



Image Segmentation Model Presentation

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Leaderboard 1st Place
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OUR APPROACH

ASSESSMENT

- Training Session Questions
- Exploratory Data Analysis



RESEARCH

- Transfer Learning (weights and architecture)
- Relevant Hyperparameter Space



PIPELINE

- Scalable/usable package - 17 model architectures
- Balancing augmentation

ARCHITECTURE

- Resnet50-Unet
→ Robustness, Low Memory, Fast Training, Extensive Open Source Use



REFINEMENT

- Systematic Hyperparameter Tuning
- Custom Layer Implementation
- Ensemble Predictions



THE WINNING MODEL



Mean ensemble of five Resnet50-Unet probability tensors with preprocessing, earth-mover distance balanced labels, decaying learning rate and early stopping.

Things that worked

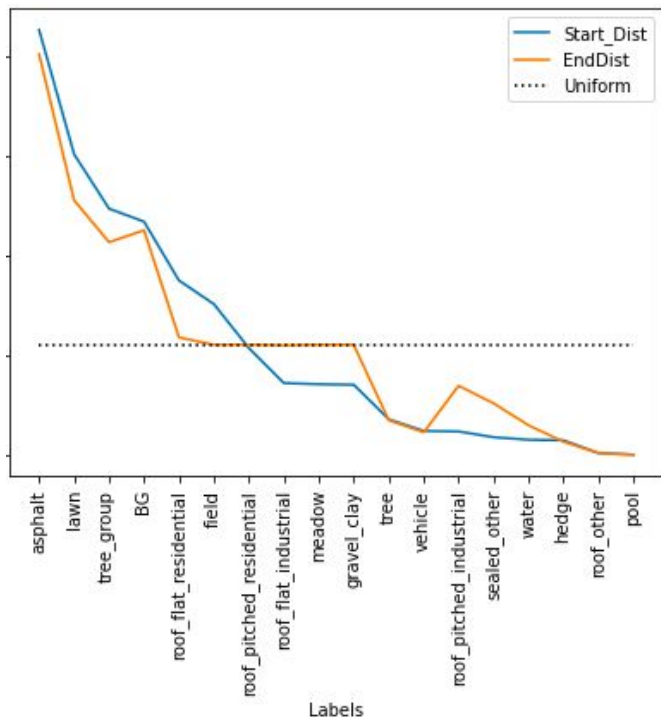
- ✓ Balancing Augmentation
- ✓ Unet Architecture
- ✓ Transfer Learning (ImageNet)
- ✓ Ensemble Predictions
- ✓ Jaccard Distance Loss

Things that did not work

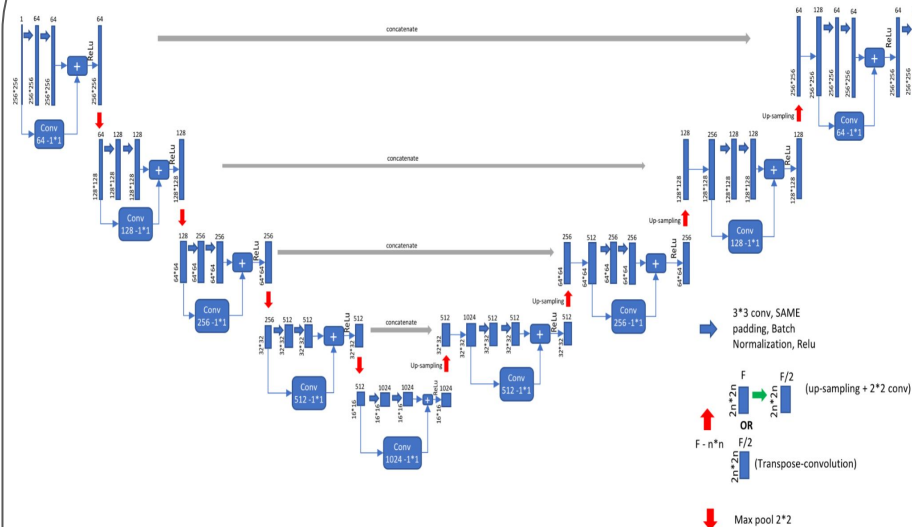
- ✗ Conditional Random Field Layer
- ✗ Dice Loss + Focal Loss
- ✗ EfficientNet
- ✗ Spacenet4 Weights
- ✗ Submodels

