The BDDS Platform for Big Biomedical Data Management and Analysis: Discovering the role of Amyloid Deposition in Neurodegenerative Diseases

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BIG DATA FOR DISCOVERY SCIENCE

Abstract

Objective: Investigate if there are commonalities in patterns of ***amyloid deposition*** in individuals with Alzheimer's Disease or Parkinson's Disease that identify those individuals with or at risk for cognitive dysfunction

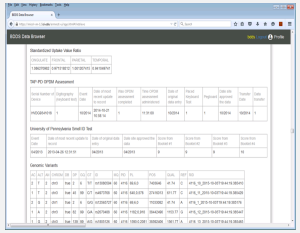
Approach: We created a ***platform*** for integration of multi-omic data, facilitate data discovery, cohort creation, enable rapid, scalable and reproducible analysis and finally publish results

Approach

We employed a systematic, reproducible approach that leveraged existing capabilities for understanding commonalities in amyloid deposition that included the following stages and challenges

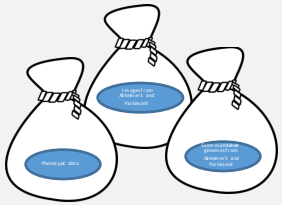
Data Ingest	• Multi-omic data • Multiple distributed repositories • Data usage agreements • Data cleanup and integration
Data Query and Exchange	• Easy to find data • Enable creation of patient cohorts • Send data for analysis
Data Analysis	• Multiple analysis platforms • Ease of use • Scale
Data Publication and Integration	• Enable discovery • End-to-end data view

The BDDS Platform



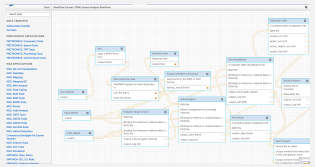
1. Data Ingest - ERMRest

- Phenotypic, Genotypic and Imaging datasets
- Multiple repositories
- Data Usage Agreements
- Automated data clean up and ingest



2. Data Query and Exchange - BagIt

- ERMRest provides high-level API for query
- Adopted the BagIt specification to create databags
- Enhanced BagIt to support big biomedical data

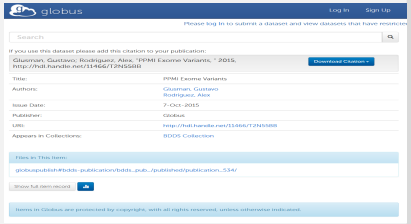


3. Data Analysis – Pipeline and Globus Genomics

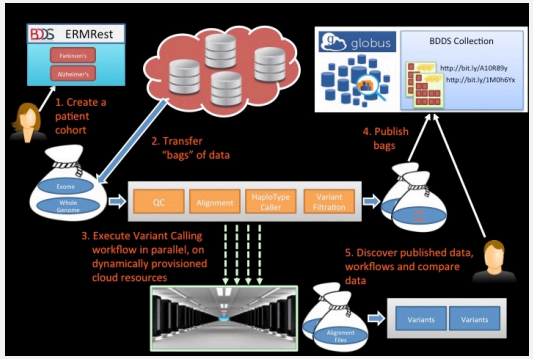
- LONI Pipeline runs the analysis on the amyloid PET and MRI images and outputs amyloid index values (SUVR: standard uptake value ratio) for each brain region, for each subject using computational resources at USC
- Genomics analysis using Globus Genomics on the Amazon cloud
- Leverages elastic provisioner that optimizes performance and costs

4. Data Publication and Integration – Globus Publication and ERMRest

- Results from analysis are integrated with ERMRest
- Results are published in Globus Publication service with appropriate metadata



Analyzing role of Amyloid Burden



Discussion & Conclusions

- We created a powerful platform by integrating several existing services and capabilities
- Platform development resulted in adopting and extending BagIt format for biomedical big data
- Future work includes applying the platform for analyzing Alzheimer's data
- Reference implementation of the NIH Commons

Bibliography

1. The BagIt File Packaging Format (V0.97) available at : http://tools.ietf.org/html/draft-kunze-bagit-11
2. Minids: http://minid.bd2k.org