

AstroNet: When Astrocyte Meets Artificial Neural Network



Authors: Mengqiao Han,
Liyuan Pan, Xiabi Liu



Affiliation: Beijing Institute of
Technology



Conference: CVPR 2023

[Presentation video](#)

Presented by : Aravind Dulipudi



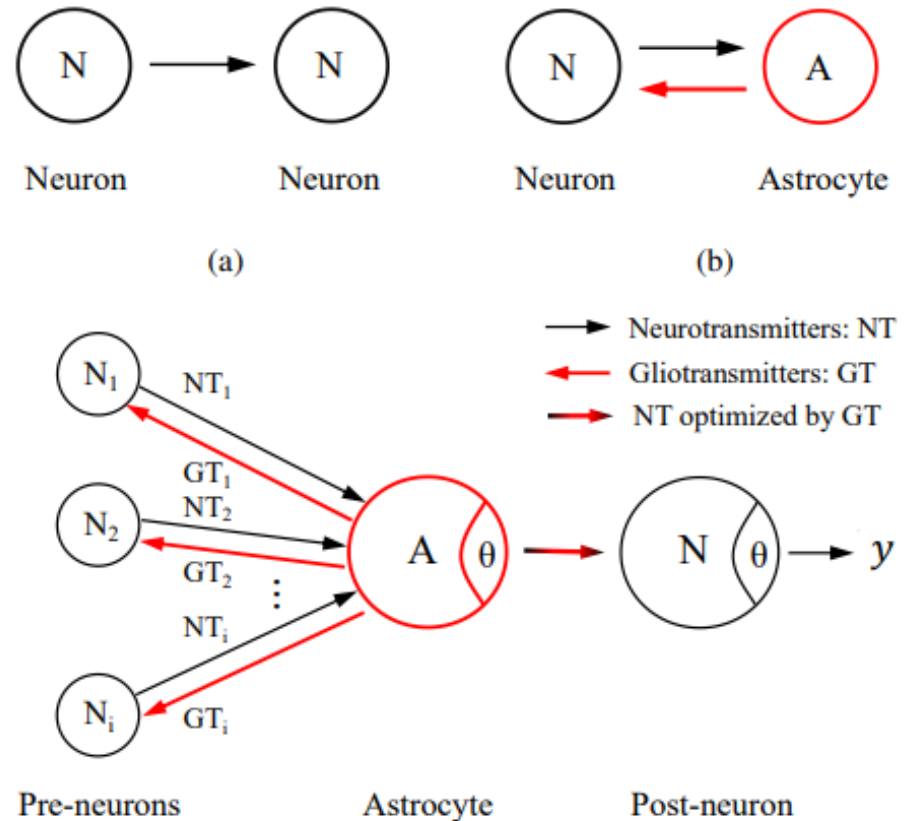
Abstract



Novel approach
integrating astrocytes
in neural networks



AIM: Enhance
accuracy and
efficiency in network
structure optimization



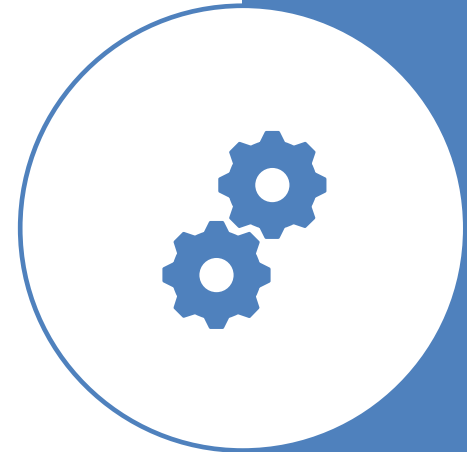
Introduction

- Challenges in neural network structure learning
- Potential of astrocytes in neural regulation
- Novelty in applying biological concepts to AI



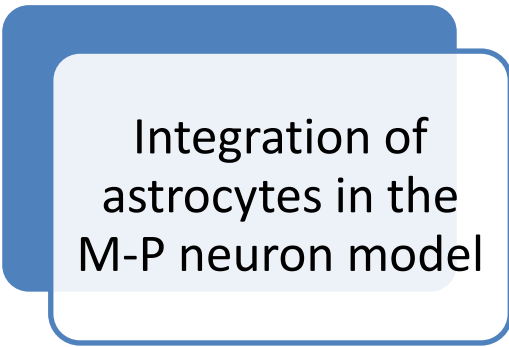
Main Objectives

- Propose AstroNet model
- Achieve adaptive network structure optimization
- Enhance accuracy and efficiency

