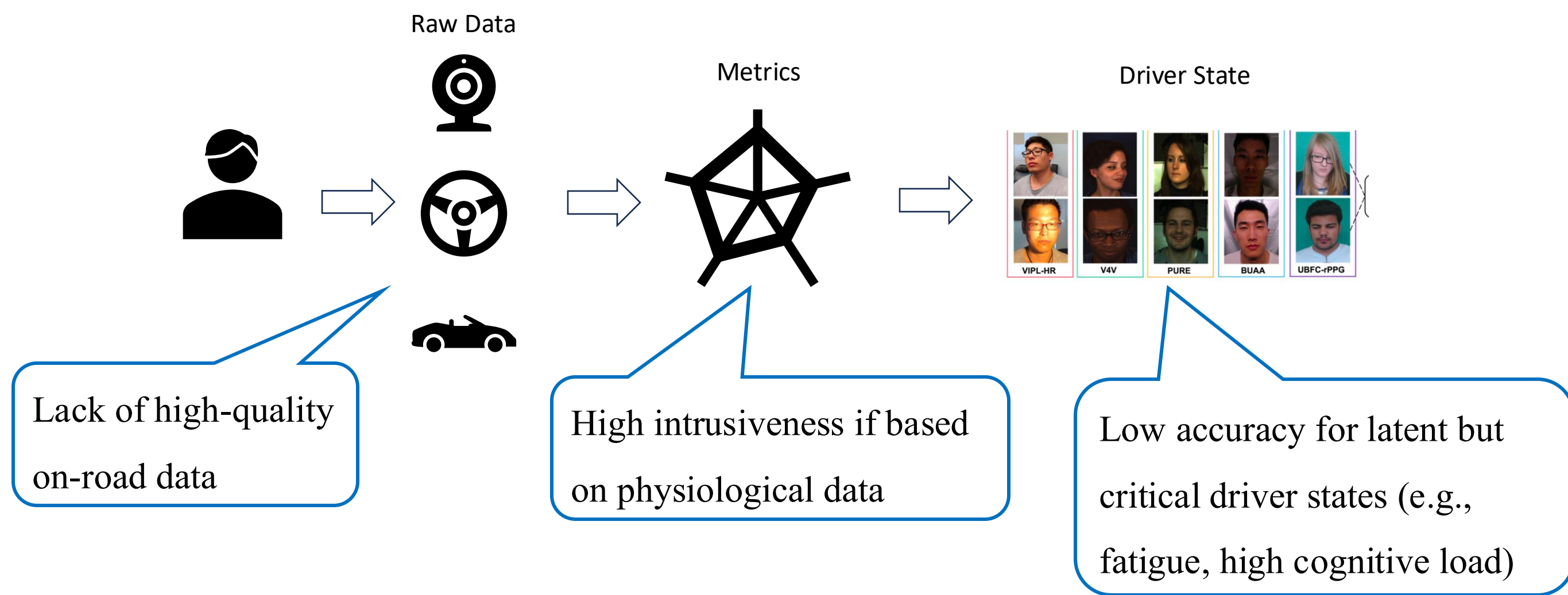


## Background

- Driver monitoring system (DMS) has become mandatory in Europe
- DMS is essential for driving safety, especially in SAE L2/3 vehicles
- State-of-the-art DMS still suffer from:



## Non-invasive Driver Bio-Metrics and State Estimation

### Challenge 1: How to ensure generalizability and robustness in individual heterogeneous and environmental changes?

**Domain Generalization**

- Style and Invariant Semantic Disentanglement
- Plausible Data Augmentation and Invariant Risk Minimization
- Conditional Diffusion for Occlusions Recovery

