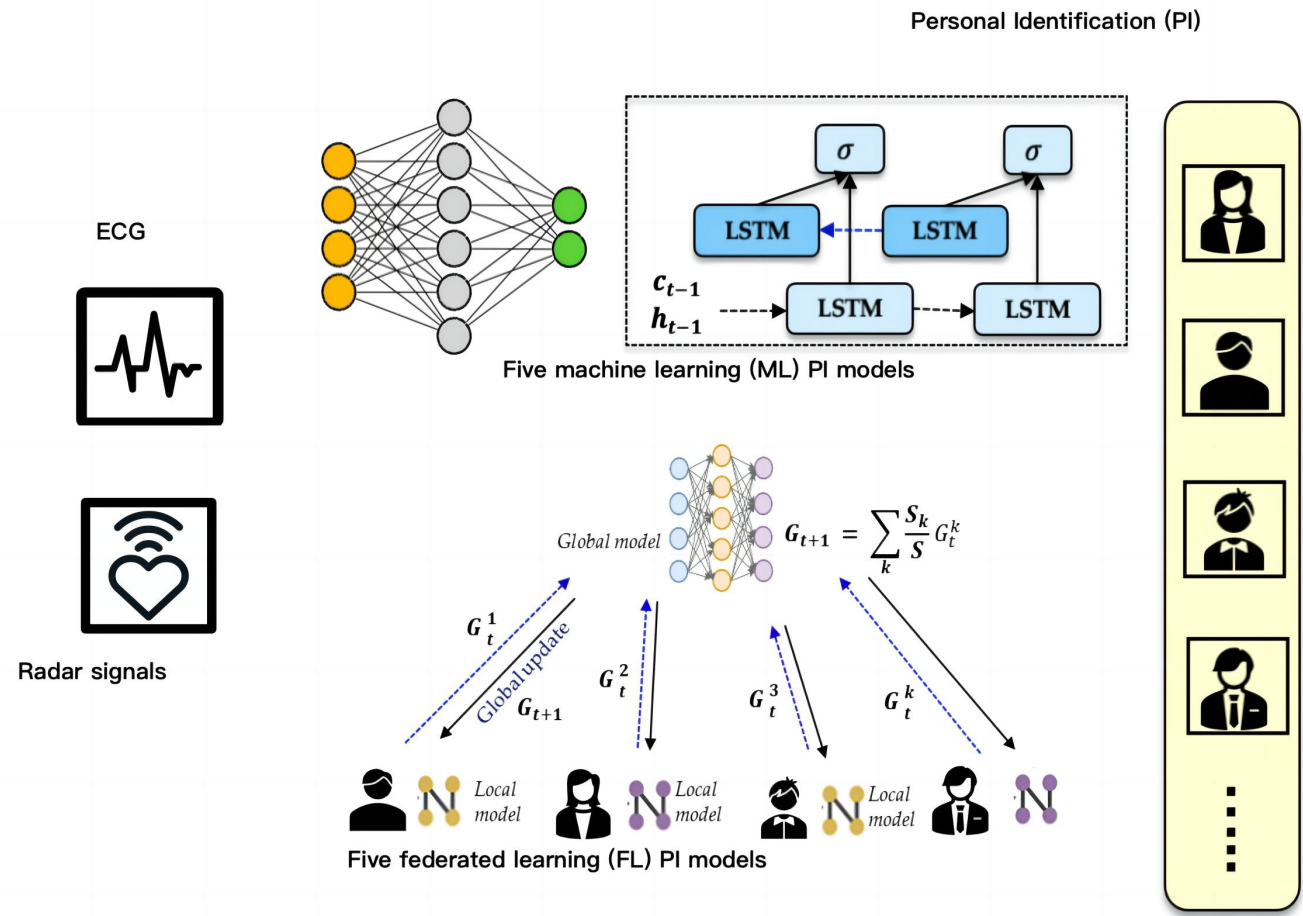


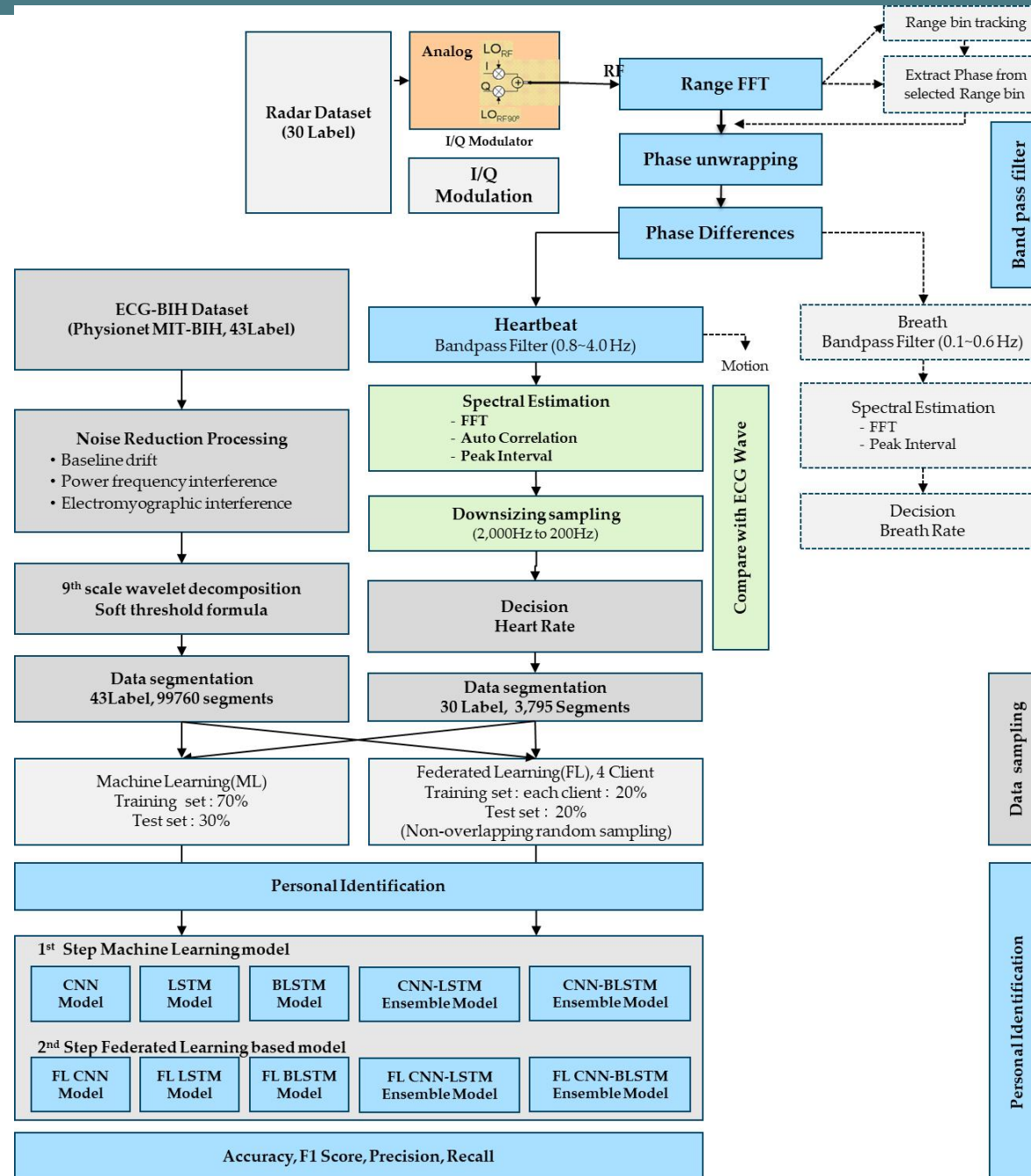
- 제목 :

Federated Learning-Based Privacy-Preserving Personal Identification  
Using Non-Contact Radar Signals

## Graphical Abstract



- ECG : MIT-BIH Arrhythmia Database
  - 43명
- Radar Single: A dataset of clinically recorded radar vital signs with synchronised reference sensor signals
  - 30명



# 운동상태

- Resting: 정상 호흡
- Valsalva: 숨을 깊게 들이 쉬고 잠시 숨을 참은 상태
- Apnea: 호흡이 일시적으로 멈추

Dataset	Method	Model	State	Acc	F1	SEN	SPE	
Radar Signals	Federated Learning	CNN-LSTM Ensemble	Resting	75.5	74.6	75.55	99.1	
			Valsalva	69.4	68.8	69.4	98.9	
			Apnea	42.6	41.8	42.6	98.5	
				Random Mix	81.3	81.2	81.3	99.3
		CNN-BLSTM Ensemble	Resting	81.9	80.6	81.9	99.3	
			Valsalva	74.6	74.3	74.6	99.1	
			Apnea	45.7	43.6	45.7	98.5	
			Random Mix	82.1	81.9	82.1	99.3	

Dataset	Method	Model	Acc	F1	SEN	SPE
ECG(MIT-BIH)	Machine Learning	CNN	98.6	98.6	98.66	99.9
		LSTM	98.9	98.9	98.92	99.9
