원격 PPG에 대한 메타러닝 기반 개인화 연합학습 적용 및 성능 평가

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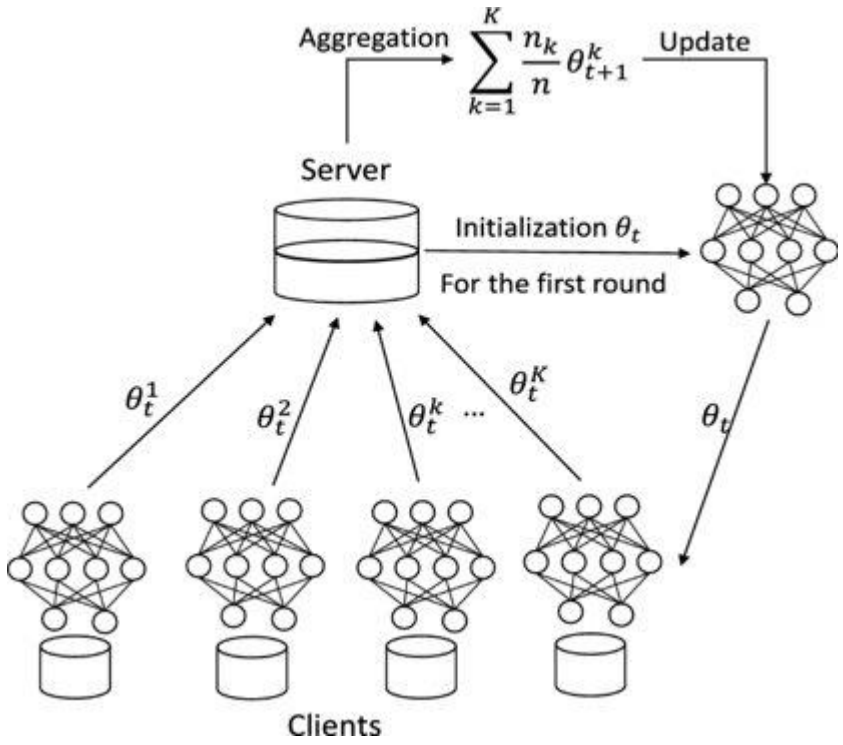
연합학습(Federated Learning)



Algorithm 1 `FederatedAveraging`. The K clients are indexed by k; B is the local minibatch size, E is the number of local epochs, and η is the learning rate.

Server executes:
initialize w_0
for each round $t = 1, 2, \dots$ **do**
  $m \leftarrow \max(C \cdot K, 1)$
  $S_t \leftarrow$ (random set of m clients)
  for each client $k \in S_t$ **in parallel do**
    $w_{t+1}^k \leftarrow \text{ClientUpdate}(k, w_t)$
  $w_{t+1} \leftarrow \sum_{k=1}^{K} \frac{n_k}{n} w_{t+1}^k$

ClientUpdate(k, w): *// Run on client k*
$\mathcal{B} \leftarrow$ (split $\mathcal{P}_k$ into batches of size B)
for each local epoch i from 1 to E **do**
  for batch $b \in \mathcal{B}$ **do**
    $w \leftarrow w - \eta \nabla \ell(w; b)$
return w to server

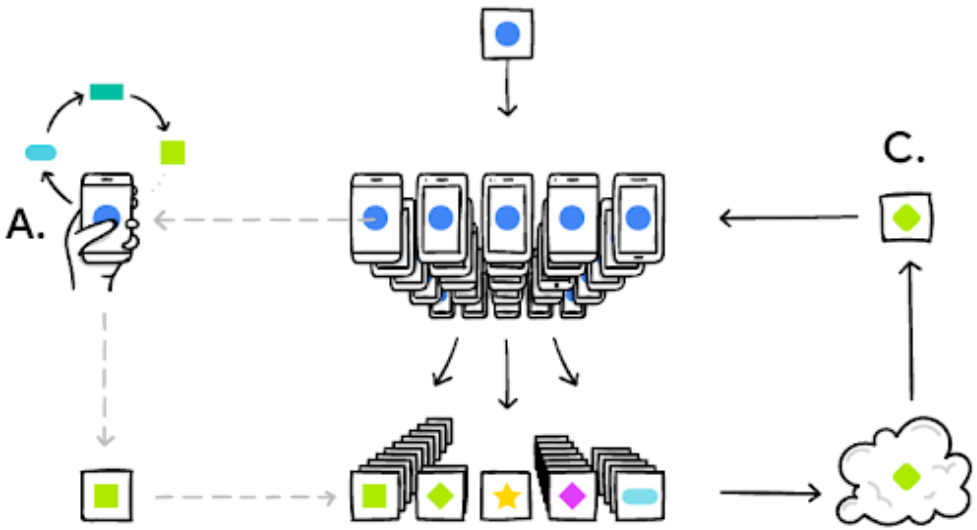
Federated Learning: Collaborative Machine Learning without Centralized Training Data(Google AI Blog)

