



Demo: FLaaS - Enabling Practical Federated Learning on Mobile Environments

Kleomenis Katevas^{*1}, Diego Perino², Nicolas Kourtellis²



¹Brave Software, London UK; ²Telefonica Research Barcelona, Spain

DESIGN CHALLENGES

1. Easy to use by App designers & users
2. Multi-use case coverage
3. On-device ML training
 - 3a. Single-app FL modeling
 - 3b. Joint-app FL modeling
4. Secure & private ML training
5. Production ready

ENVISIONED USE CASES

1st use case:
Individual apps for own ML problem

- Movistar
- Spotify
- Instagram

2nd use case:
Collaborative similar apps for same ML problem

- Instagram+Facebook
- YouTube+Netflix

3rd use case:
Collaborative, but orthogonal apps for new ML problem

- Uber+Spotify
- GMaps+Spotify

ADMIN INTERFACE

SYSTEM ARCHITECTURE

CLIENT DEVICE MODULES

FLaaS Local:

- Comms with Server
- Comms with Apps
- Notifications
- Model Aggregation
- Authentication

FLaaS Library:

- Comms with FLaaS Local
- Comms with App
- Data Access Policy
- On-device ML training

REAL USER STUDY DESIGN

- 144 unique users, 5 EU countries
- 4 weeks long (2-week windows/user)
- 116 Android models, 15 manufacturers
 - Samsung(44%),Xiaomi(24%),Huawei(12%)
- **Demographics:**
 - 61% male : 39% female
 - 18-29y: 34%
 - 30-39y: 41%
 - 40-49y: 17%
 - 50+y: 8%
- 3780 survey responses for feedback

USER STATS & FEEDBACK

Device Availability for ML tasks:

- 94-99% of devices available/day
- 37-82% of devices available/hour

Impact on Phone Performance:

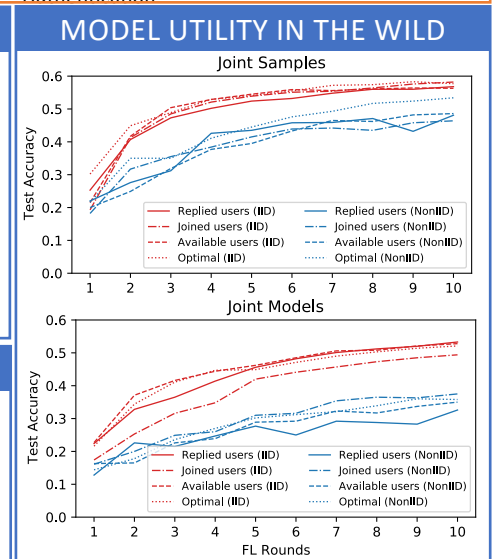
- 90.8% users: no change
- 8.5% users: somewhat slower device
- 0.8% users: very slow device

Impact on Phone Battery:

- 73.7% remarked no change
- 22.7% noticed some change
- 3.6% noticed drastic change

ON-DEVICE ML-TRAINING COST

Model	Device Specification					
	Pixel 3a (P3a)		Pixel 4 (P4)		Pixel 5 (P5)	
	Octa-core (2x2.0 & 6x1.7 GHz), 4GB RAM					
	Octa-core (1x2.84, 3x2.42 & 4x1.78 GHz), 4GB RAM					
	Octa-core (1x2.4, 1x2.2 & 6x1.8 GHz), 8GB RAM					
	Duration(sec)	CPU usage(%)	Power Discharge (mAh)			
	JS	JM	JS	JM	JS	JM
	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)
P3a	167.3(13.1)	85.3(1.5)	17.9(2.1)	29.7(0.6)	56.8(8.6)	37.8(0.5)
P4	117.1(1.1)	62.1(0.8)	15.4(0.1)	27.8(0.4)	41.3(0.9)	29.7(0.5)
P5	115.0(0.4)	62.8(0.9)	16.1(0.1)	28.8(0.4)	42.7(1.0)	32.4(0.7)



ACKNOWLEDGEMENTS

This project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreements No 830927 (Concordia), No 871370 (Pimcity) and No 871793 (Accordion). The poster reflect only the view of the author(s) and the Commission is not responsible for any use that may be made of the information it contains.

OPEN-SOURCE CODE

<https://github.com/FLaaSResearch>

*Work performed at Telefonica Research

