Ocean Floor Contour Prediction

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Introduction

Background and Motivation

- Mapping the ocean floor is crucial
  - Navigation, marine resources management, predicting natural hazards
- High detail mapping (LiDAR or Acoustics)
  - Ships and AUVs
  - Expensive and Time consuming

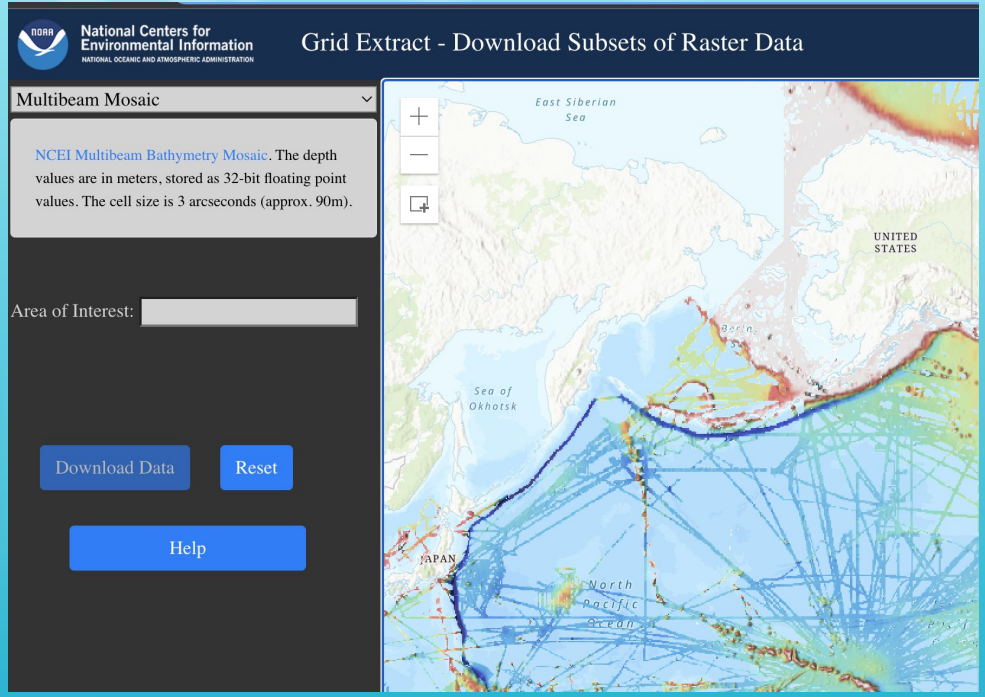
Related Work

- GEBCO Seabed 2030 Project (UN)
- Satellite Geoid Estimation (US Navy)
- BathyNet (Developing deep net - 2021)
- Mostly Unpublished

Methodology

Dataset

- Data from NOAA Seafloor Mapping
  - Mostly well mapped areas
- Depth as Values
- Done Manually
- 32k Images



