Documentation for **Photonic Neural Computing Project**

Apr 10, 2023

Progress:

- Added non-linear optical activation layer functionality to the model.
- Converted the training/test datatypes to complex64, but getting another error now.
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Apr 6, 2023

Progress:

- Tried to train the model, but got the following error:
  TypeError: Input 'y' of 'Mul' Op has type complex64 that does not match type float32 of argument 'x'.
- Removed the `Softmax` activation layer but error still persisted.
- Go through the following:
  https://neurophox.readthedocs.io/en/latest/neurophox.tensorflow.html#module-neurophox.tensorflow.layers
- Error unsolved.

Apr 4, 2023

Tasks:

- Create a GitHub repo for this project and share it with Manoj and Rekha.
- Finish the toy model and keep in mind the physical implementation of the networks.
- Do a literature review on photonic processors/optical neural networks.

- Make some structural changes to the documentation: add paper summaries, reverse the chronology and add a table of contents.

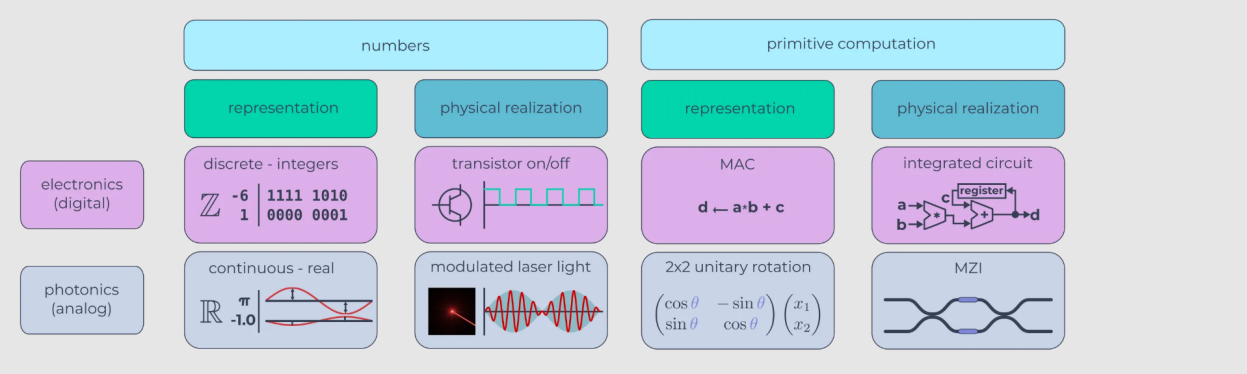
Apr 3, 2023

Progress:

- Read further about ONNs and how nanophotonics relates to matrix processing.
- Started coding the model. Reached a roadblock on how to use the neurophox layers correctly.

Notes:

- For a better understanding of implementation.



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Resources:

- https://medium.com/lightmatter/matrix-processing-with-nanophotonics-998e294dabc1
- https://github.com/solgaardlab/neurophox-notebooks

Mar 30, 2023

Progress:

- Faced a dependency issue with Pytorch after installing Neurophox.

  The operating system cannot run %1. Error loading "c:\ProgramData\Anaconda3\envs\ml-env\lib\site-packages\torch\lib\shm.dl

l" or one of its dependencies.

Created a separate environment for Neurophox and got it working.

- Read the documentation along with papers associated with Neurophox.

Notes:

- Photonic: optical computing elements that are implemented with integrated optical circuits, which can be fabricated using traditional semiconductor/oxide processes.
- Mach-Zehnder interferometers: Any matrix tile can be implemented with two MZI meshes and a column of attenuators (MZIs with one blocked input and output.

Resources:

- https://opg.optica.org/optica/fulltext.cfm?uri=optica-5-12-1623&id=403184
- https://arxiv.org/abs/1808.00458
- https://arxiv.org/abs/1909.06179 (*)
- https://arxiv.org/abs/1903.04579 (*)

Mar 28, 2023

Tasks:

- Play around with Neurophox and implement a toy model on the MNIST dataset.

Resources:

- https://neurophox.readthedocs.io/en/latest/
- https://github.com/solgaardlab/neurophox
