Fusing Structural and Functional MRIs using Graph Convolutional Networks for Autism Classification

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spectrum AI

github.com/RichardOlij/Fusing-ss-GCN-for-Autism-Classification

Introduction

Autism Spectrum Disorders (ASD)

- Structurally indistinguishable
- Functionally different

(f-)MRI

- High resolution imaging of the brain
- Capture brain structure
- Capture brain functionality over time

ABIDE Dataset

- Autism Brain Imaging Data Exchange
- ABIDE I & II
- 2100+ subjects
- 38 acquisition sites

Challenges

- Different acquisition hardware
- High data dimensionality

Previous research

- Handpicking subjects
- Expert knowledge dimensionality reduction
- Parisot et al. [2018]

Model architectures (p-GCN)

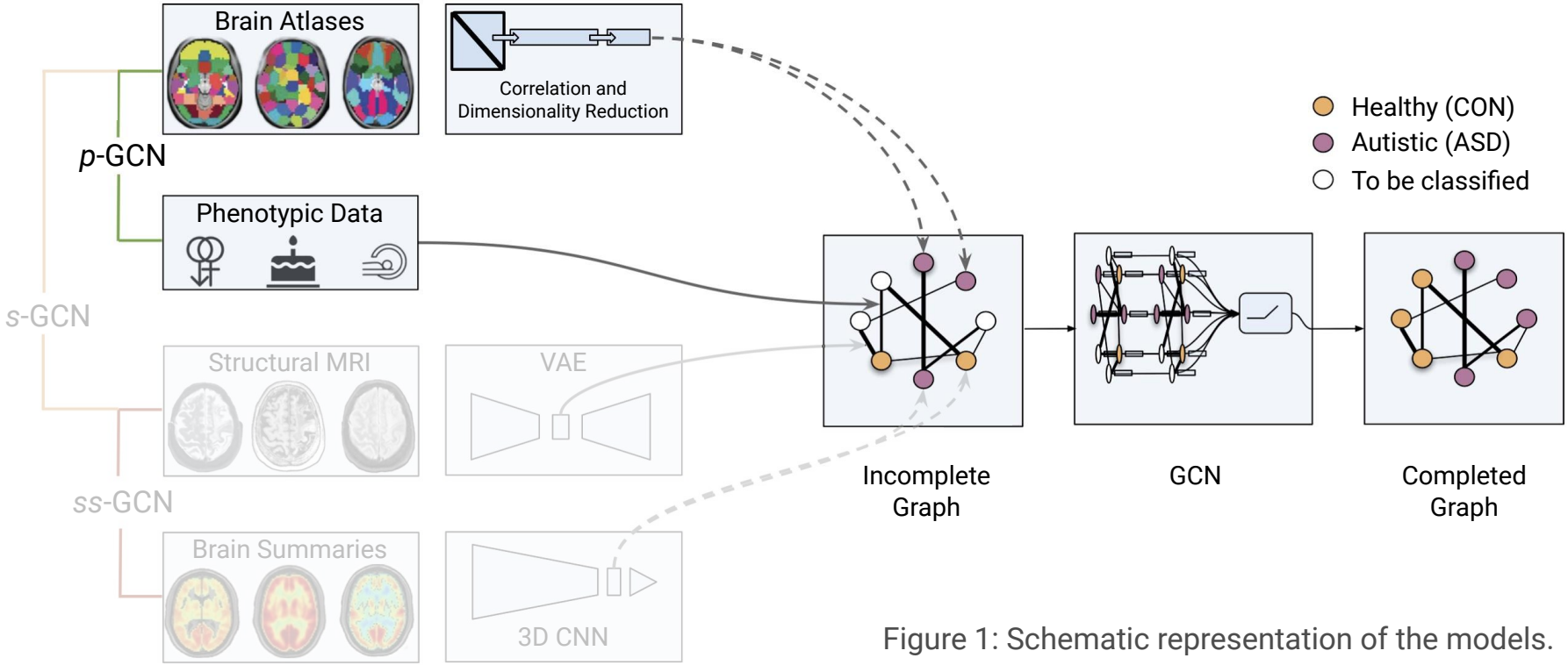

Figure 1: Schematic representation of the models.