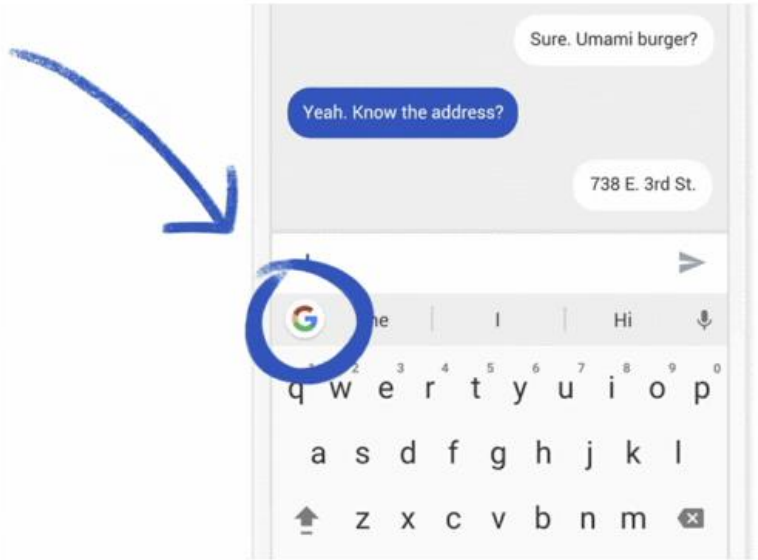
McMahan, Brendan, et al. "Communication-efficient learning of deep networks from decentralized data." *Artificial intelligence and statistics*. PMLR, 2017

연합학습(Federated Learning)

데이터의 공유 없이, 모델을 학습시킬 수 있는 인공지능 기술

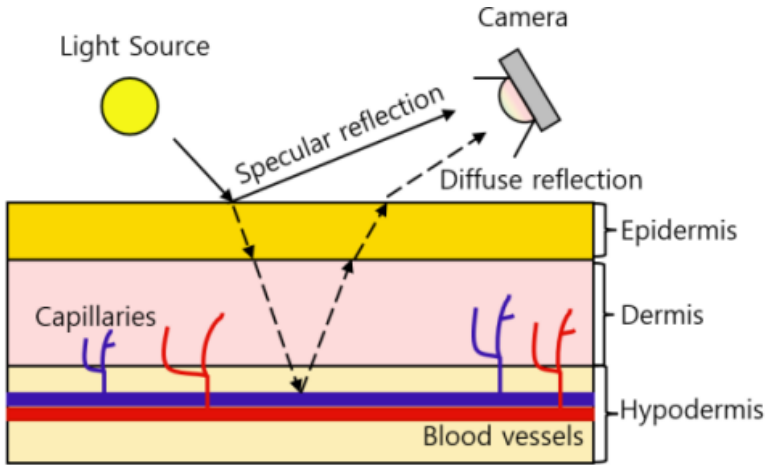
1. Communication Cost
2. Data Privacy
3. Generative Model

