Algal Bloom Forecasting

Classical ML Algorithms VS Deep-Learning models

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1. Background

- Algae negatively impact water quality
- Machine Learning: extensive research done
- Novelty: applying these methods to this specific problem

2. Methodology

- Linear Regression - easy to implement method as a baseline
- UNet - shows great promise in image segmentation
- Train on 25k samples
- Compare loss to determine accuracy
- Compare every 250 training samples

3. Experimental setup

Data preperation
- Pre processing data helps: clipping and normalizing
- Set NaN values to 0

Linear Regression
- Dataloader provides high dimensional tuples
- Input needs to be flattened to prevent model of several terabyte

Data loading
- Pre processing data helps: clipping and normalizing
- Set NaN values to 0

U-Net
- Adapt U-Net architecture by removing SoftMax
- Set output channels to 1 to predict value

Loss plots

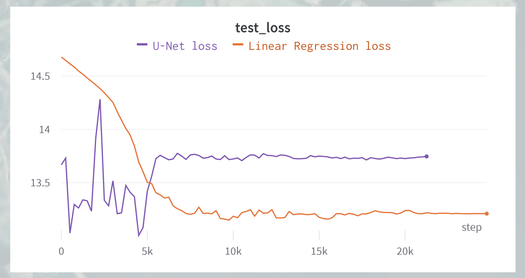

Fig. 1
U-Net / Linear Regression losses. x-axis: epochs, y-axis: loss. Every 250 samples the models are evaluated against test set

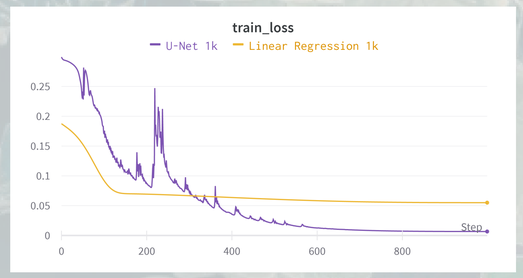

Fig. 2
U-Net / Linear Regression losses. x-axis: epochs, y-axis: loss. Trained on single sample to demonstrate overfitting.

4. Results

Fig 1:
- Linear Regression model converges as expected
- U-Net converges on high loss value
- U-Net has a lot of fluctuation and doesn't trend downward

Fig 2:
- U-Net trends to 0, which is good
- Validation that linear Regression also trends downward

5. Discussion

- Dataset likely not the issue due to Linear Regression model converging
- However, implementation also seems to be working since overfitting works
- Time constraint and software issues prevented further experimenting

6. Conclusions

- Hard to draw definitive conclusions
- U-Net shows lower losses at start of training, showing potential

7. Future Work

- Experiment more with different settings of U-Net
- Different models like the ConvLSTM model show potential
- Evaluate performance on other lakes

8. References

- Background image: Google (2022) Embalse de Paso del Palmar. Available at: https://www.google.com/maps/@-33.1037339,-57.3472018,24060m/data=!3m1!1e3 (Accessed: 13-12-2022)

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