Differentiating sparse matrix operations with reversible programming

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1 Project Information

1.1 Scheme Description

Sparse matrices are extensively used in scientific computing, however there is no automatic differentiation package in Julia yet to handle sparse matrix operations. This project utilizes the reversible embedded domain-specific language NiLang.jl to differentiate sparse matrix operations by writing the sparse matrix operations in a reversible style. The generated backward rules are ported to ChainRules.jl as an extension, so that one can access these features in an automatic differentiation package like Zygote, Flux and Diffractor directly.

1.2 Time Planning

This project is shipped by four (mostly) sequential stages:

(1) Implement low level operations by NiLang.

(2) Carefully test by CI and export chain rules into ChainRules.jl.

(3) Implement high level operations by NiLang and export chain rules.

(4) Add some use cases and enhance docs.

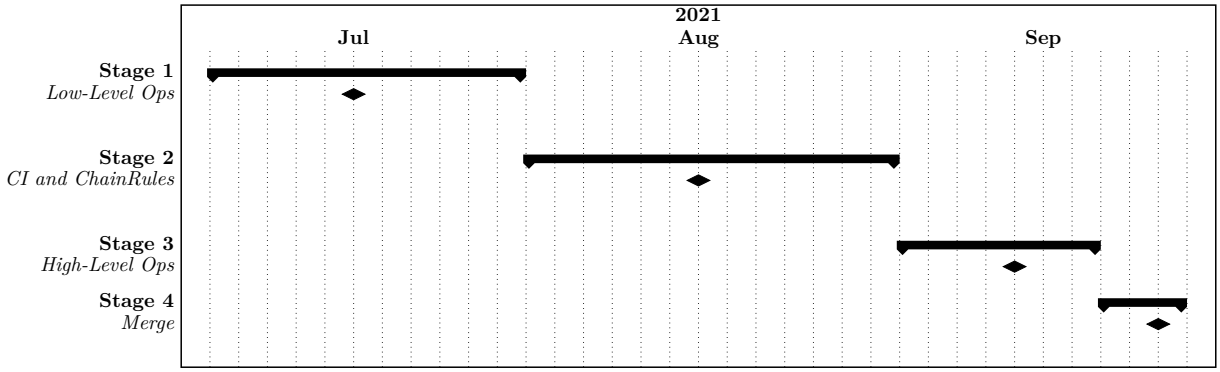
I list the timeline of this project in the form of Gantt chart.

(1) 1st Jul - 31st Jul Implement low level operations by NiLang.

(2) 1st Aug - 15th Aug Carefully test by CI and export chain rules into ChainRules.jl.

(3) 15th Sep - 20th Sep Implement high level operations by NiLang and export chain rules.

(4) 21st Sep - 30th Sep Add some use cases and enhance docs.



2 Project Summary

2.1 Project Output

(1) Differentiate sparse matrix operations in Julia base by rewriting the sparse functions in NiLang.jl. *Already completed.*

(2) Port the generated backward rules to ChainRules.jl as an extension.

(3) Release an open source julia package with test coverage over 85%.

(4) Add some use cases for getting a start.

2.2 Scheme Progress

You could demonstrate the current progress according to the original scheme and time plan

2.3 Problems and Solutions

You could focus on the summary and experience

2.4 Development Quality

You could give a self evaluation of development quality

2.5 Communication and Feedback with Mentor