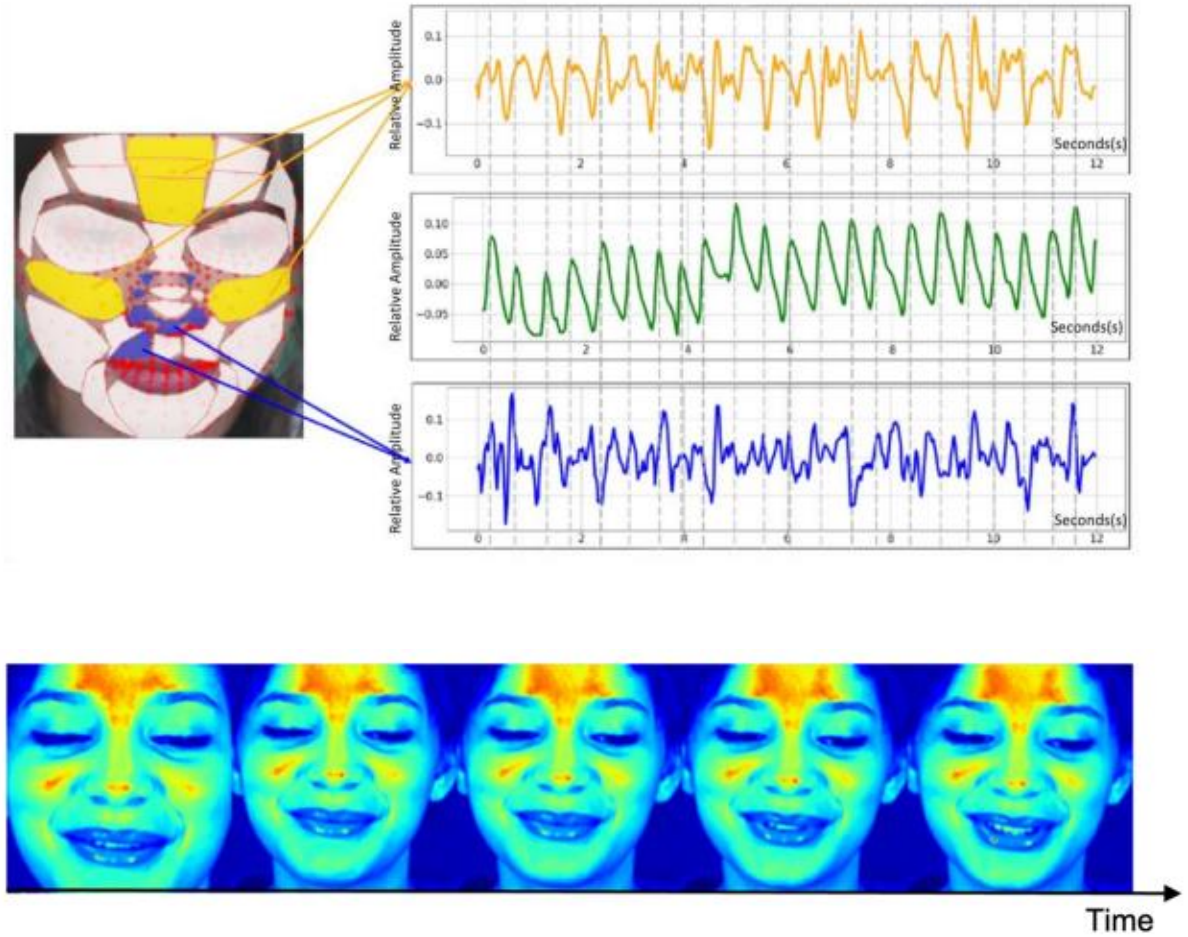




Google AI Blog

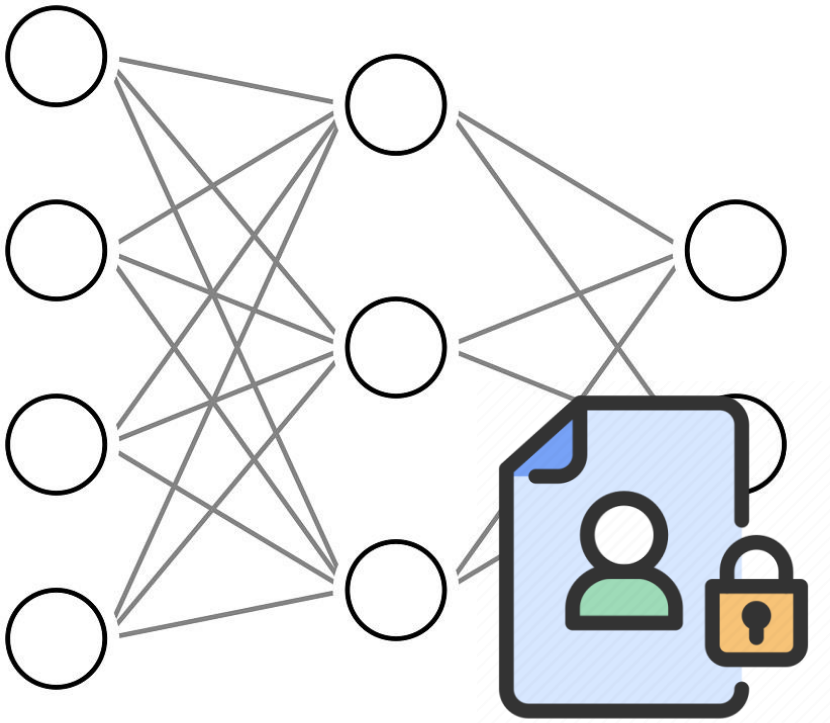
원격 PPG(Remote Photo-plethysmography)



