We Can See Beach Litter

Week 1 Project Update

By David Cherney

For
Yamagata Prefecture
Ministry of Health


TrashNet's
TrashVision

Brief Outline

1. The Task
2. Model Development
3. Model Deployment

The Task

PEOPLES' REQUEST

Use tech to help beachlitter problem

- Max human cleanup efficiency
  - Where needed most?
- Spread aspiration
  - See beach without litter
- In the future possibly
  - Automate with robotics
  - Aerial surveys

01

Data

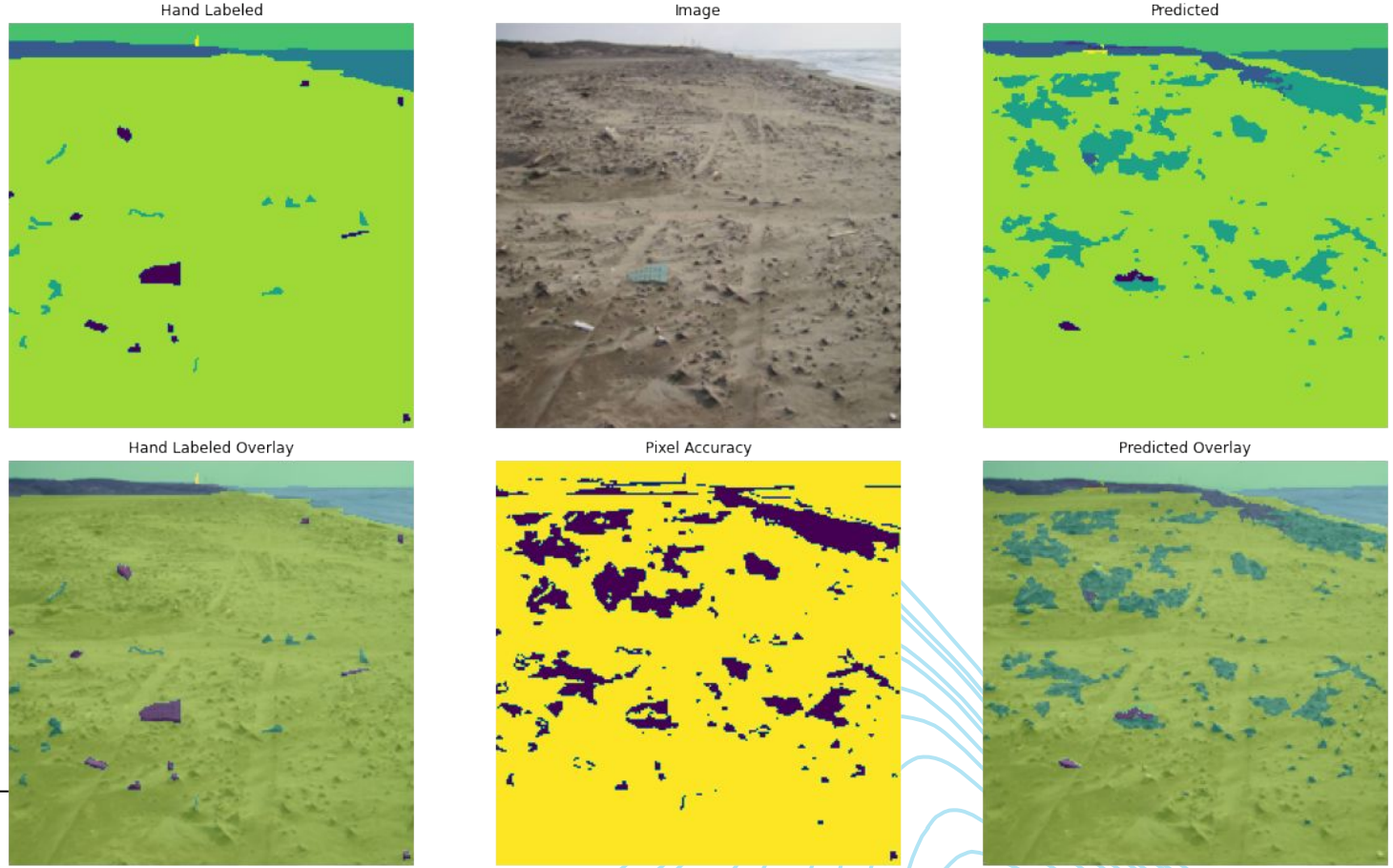
Image mask pairs