### Challenge 2: How to utilize the co-occurrence of multiple driver anomaly states?

**Multi-Task**

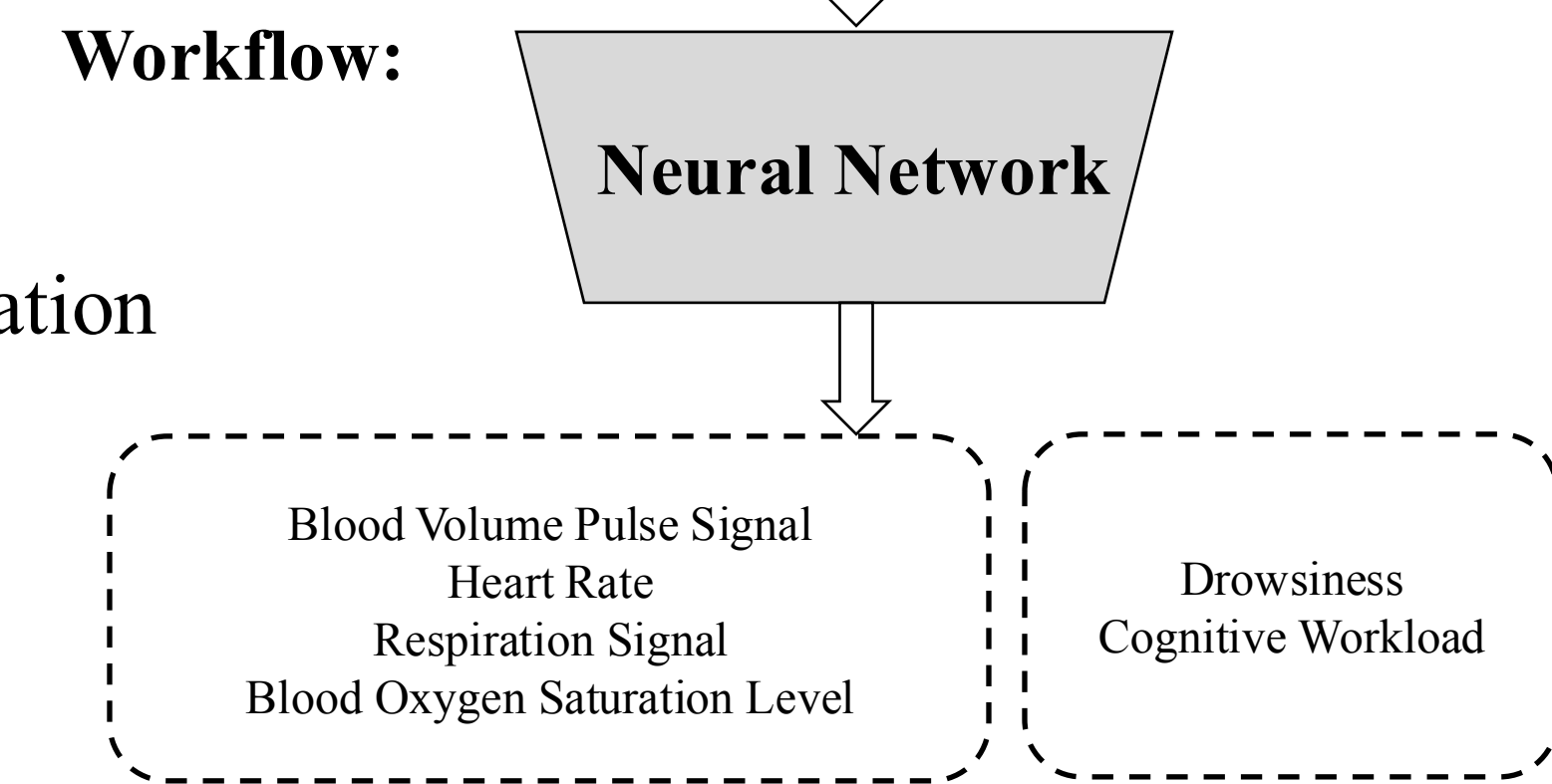