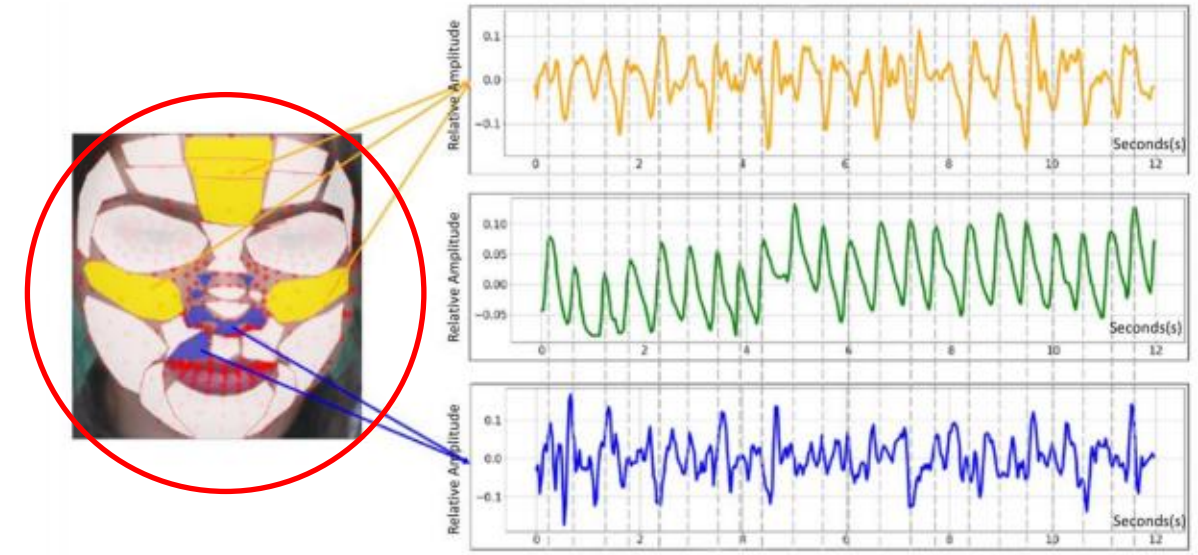


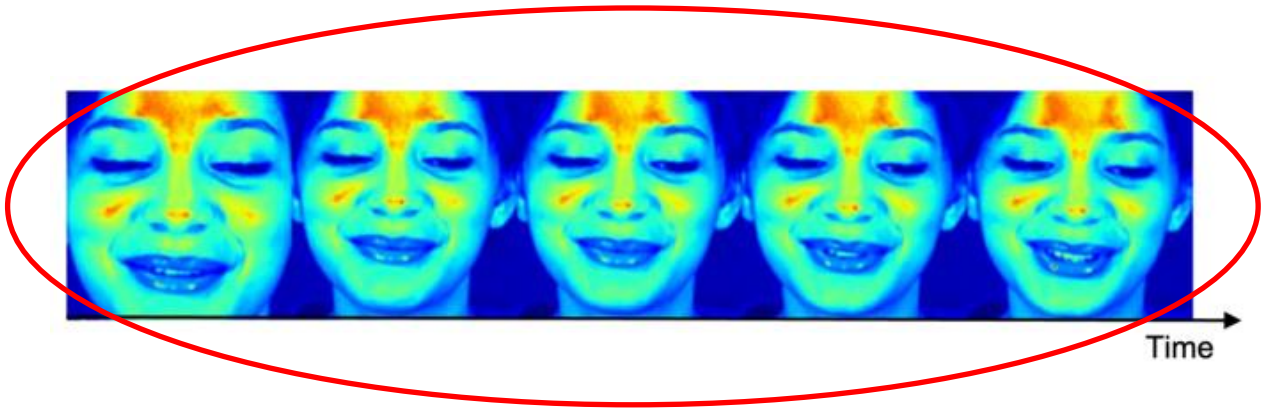
A Study of Projection-based Attentive Spatial-Temporal Map for Remote Photoplethysmography Measurement, MDPI bioengineering, Dae-Yeol Kim, Tvstorm
Assessment of ROI Selection for Facial Video-Based rPPG, MDPI, sensors, Dae-Yeol Kim, Tvstorm