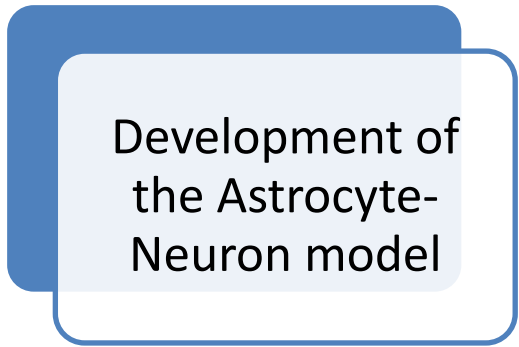




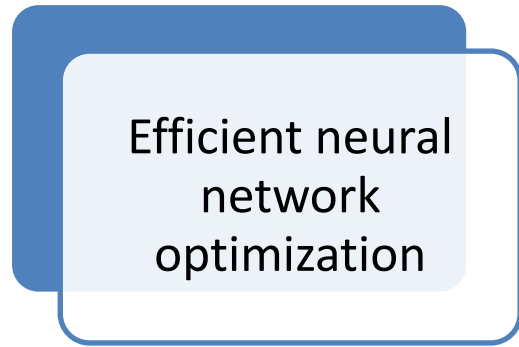
Key Contributions



Integration of
astrocytes in the
M-P neuron model



Development of
the Astrocyte-
Neuron model



Efficient neural
network
optimization

Methods



ASTROCYTE-
NEURON MODEL
EXPLANATION

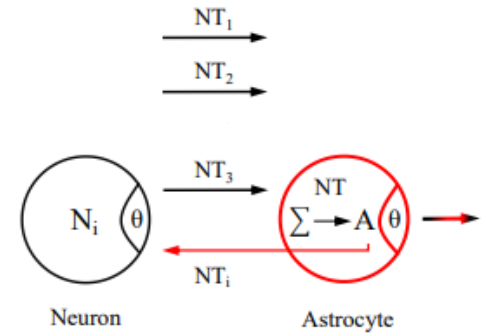
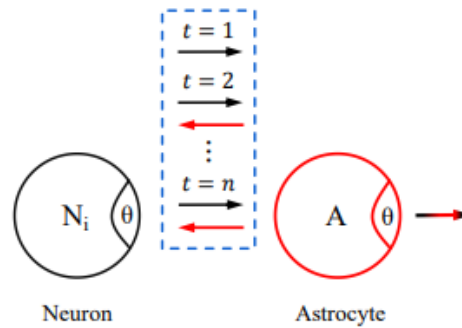