8 mask classes

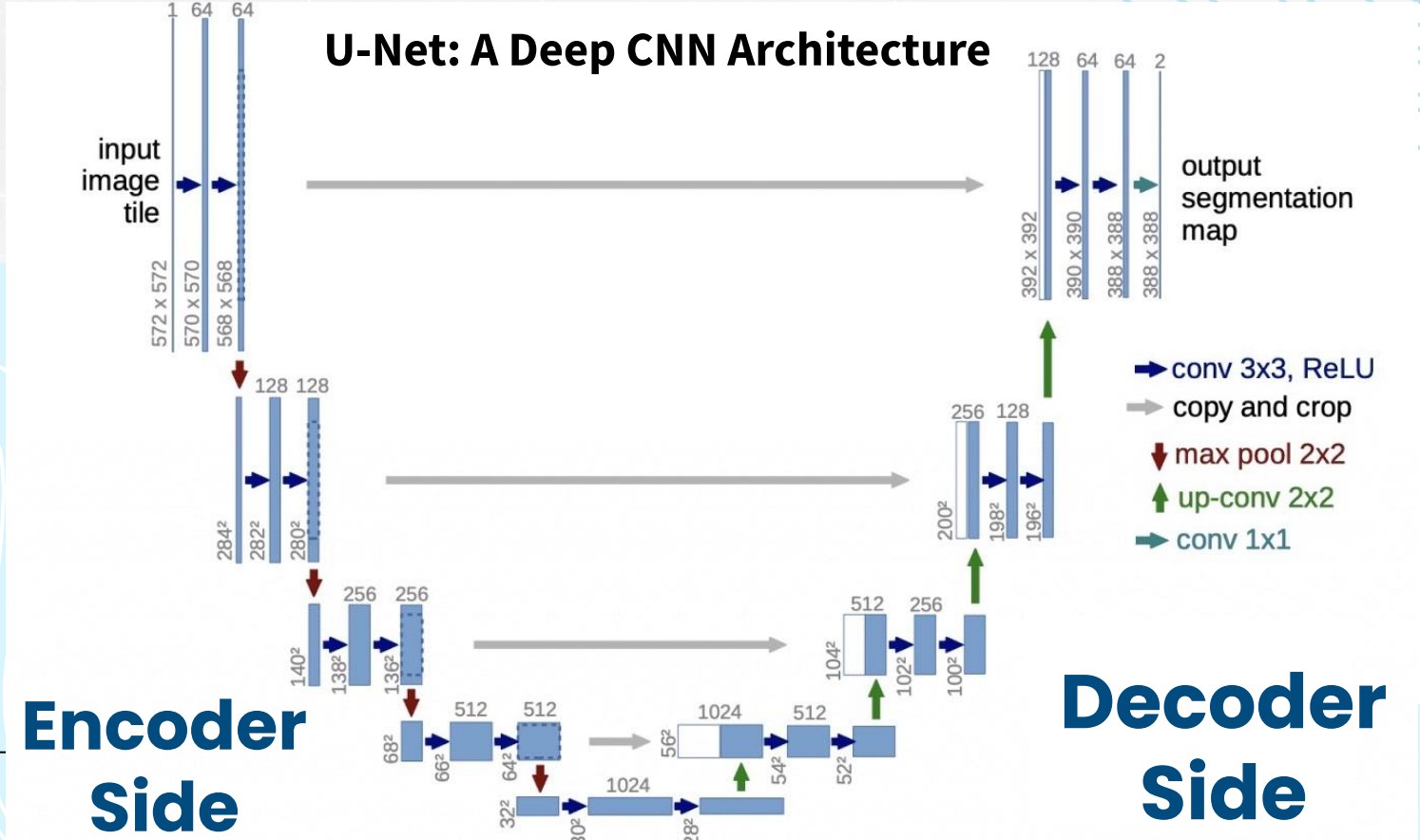
1	Artificial Litter	Red
2	Background	Green
3	Living	Light Green
4	Sea	Blue
5	Natural Litter	Purple
6	Sky	Light Blue
7	Sand Beach	Grey
8	Non Living	Brown

- 7,000 digital images from volunteers
- 3,500 hand labeled

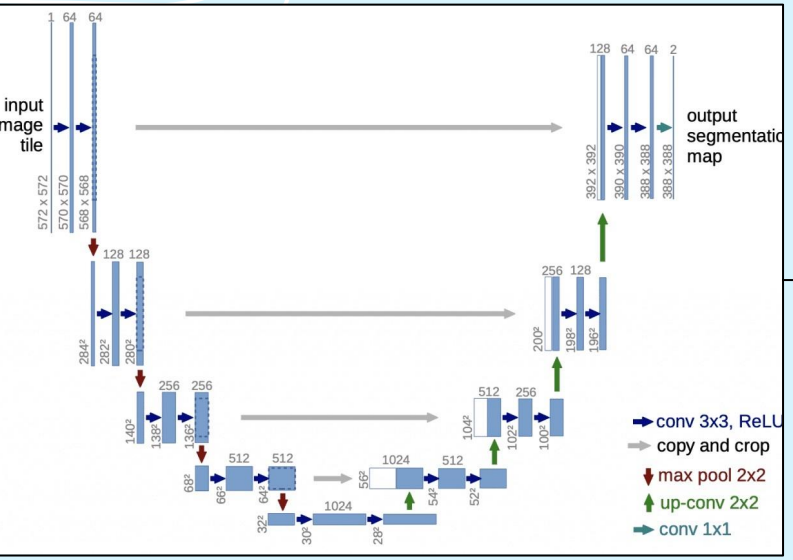
Metric: Pixel Classification Accuracy



2 The Model


U-Net: A Deep CNN Architecture
input image tile
output segmentation map
conv 3x3, ReLU
copy and crop
max pool 2x2
up-conv 2x2
conv 1x1
Encoder Side
Decoder Side