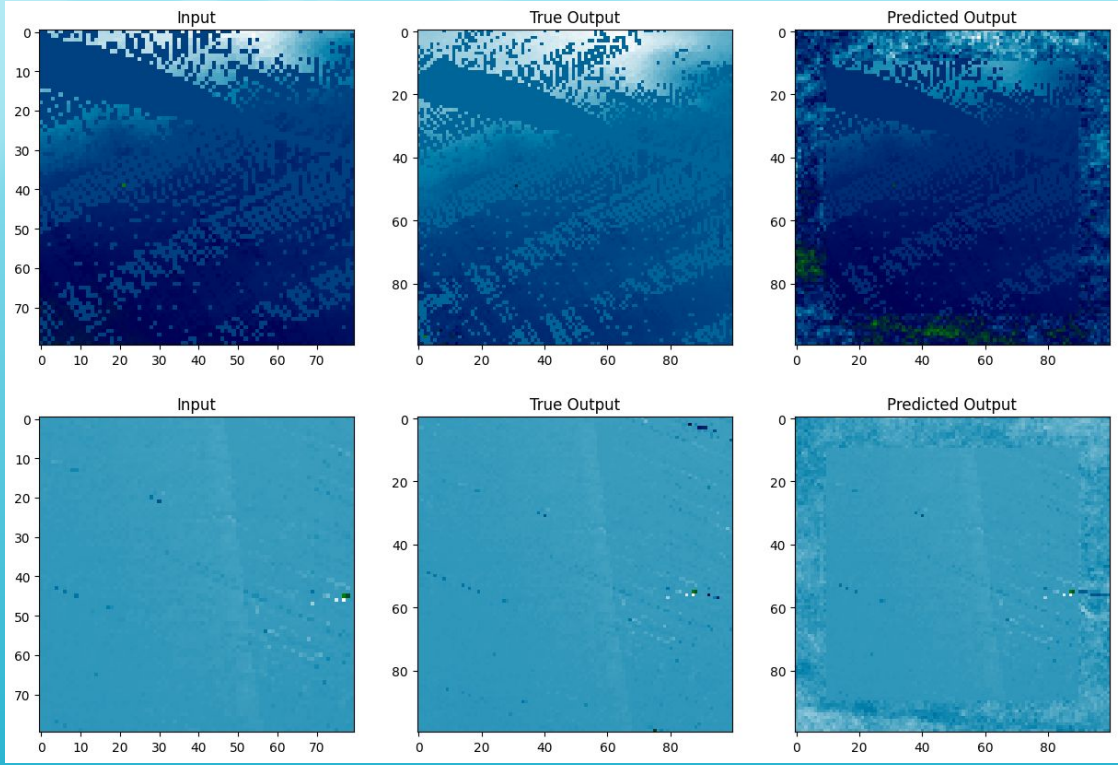
Predicting Contours

- Setup
  - Reassigned NaNs (unmapped areas) to image's average depth
  - Train on center and predict expansion
    - Input output
      80x80 → 100x100
- Baseline models
  - Linear Regression
  - Vanilla CNN
- Specialized models
  - U-Net (try to leverage identity relation)
  - Conditional GAN

