Drift, Robust Aggregation

- Developed geometry-sensitive aggregation mechanisms that reweight client updates using deviation from the consensus direction to reduce instability caused by divergent local objectives under heterogeneous federated optimization.
- Built controlled federated evaluation pipelines across IID and Dirichlet non-IID regimes, linking update drift growth to communication efficiency degradation and downstream convergence instability.

Experience

Research Engineer / Lecturer, Department of Computing Oct 2021 – Present
Canterbury Christ Church University, Kent, United Kingdom

- Built reproducible distributed ML research infrastructure using PyTorch, Transformers, Hydra, MLflow, Docker, SLURM, and Linux orchestration workflows for large-scale federated experimentation.
- Supervise MSc and PhD research in privacy-preserving AI systems while maintaining active open-source ML research repositories and IEEE publication output.
- Published and presented IEEE research across federated learning, trustworthy AI, IoT security, and privacy-preserving distributed systems; selected as NeurIPS reviewer and recipient of Golden Apple Teaching Awards.

Publications & Research

- 5 IEEE conference publications across federated learning, privacy-preserving AI, IoT security, and trustworthy distributed systems.
- NeurIPS 2026 submission investigating instability dynamics and optimization geometry in federated parameter-efficient fine-tuning under heterogeneous client distributions.
- ICML-track research on adaptive personalization depth and client-specific routing in federated learning systems.

Technical Stack

Distributed & Federated ML: Federated Learning, PEFT/LoRA, Non-IID Optimization, Personalized FL, Distributed Training
ML Systems & Infrastructure: PyTorch, Transformers, Hydra, MLflow, Docker, Linux, SLURM, Experiment Orchestration
Research & Analysis: Optimization Geometry, Stability Diagnostics, Multi-Seed Evaluation, Representation Analysis
Programming: Python, Bash, SQL, APIs/Backend Development

Education

PhD, Privacy-Preserving Federated Learning for Smart Systems 2021 – 2024
Canterbury Christ Church University, Kent, United Kingdom
MSc Cyber Security & Forensics (Distinction) 2020 – 2021
University of Westminster, London, United Kingdom