TECHNICAL DEEP DIVE

BALANCING AUGMENTATION



RESNET50 - UNET



<https://medium.com/@nishanksingla/unet-with-resblock-for-semantic-segmentation-dd1766b4ff66>

Data preparation

- Use-Case Tailored High Level API¹
- Helper Functions
- Submodels

```
full_count, dist_df_count = mlos(params, 'Count',  
write_balance=True)  
write_segment_data(params, 'train', True)  
  
model = Train_Model(params, loss_func=jaccard_distance,  
reduce_map=False)  
results = Predict_Model(params, model, test=True,  
ensemble=False)  
  
labels = pd.read_csv(params['label_scores'], sep=';')  
eval_df = evaluate(model, params, ensemble=False)
```

Model
Training and
Predictions

Evaluation

¹ Can be installed from <https://github.com/aboomer07/image-segmentation-keras>

SCALABILITY

EFFICIENCY

- Balancing augmentation implemented in high level API
- Distributed Computation (Keras)

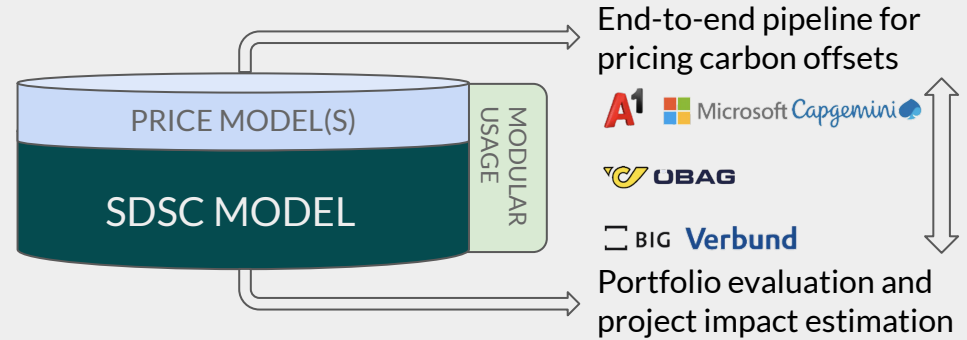
LABEL SET COMPRESSION

- Custom class specific evaluation shows poor accuracy on potentially duplicate labels
- Accuracy increase may outweigh information loss on reduced label set

RELIABILITY

- Strong robustness of test results

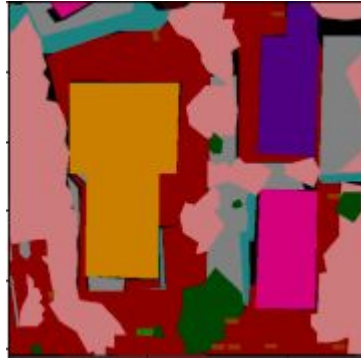
VERSATILITY



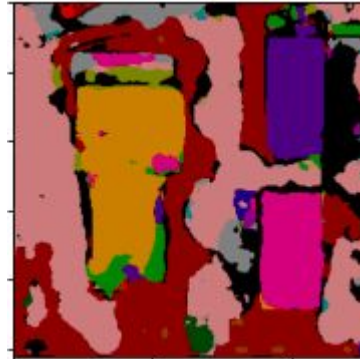
Image



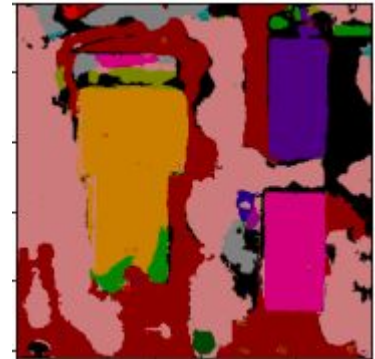
True Mask



Predicted Mask



CRF Mask



THANK YOU