



How can we (and data science) help the environment?



Remember:
we can all make personal choices too.
E.g. buy packaging free where possible



Recent experience

Solar can be a renewal distributed power source

Many roofs without solar

Help automate the solar installation process

CANVA??

Installations can be complex

Satellite image data

ML and Deep Learning

101 other ways not explored here.

Many other factors

Use available technology to massively push solar installations

Rising electricity costs

Enough solar energy hits the Earth every hour to meet all of humanity's power needs for an entire year.

Save:
Carbon Cost

Drive:
Job creation
Change by example



What is the real ask here?
Outcomes?
Data?

FOCUS:

Take care

How can we slip through complexities?

Greater roof size is more efficient

Break down analysis into stages

Outcomes:

Roof space suitability

Where is the best installation? ROI?

Potential carbon savings & cost savings

2a. Existing Solar panel installations

2b. Weather & % sun

2c. Orientation (pitch)?

1. Roof classification - per pixel

Satellite data is available, polygon data can help train

Looks complex, simplify?

Satellite data is available, polygon data can help train

Stage 1
MAXAR Santiago:
Datum matched polygons and 256 colour layered 30cm satellite

OUTPUT @ DEMO:
1: imagery
2: data download

Stage 2
OSM etc London
OSM Polygons & Freely available satellite data

2 stages

Found data:

MAXAR:
Precision3D
Telco suite

OSM: Huge free resource of map data

Other free Satellite data: ??





What data?

data size

train on OSM cut outs

Train: LONDON boroughs

Validate: Santiago MAXAR?

google earth engine - complex, but API
earthengine.google.com

data from a good paper?

test on Bristol

google scholar: image segmentation roof deep learning

Found data:

MAXAR:
Precision3D
Telco suite

OSM: Huge free resource of map data

Other free data: ??

need research paper level labelled data to secure effectiveness

Stage 1:
Maxar or other specific well labelled data (tbc)

Stage 2
OSM etc London

OSM Polygons & Freely available satellite data

Approach



What about
soft skills?

Collaboration

Teamship

Communicate

...

Be
trustworthy

...

Remember

AGILE

Sources:

[Agile
Manifesto](#)

[Agile
Principles](#)

[How to
best
learn
Agile](#)





How does the demo work?

INPUT @ DEMO:

A: postcode area (e.g. se23)
OR
B: London borough



Heatmap:
denser colour
= better
[solar ROI or
larger roofs
or etc]

OUTPUT @ DEMO:
1: imagery
&
2: data
download

1
Roof
space
suitability

2a
Potential
carbon
savings &
cost saving

2b
Where is
the best
installation?
ROI?

Additional
data on ROI
or carbon
saved etc if
we have time

Cached
pre-tested
results if
need be

Scaled live-
processing
if plausible

By
postcode
group
(London)

London is
an
assumption
for now!

By
London
Borough





And the
model?

U-Net model

https://github.com/google/earthengine-api/blob/master/python/examples/ipynb/UNET_regression_demo.ipynb

Metric

Model for
segment:
U-Net

IoU loss
function

Intersection over Union loss

The accuracy metric can sometimes provide misleading results when the pixel class (PV) presence is small within the image, as the measure will be biased in mainly reporting how well the true negative cases (no-PV) are identified. A more suitable metric for image segmentation is the Intersection over Union (IoU), which consists of computing the common pixel area between the prediction and the ground-truth and dividing it by the area of union.

