Maritime Vessel Images Classification Using Deep Convolutional Neural Networks

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Introduction

Convolutional Neural Networks

Dataset - Data collection

- $E2S2 - Vessel$ dataset with images collected from ShipSpotting
  - From $16^{th} July, 2015 - 19^{th} July, 2015$
  - $150,000$ images of $51,500$ vessels
- Division: 80% in training, 20% in validation set
- Dataset refinement
  - No image belongs to more than one class
  - Images of same vessel pnly belong either to training or validation set but not both

Dataset - Class hierarchy

- ▶ ShipSpotting: 175 hierarchical classes
- ▶ E2S2-Vessel: aggregated to 35 classes

Dataset - Class hierarchy

- ShipSpotting: 175 hierarchical classes
- E2S2-Vessel: aggregated to 35 classes
- Top dominants:
  - cargo vesel
  - tankers
  - bulkers
  - container vessel
  - passenger vessel
- Image distribution is not uniform

Figure 2: Sample images from E2S2-Vessel dataset. Images within the same column belong to same class. From left to right: (a) Cargo vessel; (b) Container vessel; (c) Fishing vessel; (d) Military vessels; (e) Tugs
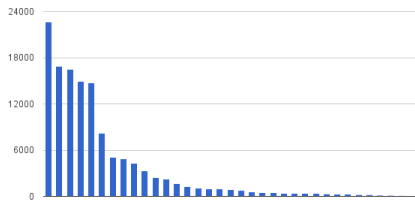
Dataset - Prepossessing

- After refinement: $130,000$ images in E2S2-Vessel
  - Training set: $80\% - 103,000$ images
  - Validation set: $20\% - 27,000$ images
- Squashing all images to size 256×256
- Converting all images to LMDB format
- Shuffling the order of images in both training and validation sets

Training - Hardware

- Commodity hardware specifications
  - CPU: Intel Core 2 Quad Q9550 @2.38GHz
  - RAM : 4GB DDR3
  - GPU : NVIDIA Geforce GTX 560 Ti with 2GB of memory

Training - Models

- Commodity hardware specifications
  - CPU: Intel Core 2 Quad Q9550 @2.38GHz
  - RAM : 4GB DDR3
  - GPU : NVIDIA Geforce GTX 560 Ti with 2GB of memory

Training - Process

- Commodity hardware specifications
  - CPU: Intel Core 2 Quad Q9550 @2.38GHz
  - RAM : 4GB DDR3
  - GPU : NVIDIA Geforce GTX 560 Ti with 2GB of memory

Results