		BLSTM	98.3	98.3	98.39	99.9
		CNN-LSTM Ensemble	97.6	97.5	97.61	99.9
		CNN-BLSTM Ensemble	97.7	97.7	97.72	99.9
	Federated Learning	CNN	97.8	97.8	97.85	99.9
		LSTM	96.6	96.6	96.65	99.9
		BLSTM	97.6	97.6	97.67	99.9
		CNN-LSTM Ensemble	96.8	96.8	96.87	99.9
		CNN-BLSTM Ensemble	97.3	97.3	97.35	99.9

Dataset	Method	Model	Acc	F1	SEN	SPE
Radar Signals	Machine Learning	CNN	49.5	48.7	49.5	98.2
		LSTM	23.1	16.5	23.1	97.3
		BLSTM	29.8	24.0	29.8	97.5
		CNN-LSTM Ensemble	82.8	82.1	82.8	99.3
		CNN-BLSTM Ensemble	89.9	89.4	89.9	99.6
	Federated Learning	CNN	45.9	44.0	45.9	98.1
		LSTM	23.5	18.4	23.5	97.3
		BLSTM	29.3	25.4	29.3	97.5
		CNN-LSTM Ensemble	75.5	74.6	75.5	99.1
		CNN-BLSTM Ensemble	81.9	80.6	81.9	99.3

# 플랫폼 비교

- Flower 와 (socket + pytorch) 비교
  - CNN-BLSTM
    - Radar 30명 ACC: 77% → 81%
    - ECG 43명 ACC: 96% → 97%

# Conclusion

- 완전히 프라이버시 데이터를 사용할 경우 모델 학습을 수행할 수 없다.
  - Cross device의 경우 각 로컬 모델의 목적은 서로 다른 유형의 데이터를 식별하는 것
- Flower가 왜 더 나은 결과를 얻는지 계속 연구