User Guide

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Description

We will explain how to use the proposed IWD-QUEEN and IWD-Transformer to solve the inland waterbody detection (IWD) problem. Note that the default results are computed using quantum neural network (QNN) (i.e., mode = IWD_QUEEN). To broaden accessibility for users of traditional computers, we also provide the non-quantum counterpart of our method (i.e., mode = IWD_Transformer).

Requirements (Tested under Python 3.12.2 and CUDA 12.1 under Linux OS)

Run the following commands in a terminal to create the **cygnss** conda environment:

```
conda create -n cygnss python=3.12.2 -y
```

Then, activate the environment:

```
conda activate cygnss
```

Install all dependencies:

```
pip install -r requirements.txt
```

Run the code

- Run the MATLAB program "demo.m" to see the quantitative and qualitative performances of IWD-QUEEN.
- For non-quantum version, modify the mode to IWD_Transformer in line 10 of "demo.m".
- If you want to run this code with your own data, first generate the dataset using the "main/collector" folder. Place the data in the "cygnss_data" folder, ensuring that the folder structure follows the following required format:

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```
cygnss_data/
    1/
        1/
            file1.nc
            file2.nc
            ...
        2/
            file1.nc
            file2.nc
            ...
        ...
        31/
            file1.nc
            file2.nc
            ...
```

Each month folder (i.e., "cygnss_data/1" folder) should contain date folders

(e.g, "cygnss_data/1/1" folder) of the date, and each date folder should contain the corresponding .nc files for that day. After placing the data and setting the desired region by modifying line 11, run "main.m"; the code will preprocess the data into the "collect_result" folder accordingly. Then, modify line 7 in "demo.m".

Training

The "main" folder provides two models: IWD_QUEEN and IWD_Transformer. Depending on your needs, you can choose to train the model using either:

- train_IWD_QUEEN.py
- train_IWD_Transformer.py

The training results will be saved in "main/train_result" folder, and the hyperparameters can be modified in "config.json". Then modify line 7 in "demo.m" according to the mode you choose.

Citation

If you find our work useful in your research or publication, please kindly cite our work:

- @article{lin2025quantum,

  title={Quantum-Driven Multihead Inland Waterbody Detection With Transformer-Encoded CYGNSS Delay-Doppler Map Data},

  author={Lin, Chia-Hsiang and Lin, Jhao-Ting and Chiu, Po-Ying and Chen, Shih-Ping and Lin, Charles CH},

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