Experiments

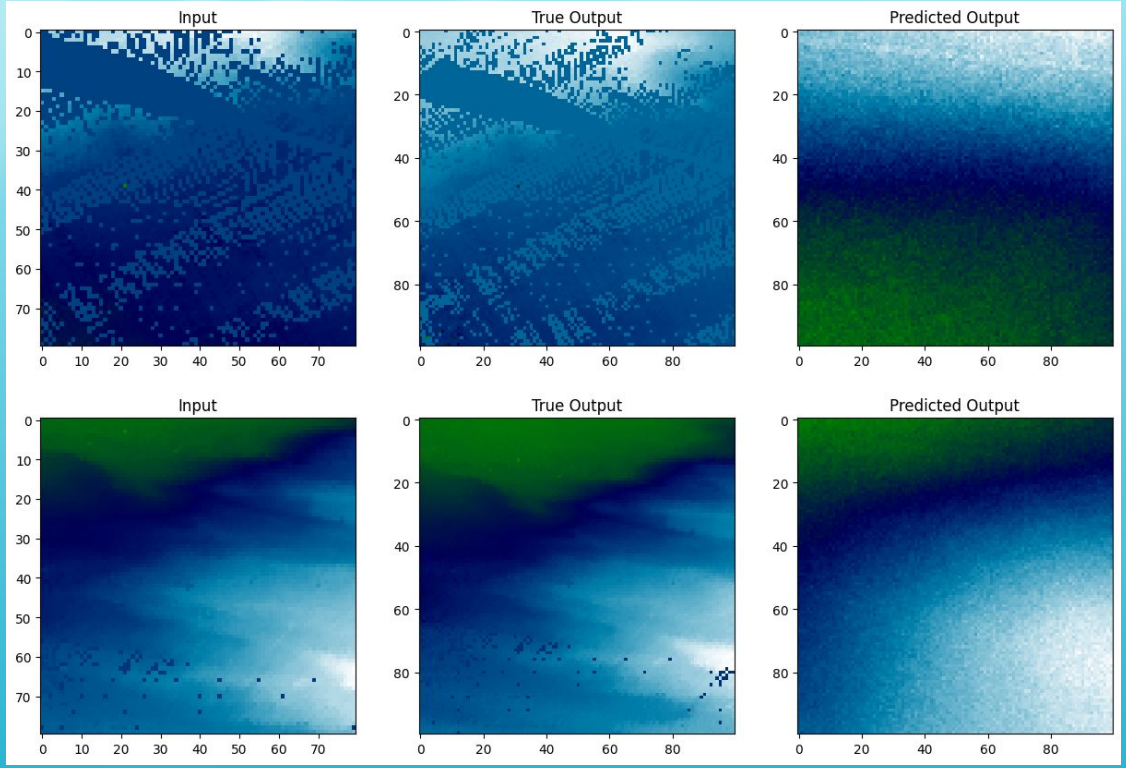
Experiments: Linear Regression

- Performance
  - MSE: 5.8×10^3
  - SSIM: 0.84



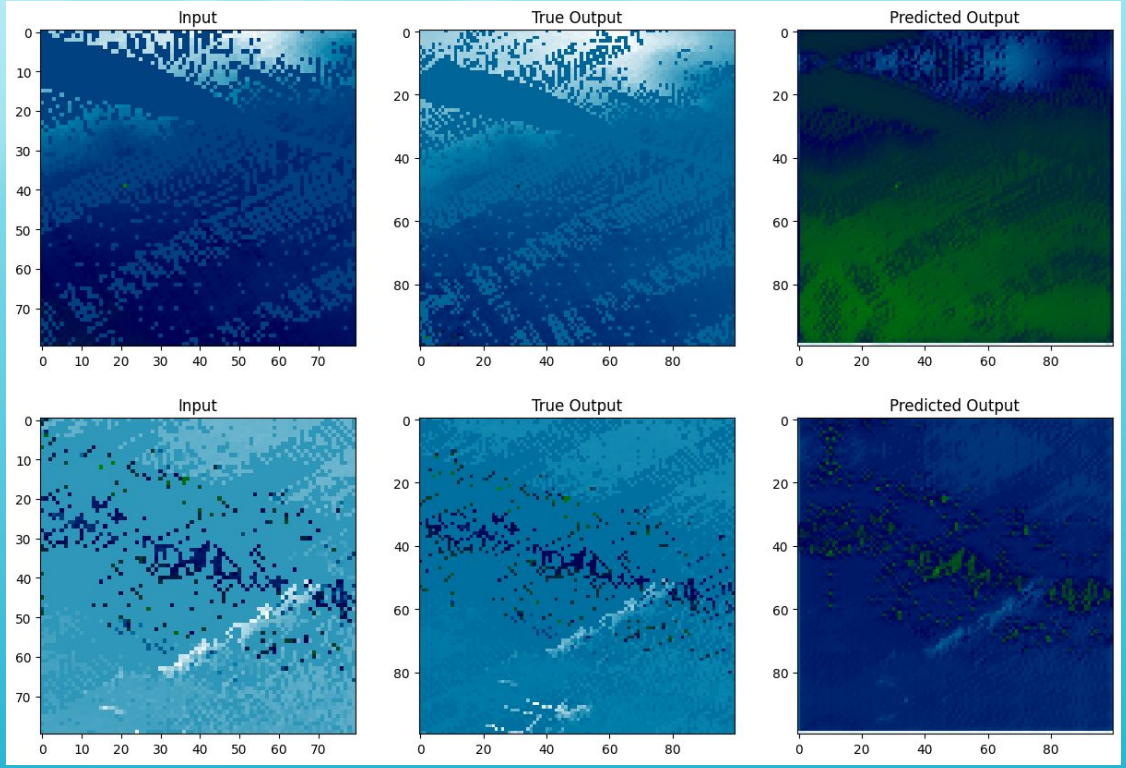
Experiments: CNN

- Performance
  - MSE: 1.1×10^{4}
  - SSIM: 0.70



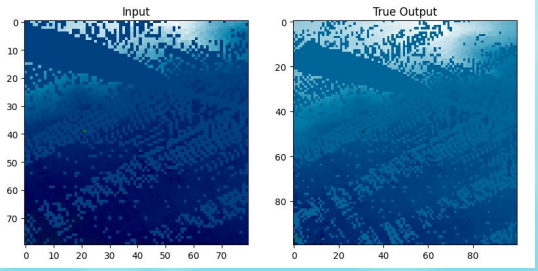
Experiments: U-Net

- Pretrained with VGG
- Performance
  - MSE: 6.0×10^6
  - SSIM: 0.85