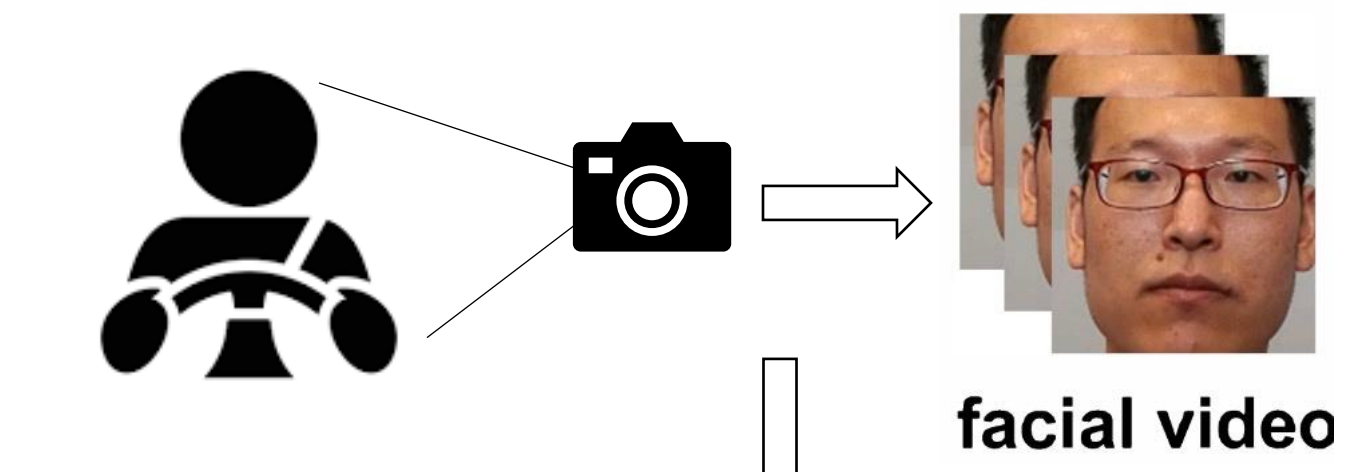
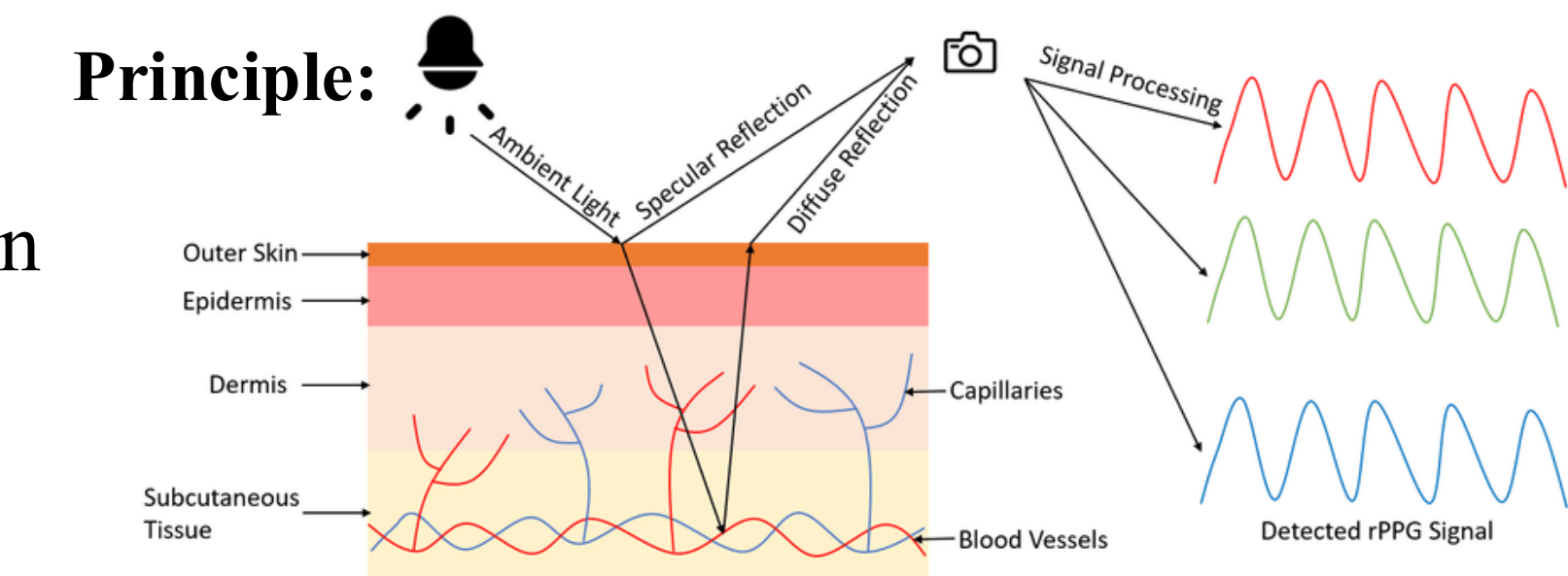
- Mixture-of-Experts for Multi-task Learning
- Prior-driven Distribution Alignment