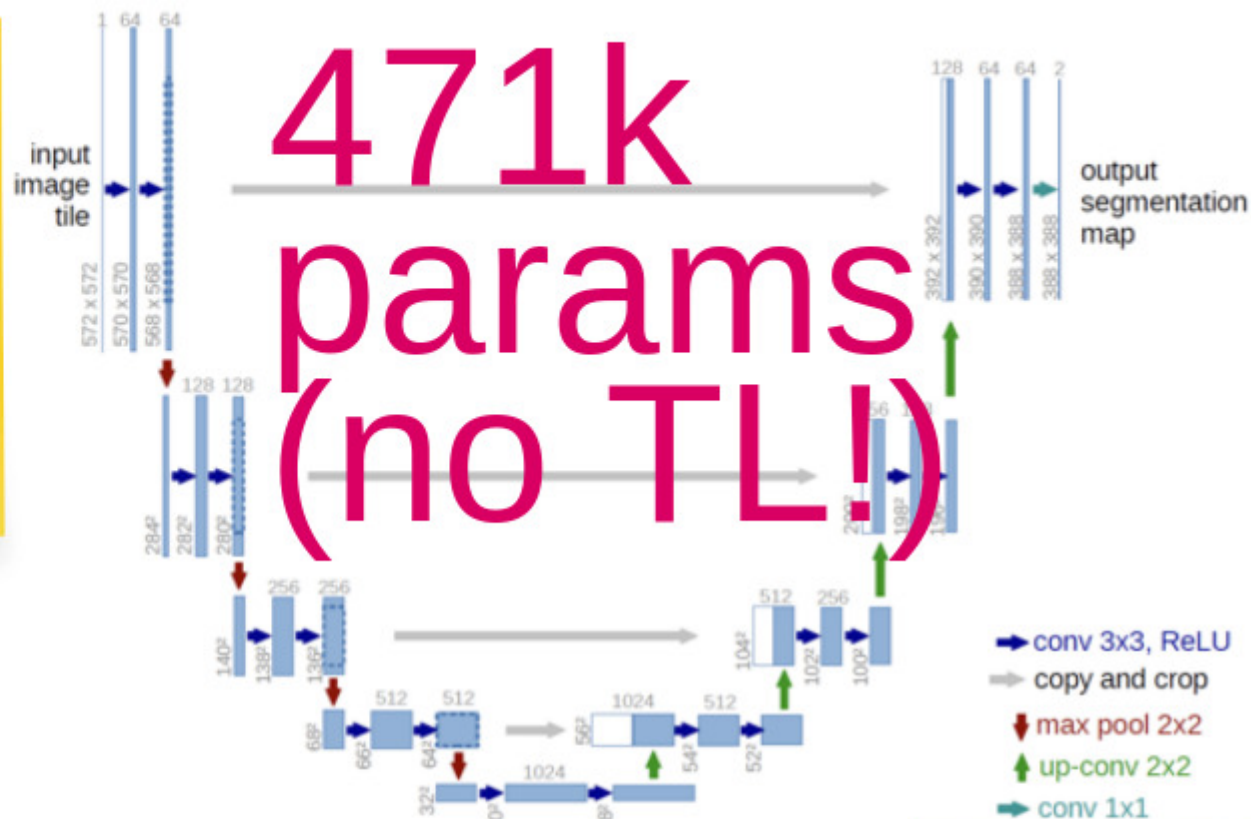
<https://iopscience.iop.org/article/10.1088/1742-6596/1343/1/012034/meta>

F1 on Precision-Recall curve

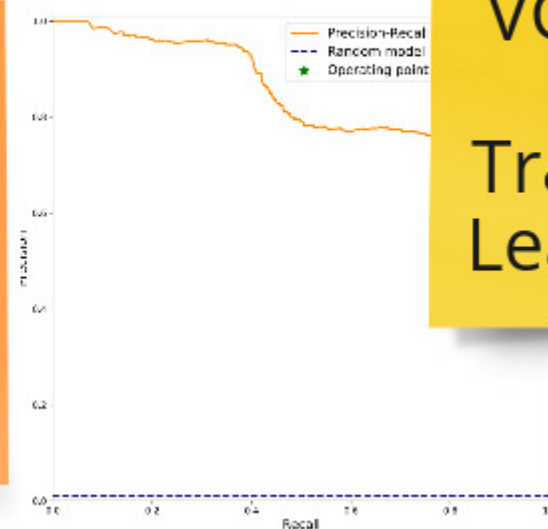
Figure 2 (right) also measures our final model skill in terms of Precision-Recall (PR) curve, more suitable than ROC curves for tasks exhibiting a large class imbalance, as in the case of our binary classification problem (PV vs no-PV pixels). Based on PR curve, we chose the probability threshold of the prediction array to be 95%, resulting in a F1 score (harmonic mean of precision and recall) of 0.8. This gives an IoU score of 0.64 and an accuracy of 0.94.

<https://iopscience.iop.org/article/10.1088/1742-6596/1343/1/012034/meta>

471k
params
(no TL!)



VGG-16
for
Transfer
Learning





How will we
work
together?



Sources:

Teamship -
England
Rugby
World cup
squad



Agree our own
set of rules

stick to
conventionally
used folders in
our repo (e.g.
notebooks,
packages, data
etc)

use a
.gitignore file
that covers....
*.csv
*.tiff

git commit
OFTEN
git commit
comments
short and
clear

2 x
requirements.txt
for MAC &
Windows

TDD

Zen of
Python

Remember

ENJOY!

arrive
when you
said you
would

be kind and
col

more?