Model architectures (*s*-GCN)

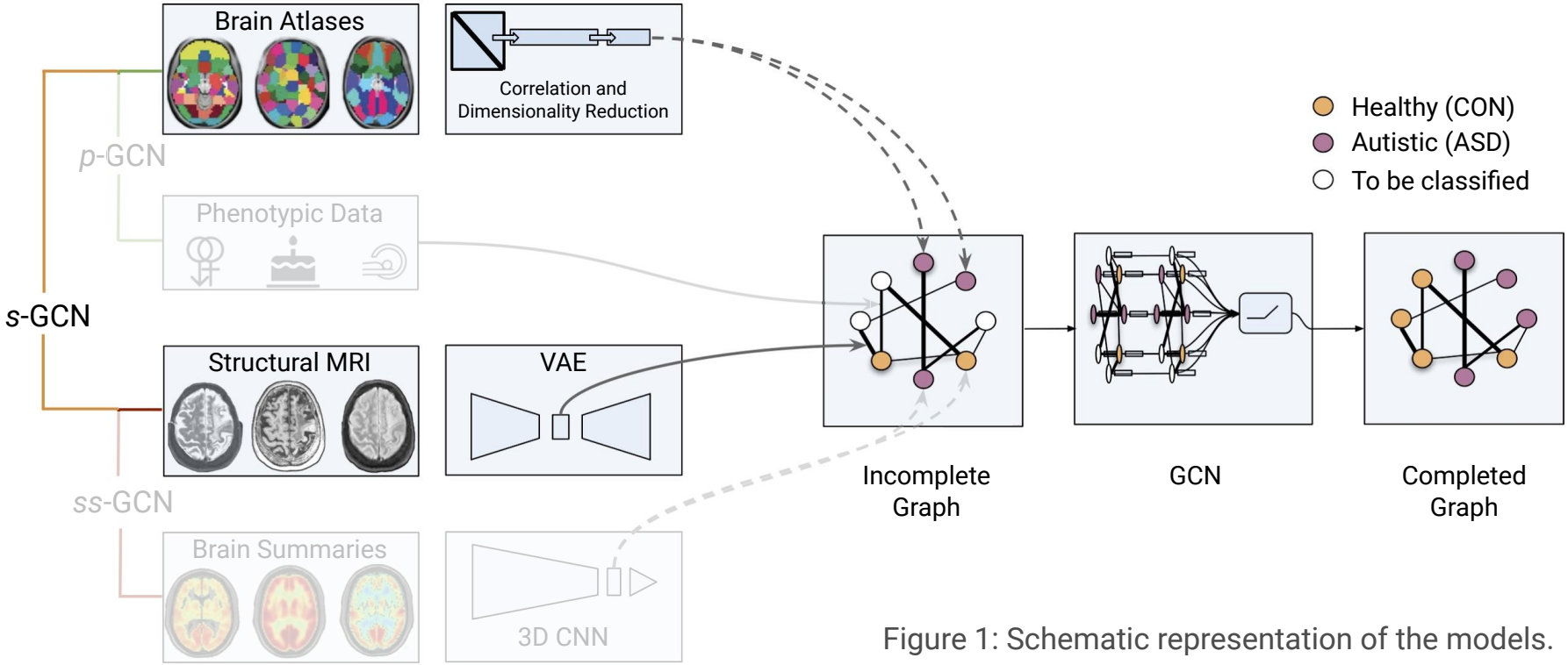

Figure 1: Schematic representation of the models.

