Project Name

SaVANNA Sparse Vectors Applied to Neural Net Architecture

Team members

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5) Stanley Wang
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Description of the project and the problem to be solved:

Doing good at detecting things in brain volumes will help the world in many ways - disease detection, understanding how diseases affect the brain, for example.

Convolutional neural networks are the gold standard for computer vision and image segmentation tasks.
CNNs require gradient descent and backpropagation, both very expensive operations; high amounts of training data and computations are necessary to train the network.

Alternative methods have been recently developed to solve similar challenges.

Random forests are fairly effective at classifying brain images.
We hope to improve on MORF to be able to work well on images and 3D brain volumes for segmentation and detection tasks.

We aim to develop algorithms to more efficiently classify and detect significant objects in brain volumes.

We will then apply these algorithms to answer the following questions:

1) Differences in brain structure between groups
2) Mapping neurons and axonal projections in brains

Timeline and tasks for each team member?

Sprint 1:

1) Create a github repo called “savanna” with the following structure
    a) Folders that divide the package into submodules.
    b) Travis CI configuration that can run tests
2) Create a pipeline (SaVANNA) using MORF to classify images
3) Write a pull request to SPORF to handle 3D volumes
4) Extend SaVANNA to handle 3D volumes

Sprint 2:

1) Download theDATA [], and process them with *ndmg* to obtain structural connectomes.
2) Use SaVANNA on the registered volumes
    a) Validate resultsw
    b) Show improved performance over CNNs in some way

Sprint 3:

1) Write paper about pipeline functionality according to the following: https://bitsandbrains.io/2019/02/10/how-to-write-a-paper.html
2) Submit to Journal of Machine Learning Research (JMLR), or another journal based on Jovo's advice.

References

[1] Levin, Keith, et al. "A central limit theorem for an omnibus embedding of random dot product graphs." arXiv preprint arXiv:1705.09355 (2017).

[2] Arroyo, Jesús, et al. "Inference for multiple heterogeneous networks with a common invariant subspace." arXiv preprint arXiv:1906.10026 (2019).

[3] Athreya, Avanti, et al. "Statistical inference on random dot product graphs: a survey." The Journal of Machine Learning Research 18.1 (2017): 8393-8484.

[4] Alexander, Lindsay M., et al. "An open resource for transdiagnostic research in pediatric mental health and learning disorders." Scientific data 4 (2017): 170181.