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USING PARSL IN CREATING MAPPERTRAC

RAVI MADDURI
Computational Scientist
Data Science and Learning
Argonne National Laboratory and
University of Chicago

COLLABORATORS
Joseph Moon, Timo Bremer,
Pratik Mukherji, Eva Palacios,
Mark Xiao and Alex Rodriguez

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OUTLINE

- Acknowledgements
- Refresher on the science use case
- Evolution of MaPPeRTac
- Progress since last year
- Future plans
ACKNOWLEDGEMENTS

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WHY DO WE NEED CONNECTOMES

- Structural connectome is a powerful tool to characterize the network architecture of the human brain
  - Shows great potential for generating important new biomarkers for neurologic and psychiatric disorders like Traumatic Brain Injury
- Structural connectome is based on network-centric view of the brain has the potential to uncover how information is rapidly communicated and integrated across multiple brain areas
  - Uses graph analysis of networks constructed using white matter fiber tractography
  - Resulted in discovery of highly connected regions in brain called “rich-club” nodes
- Structural connectome using Edge density imaging (EDI) maps the number of network edges that pass through every white matter voxel
  - Focus on white matter pathways that constitute the edges of the network
EVOLUTION OF THE PIPELINE

▪ Bash scripts
  – Hard-coded locations for applications and data
  – Worked well on one cluster at UCSF

▪ Python scripts
  – Parametrized
  – Ability to submit and run to SLURM
  – Worked well at LLNL
  – Application paths still hard-coded

▪ MaPPeRTrac
  – Uses Parsl
  – Successfully run at ANL, LLNL, AWS
  – Used Singularity container
MAPPERTRAC HAS DRASTICALLY SIMPLIFIED AND ACCELERATE THE CONNECTOME RELATED ANALYSIS PIPELINE

Original Runtimes
Current timings

19h 6h
8h 20m

842 participants analyzed
1239 structural connectomes
PERFORMANCE IMPROVEMENTS

**Average Wall Time for a Single Connectome**

- Original
- MuPPeRTrac

**Average Core-Hours for a Single Connectome**

- Original
- MuPPeRTrac

Columns:
- Image Correction
- Fiber Orientation
- Segmentation
- Tractography
- Total
MAPPERTRAC IS READY, ANALYSIS TOOLS ARE BEING REFINED AND VALIDATED

- The TRACK-TBI pipeline is ready to be deployed and to be generalized to other use cases
  - Fast and standardized analysis to support clinical research and application
  - ~1300 TRACK connectomes currently processed
  - Validation and verification is ongoing
- Available in open at https://github.com/LLNL/MaPPeRTrac
- New deep learning-based process is explored
  - CT anatomical segmentation and processing will enable improved multi-modal analysis of neuroimaging and clinical features.
  - Accelerated MRI anatomical segmentation will result in faster processing of connectomes.
WHAT’S NEXT FOR MAPPERTRAC

- MapperTrac
  - Complete testing on Google Cloud
  - Complete testing using docker container
  - Complete the manuscript

- Parsl issues
  - AWS issues
  - It would be nice to have a repository of configurations for known HPC and cloud infrastructures that can be installed as plug-ins
THANK YOU