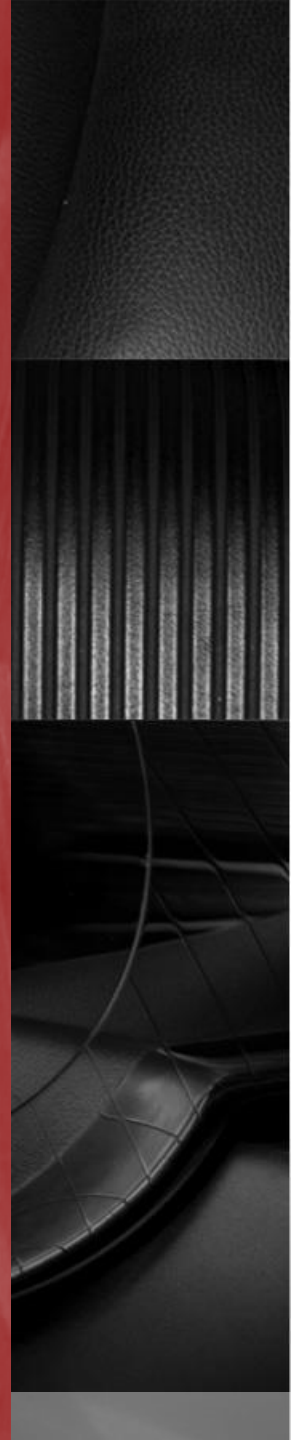
IMAGE SEGMENTATION DEEP LEARNING

SEGMENTING THE CARVANA IMAGE DATASET



Check GitHub repository: yej117/Image_Segmentation_Deep_Learning

PROJECT SUMMARY:

- For this project, we attempted the task of image segmentation through using a dataset from Kaggle; specifically the Carvana Masking Challenge.
- The idea comes from the interests of knowing how to segment the object from the image. The datasets from the Carvana Image Masking Challenge is based on high quality car photos and the backgrounds of the images usually contain similar colors as cars.

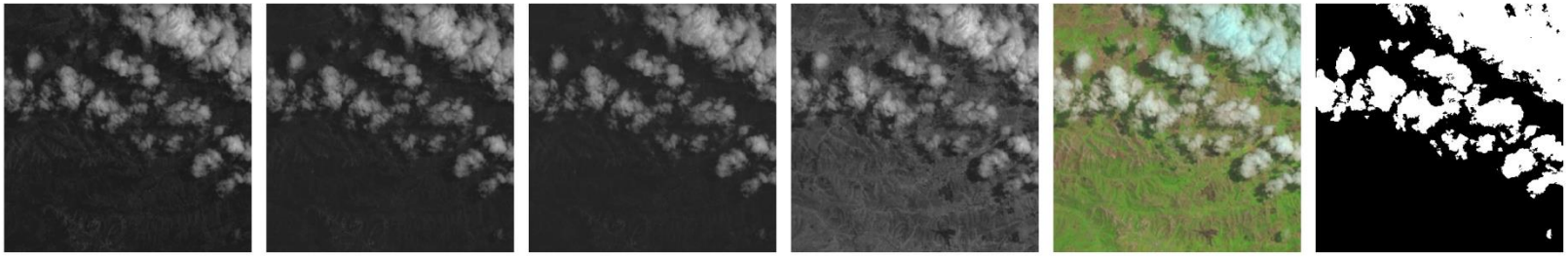
WHY THIS DATASET:

- We first wanted to gain some basic understanding of image segmentation.
- Car more easily separated from background – i.e. we have a somewhat more neutral background.
- Once we have gained this basic understanding:

  Perhaps then move on to more complex tasks like cloud segmentation.

  This is a more complex task as there are more background features/colours.

A bit too complex for now – but someday!



STORY:

- We initially wanted to do image segmentation on a cloud dataset.
- This may have been useful in many applications such as in agriculture.
- We found this a bit too challenging as beginners.
- We decided to first try something a bit simpler as practice.
- This led us to the Carvana Image Segmentation Challenge.