원격 PPG의 문제점

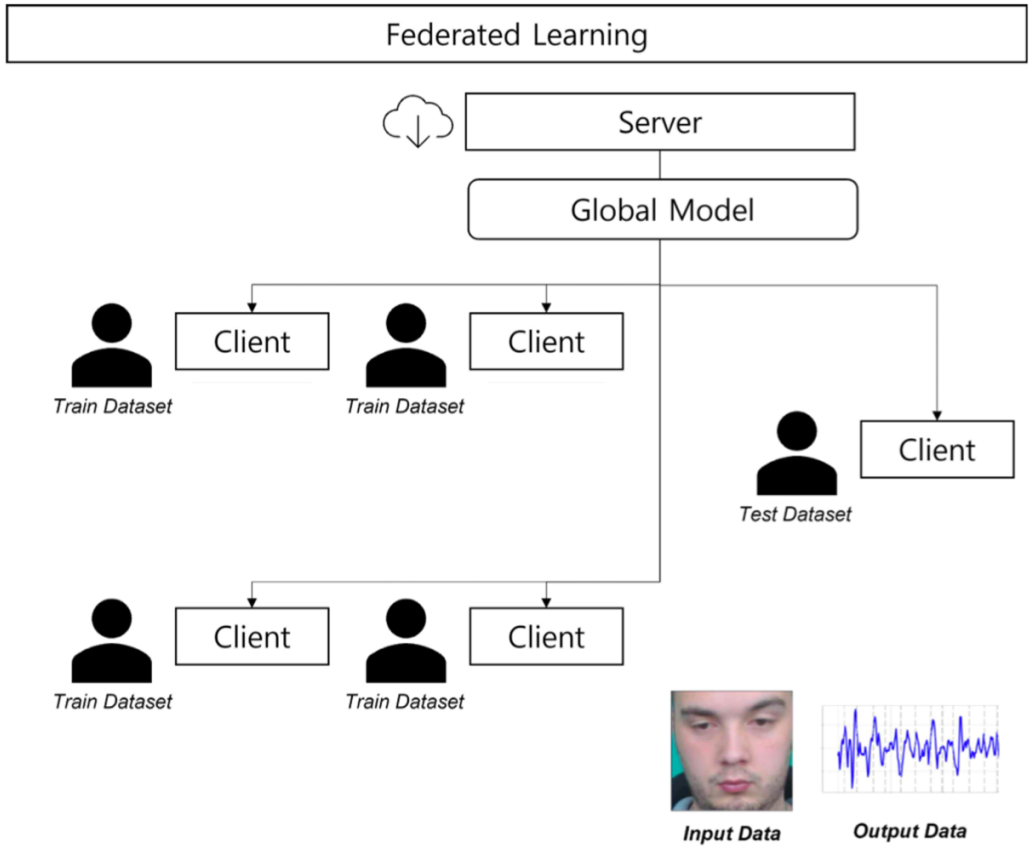


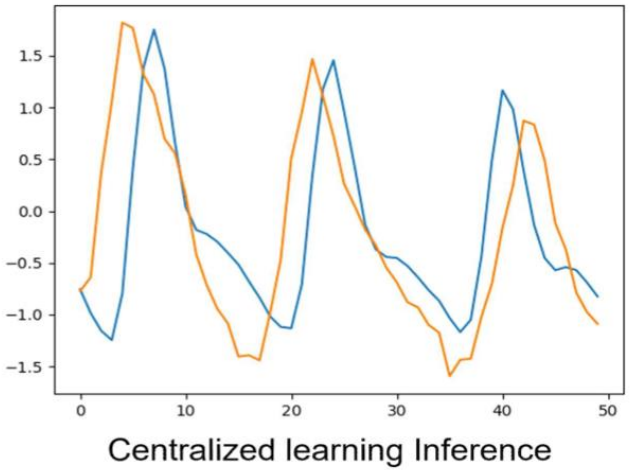
Data Privacy

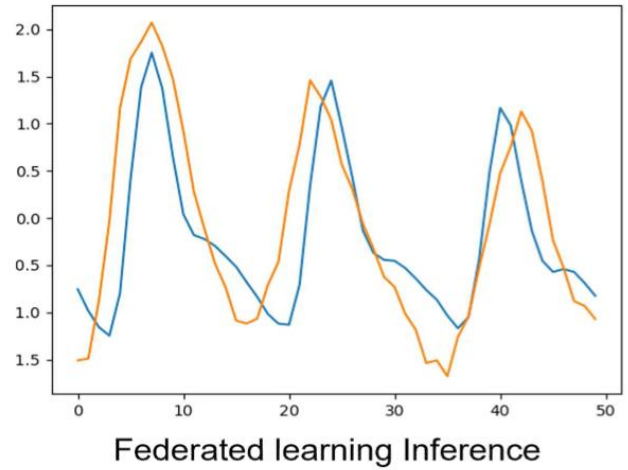




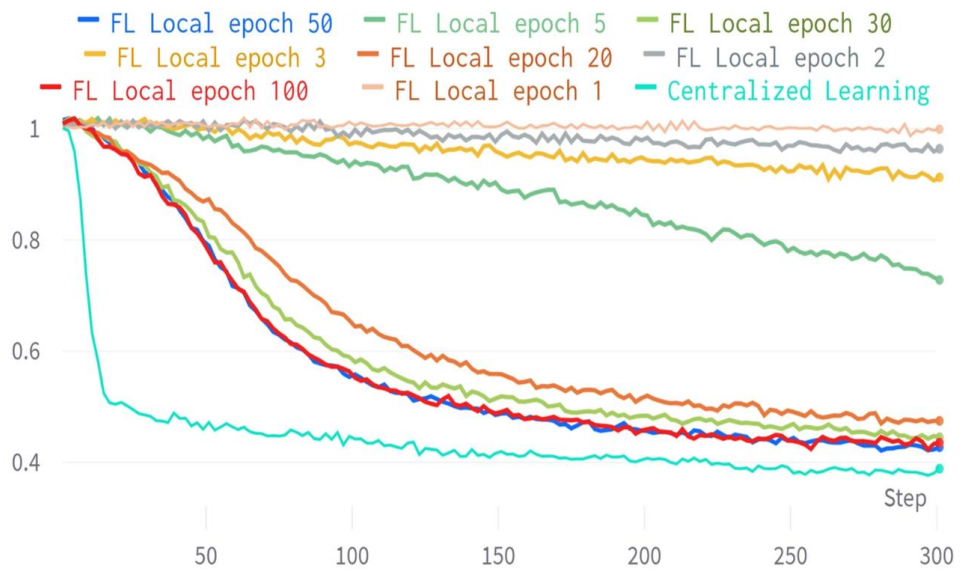
원격 PPG의 연합학습 적용