TEMPORAL
REGULATION
MECHANISM

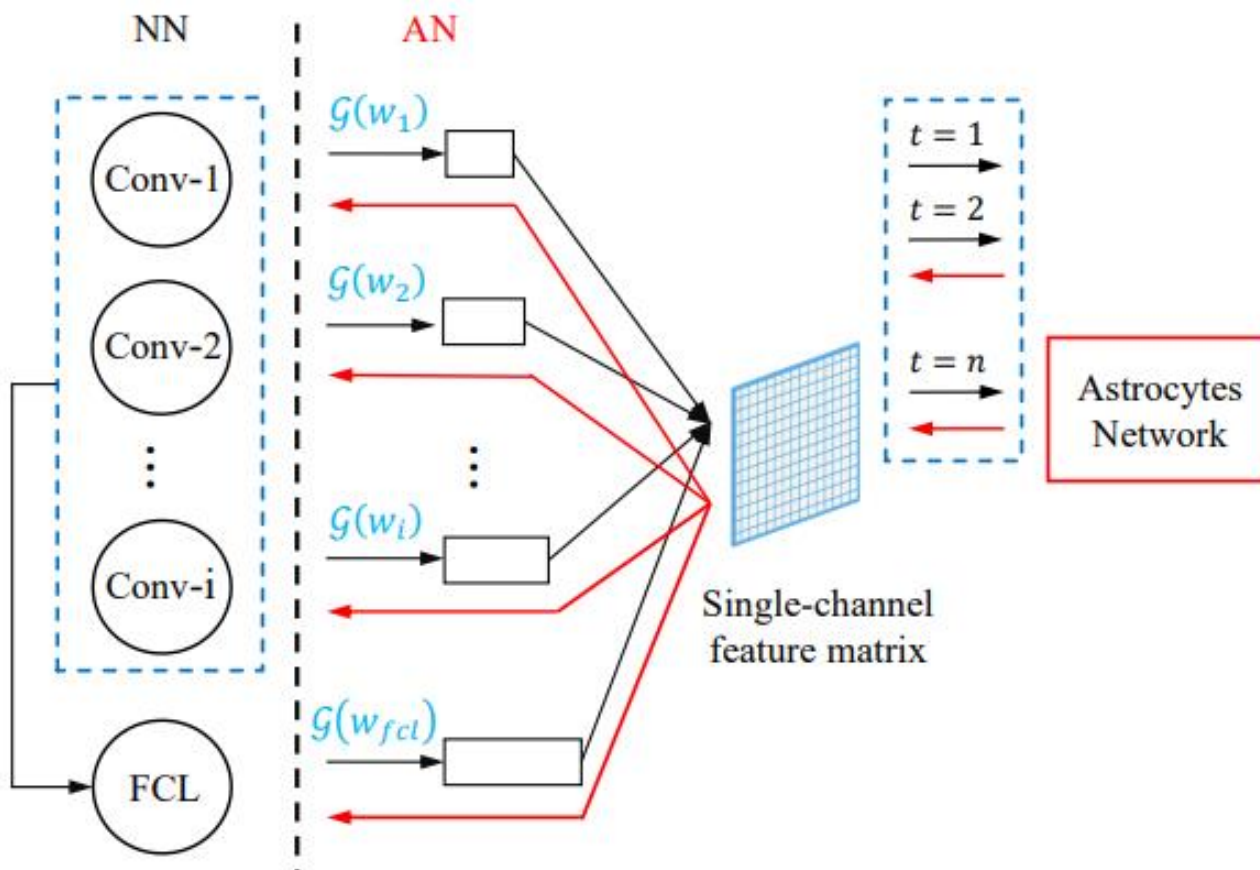


GLOBAL
CONNECTION
MECHANISM

→ Neurotransmitters: NT ← Gliotransmitters: GT → NT optimized by GT

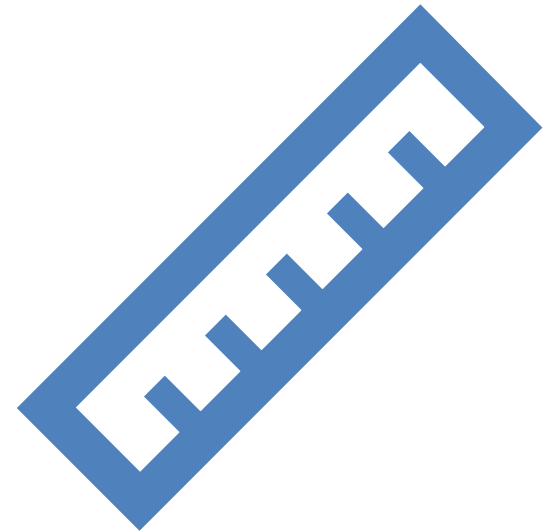


Architecture of AstroNet



Experimental Results

- Results on ImageNet, CIFAR, MNIST
- Superior performance in accuracy and efficiency
- Comparison with state-of-the-art methods



Conclusion

- Results on ImageNet, CIFAR, MNIST
- Superior performance in accuracy and efficiency
- Comparison with state-of-the-art methods



+

.

Key References

- Jose M Alvarez and Mathieu Salzmann. "Compression-aware training of deep networks." Advances in neural information processing systems, 2017.
- Gabriel Bender, Pieter-Jan Kindermans, Barret Zoph, Vijay Vasudevan, and Quoc Le. "Understanding and simplifying one-shot architecture search." International conference on machine learning, PMLR, 2018.
- Han Cai, Ligeng Zhu, and Song Han. "Proxylessnas: Direct neural architecture search on target task and hardware." arXiv preprint, 2018.
- Jia Deng, Wei Dong, Richard Socher, Li-Jia Li, Kai Li, and Li Fei-Fei. "Imagenet: A large-scale hierarchical image database." IEEE conference on computer vision and pattern recognition, IEEE, 2009.
- Li Deng. "The mnist database of handwritten digit images for machine learning research [best of the web]." IEEE Signal Processing Magazine, 2012.

Acknowledgments



Supported in part by the National Natural
Science Foundation of China [grant
number 82171965]



Liyuan Pan's work supported by the
Beijing Institute of Technology Research
Fund Program for Young Scholars

Thank you!

