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Validation of putative biomarkers in clinical cohorts

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#### Machine learning approaches to support biomarker discovery and validation

- Multitask learning
- Federated data analytics
- Biologically-informed machine learning

A new collaboration platform to advance biomarker discovery and validation

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#### Multi-task machine learning in the systems medicine network COMMITMENT



#### **COMorbidity Modeling via Integrative Transfer machine-learning in MENTal illness**





**Application scenarios multi-task learning** 

Multi-cohort biomarker discovery

- improved identification of reproducible signatures
- Identifying signatures associated with multiple clinical / environmental outcomes
- Potential reduction in required sample size (e.g. comorbidity modeling)

Parallelization of translational research

• Linking e.g. clinical, genetic and neuroimaging data in single analysis

Adapting population cohort-derived signatures to outcome prediction in clinical cohorts

### Parallelizing translational research with Federated machine learning

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#### Implementing multi-task learning in a federated system

- Protect sensitive patient data (remains behind institutional firewall)
- Enable multi-site discovery and validation studies
- Resolve consent and logistic issues related to data aggregation



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## ds**MTL** - a computational framework for privacy-preserving, distributed multi-task machine learning

In Cao, Youcheng Zhang, Jan Baumbach, Paul R Burton, Dominic Dwyer, Nikolaos Koutsouleris, Julian Matschinske, Yannick Marcon, Sivanesan Rajan, Thilo Rieg, Patricia Ryser-Welch, Julian Späth, The COMMITMENT consortium, D Carl Herrmann, D Emanuel Schwarz

### Parallelizing translational research with Federated machine learning





### High-dimensional machine learning through Biologically-informed multi-stage machine learning





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- Communication will be a critical success factor
  - Objectives and progress
  - Data and project infrastructure
  - Data harmonization (standards, ontologies)
  - Data analysis (strategy, governance, pipelines)
  - Result dissemination translational strategy
  - Study design
  - SOPs
  - Patient representatives

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- Web-based collaboration platform for research management
- Integrated collaboration, project and data management



# A new collaboration platform to advance biomarker discovery and validation





#### Thanks for your attention!

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