연합학습 적용 실험 결과

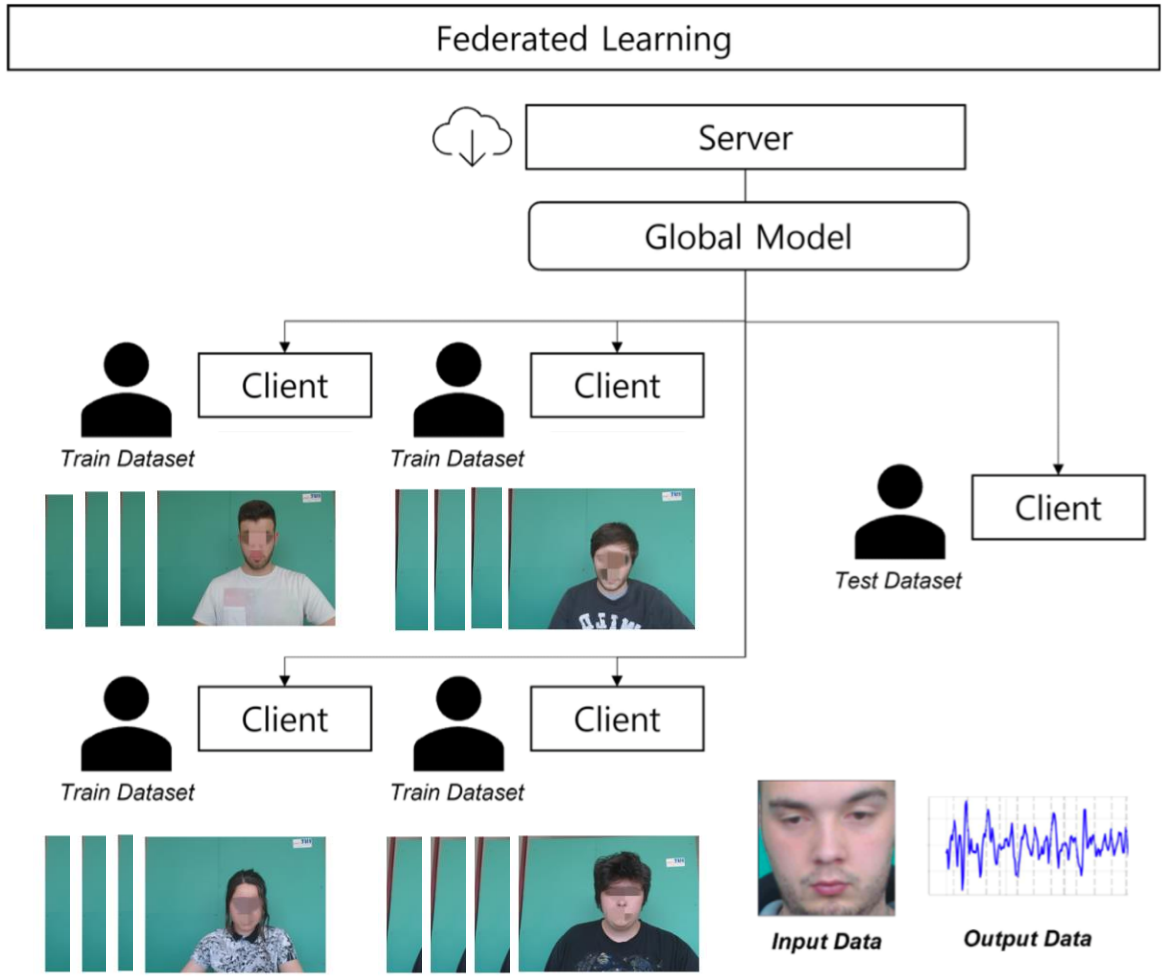


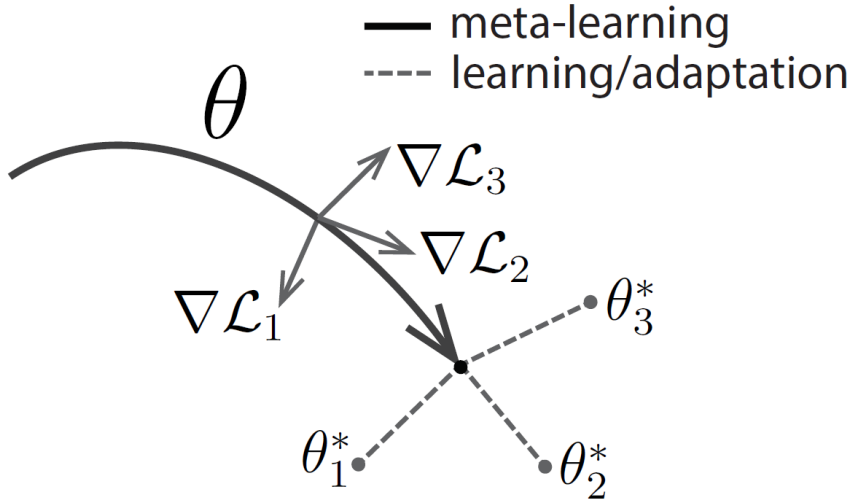
Federated Learning and Centralized Learning

	Local Model Update(epoch)	Pearson Correlation
Federated learning	1	0.0183
	2	0.0446
	3	0.0982
	5	0.2676
	10	0.4671
	20	0.5343
	30	0.5594
	50	0.5805
	100	0.5706
Centralized learning	-	0.6231

Comparison table of Pearson correlation coefficients by local model update(epoch)