MORE ABOUT THE DATASET:

- The dataset contains a large number of car images (as .jpg files). Each car has exactly 16 images, each one taken at different angles.
- The dataset provided by the challenge was separated into different folders and files as the following table (information from the Kaggle challenge website)

Table 1: Dataset information

file or folders	descriptions
train/	the training dataset images
test/	the test dataset images - the challenge is to predict the mask for each of the image inside
train_masks/	the training set masks in *.gif format
train_masks.csv	run-length encoded version of the training set masks
sample_submission.csv	show the correct submission format
metadata.csv	basic information of about all the cars in the dataset. Note that some values are missing

TOOLS

- Jupyter Notebook
- Google Colab
- GitHub
- Google Drive
- Carvana Masking Challenge Dataset from Kaggle.


OUTLINE

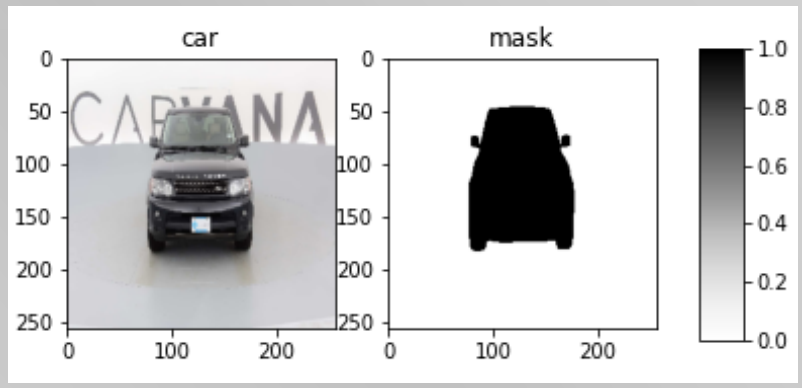
- Data Preparation
- Network Architecture U-Net: developed by Ronneberger et al., 2015
- Results: Model preformance
- Examples from Mercedes-Benz website
- Story Behind
- Future Work

DATA PREPARATION (1/2)

1. Upload the dataset to a shared google drive
2. A glimpse of the dataset

DATA PREPARATION (2/2)

3. Resize the image into (256, 256)



4. Data augmentation with `ImageDataGenerator` the following parameters

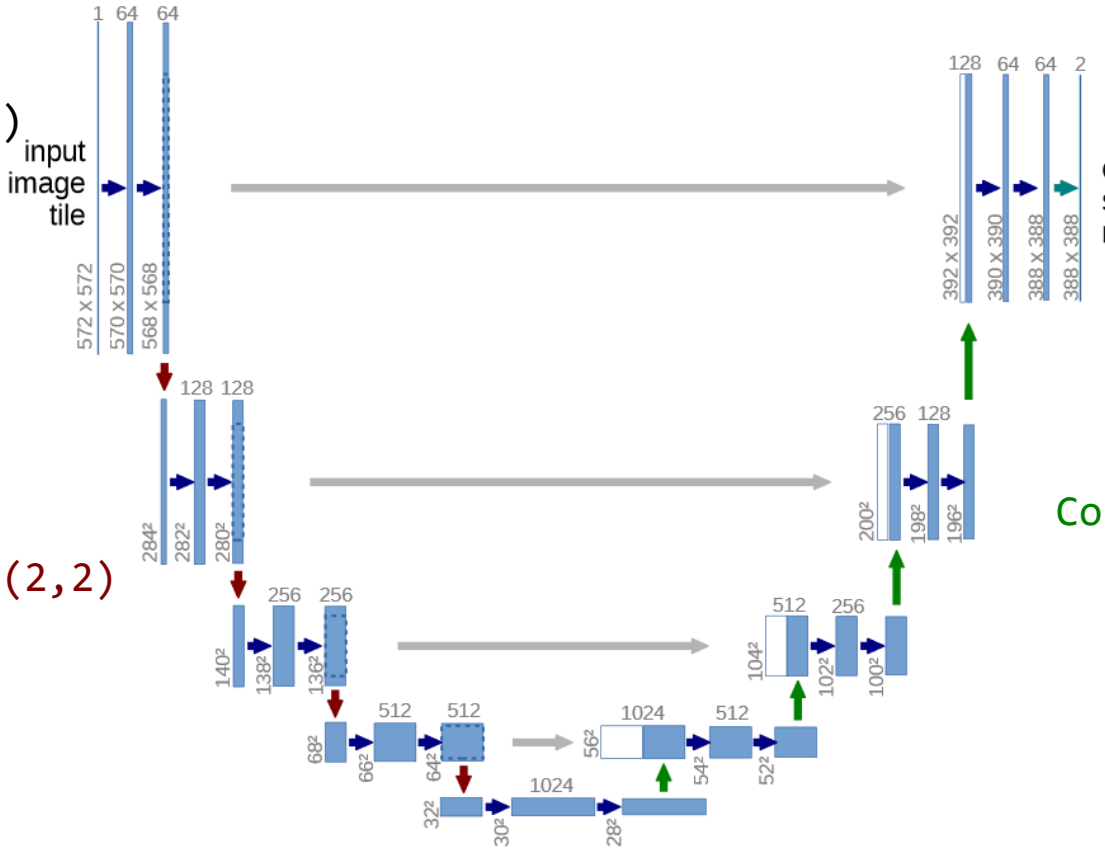
`rotation_range`	`90`
`width_shift_range`	`0.2`
`height_shift_range`	`0.2`
`shear_range`	`0.2`
`zoom_range`	`0.2`
`horizontal_flip`	`True`
`fill_mode`	`'nearest'`