The Model's Details



pre-trained

Google MobileNetV2,
trained for 1,000 class classification
Output (1000,), parameters: 1,677,128

rewired

Nikhil Tomar modified for
2 class semantic segmentation
Output (224,224,1), parameters : 317,057

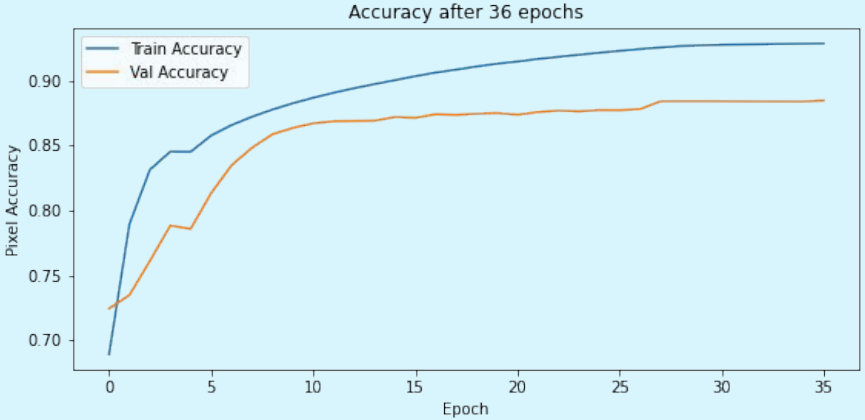
tweaked

David Cherney modified for
8 class semantic Segmentation
Output (224,224,8)

The Model's Iterations

(NB: early stop, patience = 5)

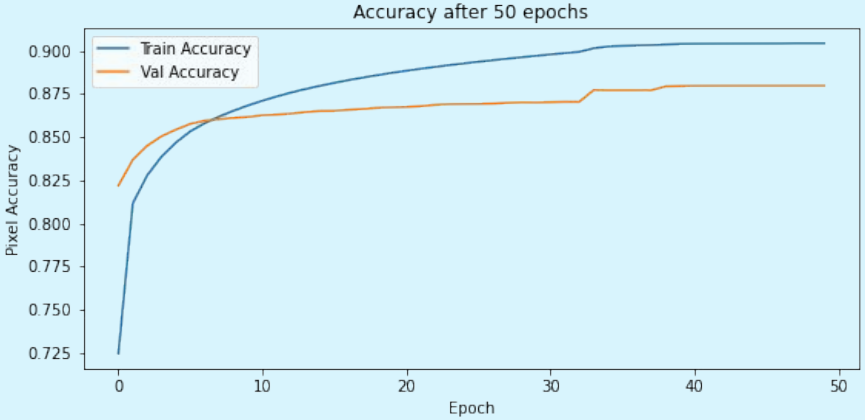
01



Train Full Network (409,144 params)
Expected: High variance

Test accuracy: **88.46%**
Train accuracy: 92.86%
Diff: 4.40

02



Train Decoder Only (317,176 params)
Expected: Lower variance

Test accuracy: **87.98%**
Train accuracy: 90.43%
Diff: 2.45

03

In the works: Train decoder only on randomly zoomed, rotated, & reflected images
Expected result: Much Lower Variance

03

Model Deployment

Delivering the model

to the people

Image credit: gettyimages.com

Phase 1

- Streamlit app for browser use is up

Hire General Assembly, DSIR1/24 graduates to

- Create a “This is(‘nt) a picture of a beach” categorical classifier for filtering
- Host database of uploaded beach images

More volunteers to

- Hand Label Masks, train model on 10,000+ images

Phase 2

Shrink the model

for low latency use on mobile devices

Original size: 8.4MB

Pruning

delete parameters ≈ 0

Quantizing

Store remaining #s in Uint8 format

Estimated model size:

110kB

Phase 3

Hire **another** General Assembly, DSIR1/24 graduates to

- Build TrashNet-Mobile app
- Include *Remove Trash* button to delete trash segments and smooth.
- Include map of image locations
- Automate beach cleanup location recommendations
- Scale image database to millions

Beware of **concept drift**

Stay Relevant

As image tech evolves,

and it evolves… fast

our models will need to evolve

Thank you!

And here-here to clean beaches !!