메타러닝(Meta Learning)기반 개인화 적용

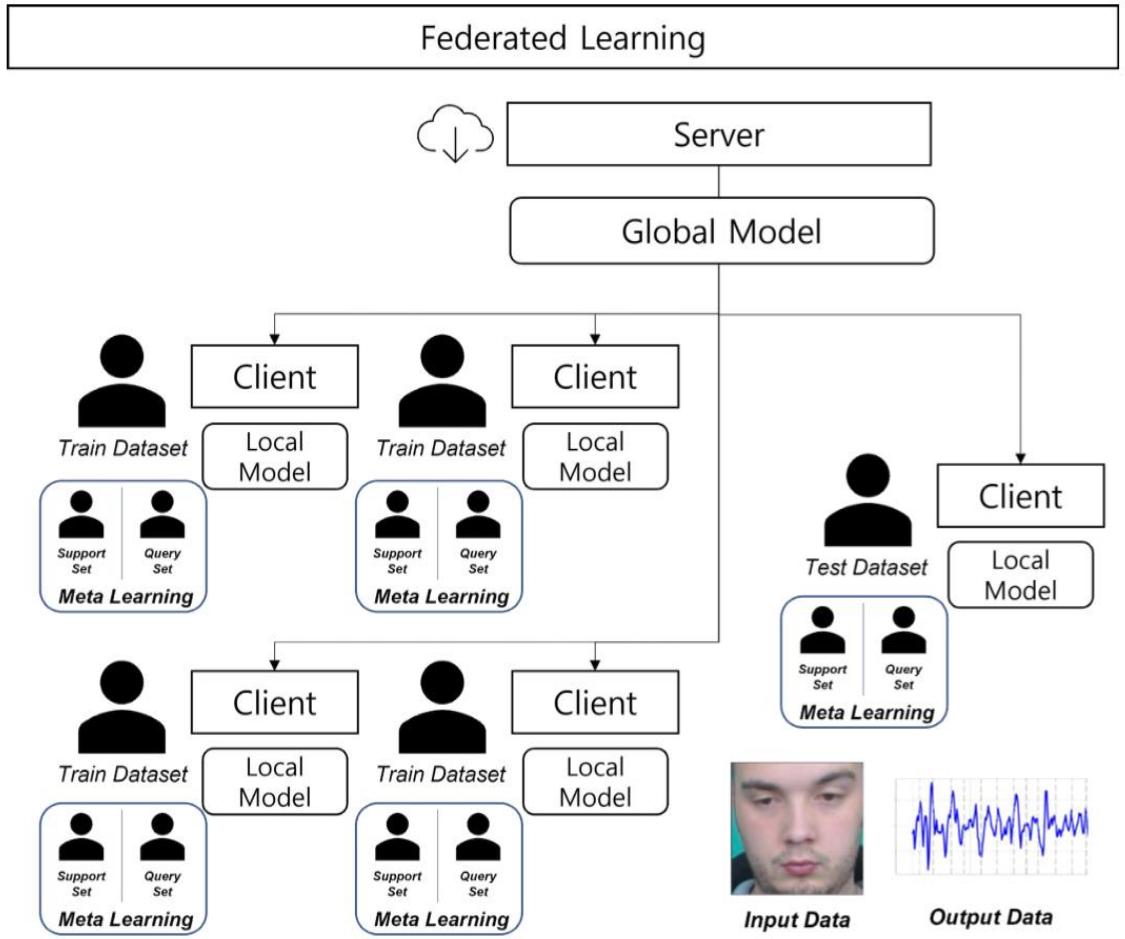


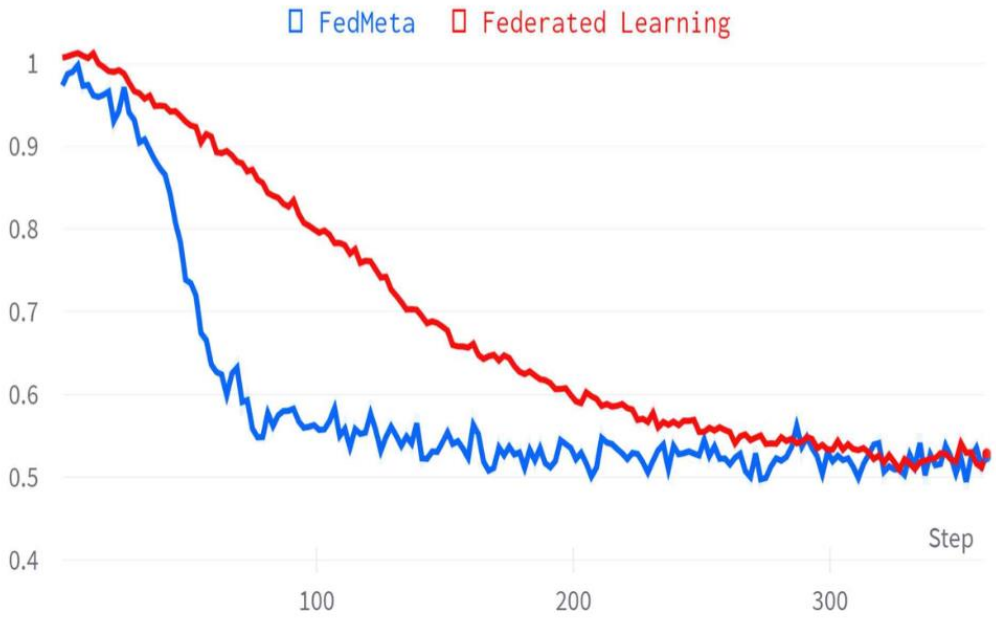


Model-agnostic meta learning (MAML)

Finn, Chelsea, Pieter Abbeel, and Sergey Levine. "Model-agnostic meta-learning for fast adaptation of deep networks." International conference on machine learning. PMLR, 2017.

메타러닝(Meta Learning)기반 개인화 적용 및 결과





Comparison FedMeta vs Federated learning

감사합니다.