### Challenge 3: How to tackle the above two challenges simultaneously?

**Synsemantic Domain Generalization**

- Prior-Inclusive Regularizations for Impartial Multi-task Estimation
- Adaptation with Mixture of Low-Rank Experts

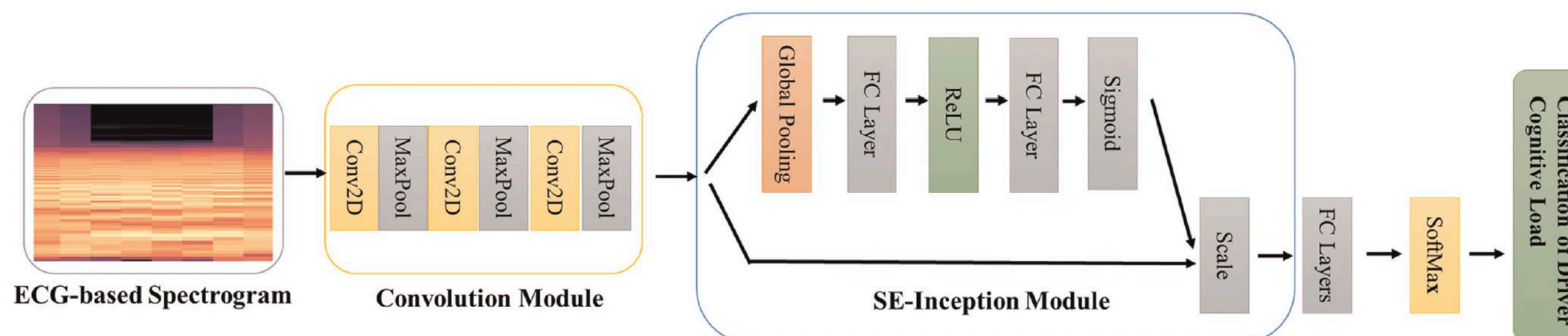
*Still Exploring!*



## From Bio Metrics to Driver States

- Transformer Network based on Physiological Time Series
- Lightweight Neural Network based on Spectrogram

**Deep Learning for Temporal Info**



## Publications

- Wang, J., Lu, H., Wang, A., Chen, Y., & He, D. (2023). Hierarchical Style-Aware Domain Generalization for Remote Physiological Measurement. *IEEE Journal of Biomedical and Health Informatics*.
- Wang, J., Wei, X., Lu, H., Chen, Y., & He, D. (2024). ConDiff-rPPG: Robust Remote Physiological Measurement to Heterogeneous Occlusions. *IEEE Journal of Biomedical and Health Informatics*.
- Wang, J., Lu, H., Han, H., Chen, Y., He, D., Wu K. (2024). Generalizable Remote Physiological Measurement via Semantic-sheltered Alignment and Plausible Style Randomization. *IEEE Transactions on Instrumentation and Measurement*.
- Wang, J., Lu, H., Wang, A., Yang, X., Chen, Y., He, D., & Wu, K. (2024). PhysMLE: Generalizable and Priors-Inclusive Multi-task Remote Physiological Measurement. *arXiv preprint arXiv:2405.06201*.
- Wang, A., Huang, C., Wang, J., & He, D. (2024). The Association between Physiological and Eye-Tracking Metrics and Cognitive Load in Drivers: A Meta-Analysis. *Transportation Research Part F: Traffic Psychology and Behaviour*.
- Wang, A., Wang, J., Shi, W., & He, D. (2024). Cognitive Workload Estimation in Conditionally Automated Vehicles Using Transformer Networks Based on Physiological Signals. *Transportation Research Record*.
- Shi, W., Wang, Z., Wang, A., & He, D. (2024). Classification of Driver Cognitive Load in Conditionally Automated Driving: Utilizing Electrocardiogram-Based Spectrogram with Lightweight Neural Network. *Transportation Research Record*.