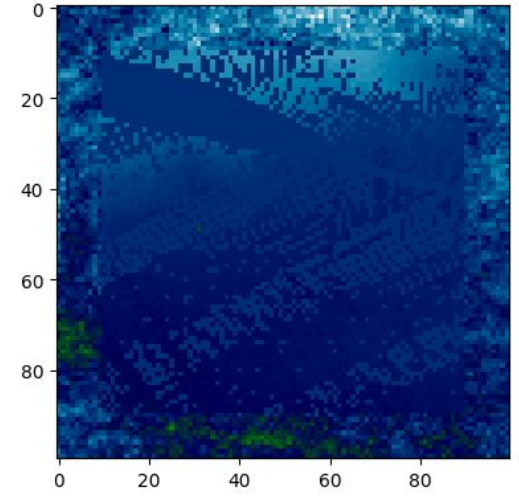


Discussion

Experiments: Comparison

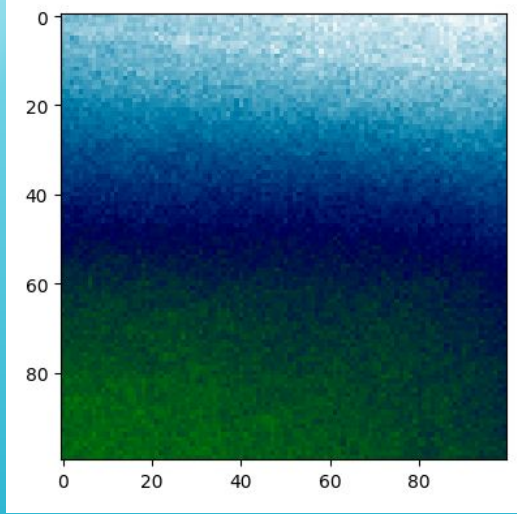


Linear Regression



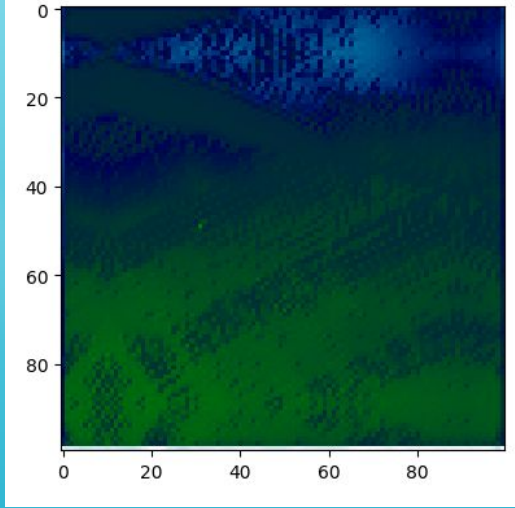
MSE: 5.8 x 10^3
SSIM: 0.84

CNN



MSE: 1.1 x 10^4
SSIM: 0.70

U-Net



MSE: 6.0 x 10^6
SSIM: 0.85

Conclusion

- Limitations
  - Difficult data collection
  - Training power
- Future work
  - Frame Prediction
  - cGan

Thank You!