Model architectures (*ss*-GCN)

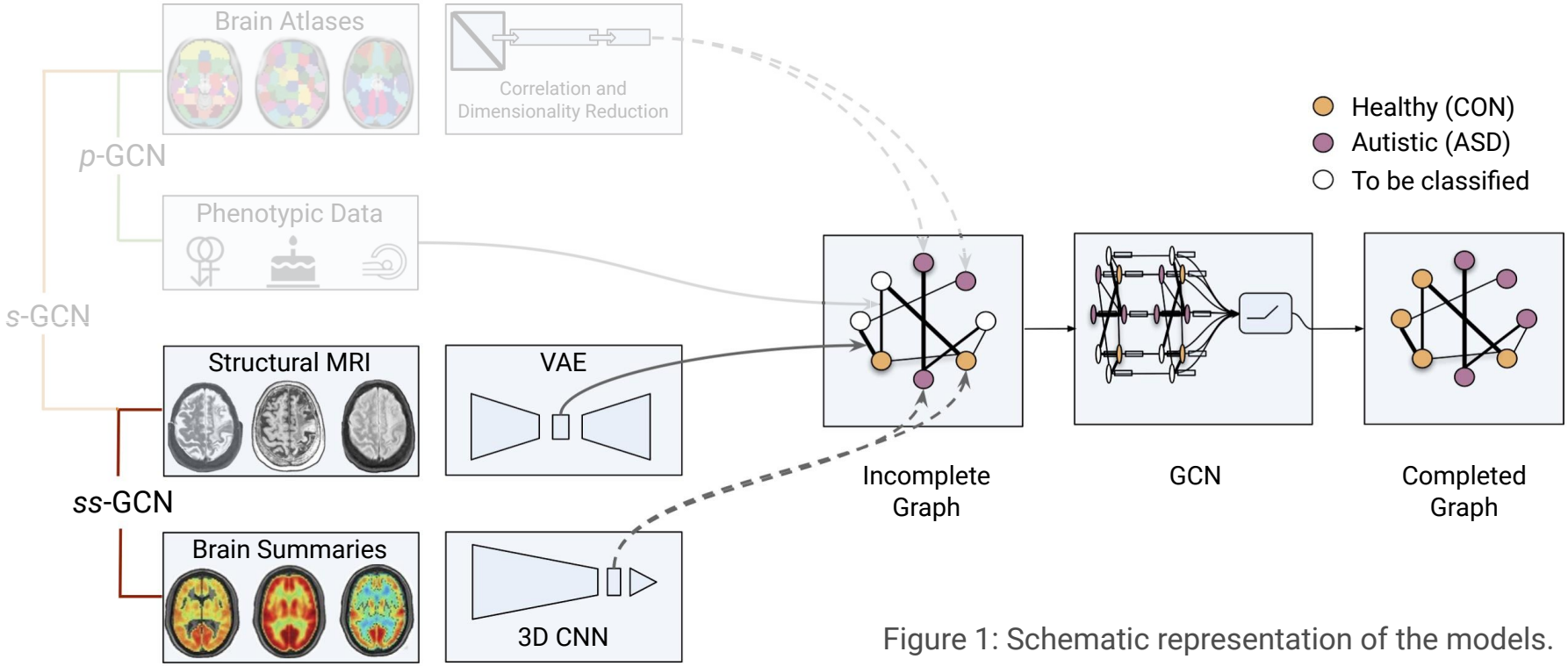

Figure 1: Schematic representation of the models.

Results overview

Site	*p*-GCN	*s*-GCN	*ss*-GCN
ABIDE II GU_1	59.1 ± 4.4	59.7 ± 3.0	**68.0** ± 2.3
ABIDE I USM	60.9 ± 4.5	60.9 ± 2.9	**61.1** ± 2.3
ABIDE II UM_1	59.4 ± 5.6	**62.3** ± 3.4	61.5 ± 2.7
ABIDE II KKI_1	50.1 ± 4.1	50.8 ± 3.2	**68.9** ± 2.1
ABIDE I NYU	**65.3** ± 3.5	64.5 ± 3.4	63.0 ± 2.6

Table 2: Accuracies (%) of different GCN models for the leave-one-site-out experiment.

Conclusion

What we aimed to improve:

- Remove expert knowledge
  - to preprocess and filter data
  - to create relational information
  - and for dimensionality reduction
- Use both ABIDE datasets for future comparison
- Improve predictive power

What we improved:

- Expert knowledge bypassed by
  - using all data instead of removing outliers
  - structural brain data and a VAE create relational information
  - and a 3D-CNN reduced dimensionality
- Both ABIDE datasets are used and many experiments are performed
- Outperforming state-of-the-art results