NETWORK ARCHITECTURE: U-net (Ronneberger et al., 2015)

- An end-to-end fully convolutional network with no dense layer
- Accept image of any size
- Especially useful for image segmentation tasks
- Works through repeated applications of convolutions, each followed by a rectified linear unit (ReLU) and max pooling (up-sampling)

NETWORK ARCHITECTURE: U-net

Input:
(256, 256, 3)



Conv2D (3,3)
Conv2D (3,3)
MaxPooling2D (2,2)
⋮

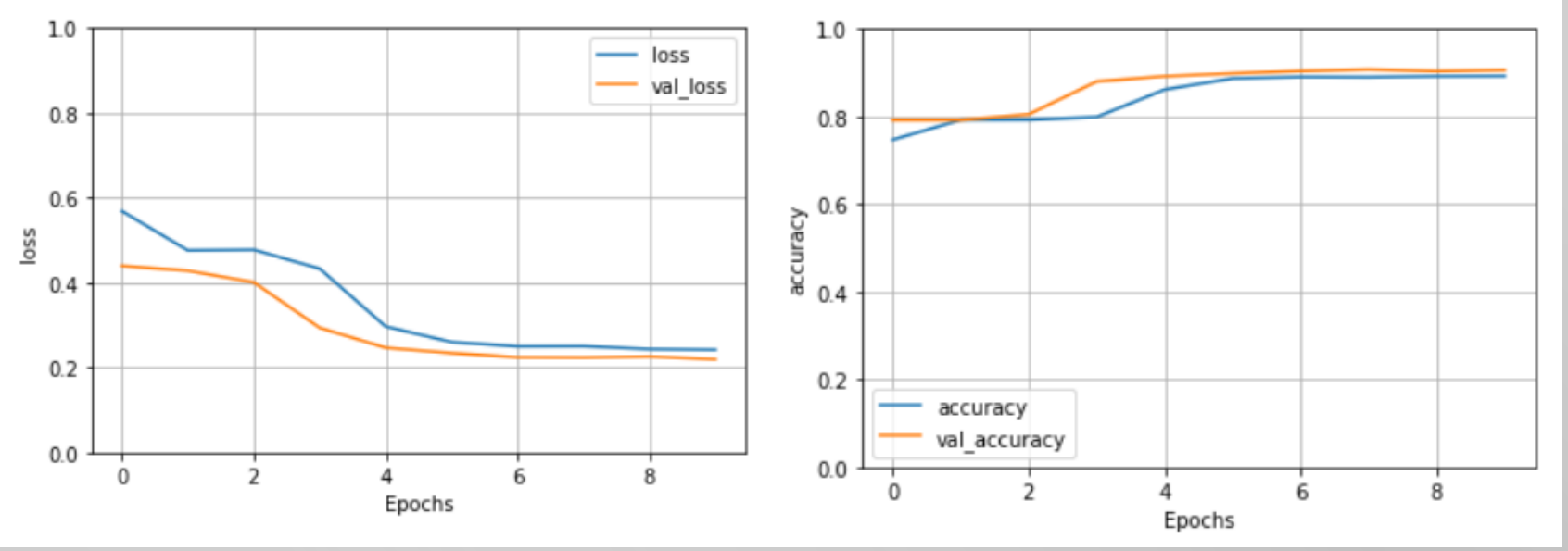
Conv2D (3,3)
Conv2D (3,3)

Output layer:
Conv2D (2,2)

⋮
Conv2D (3,3)
Conv2D (3,3)
concatenate
Conv2DTranspose (2,2)

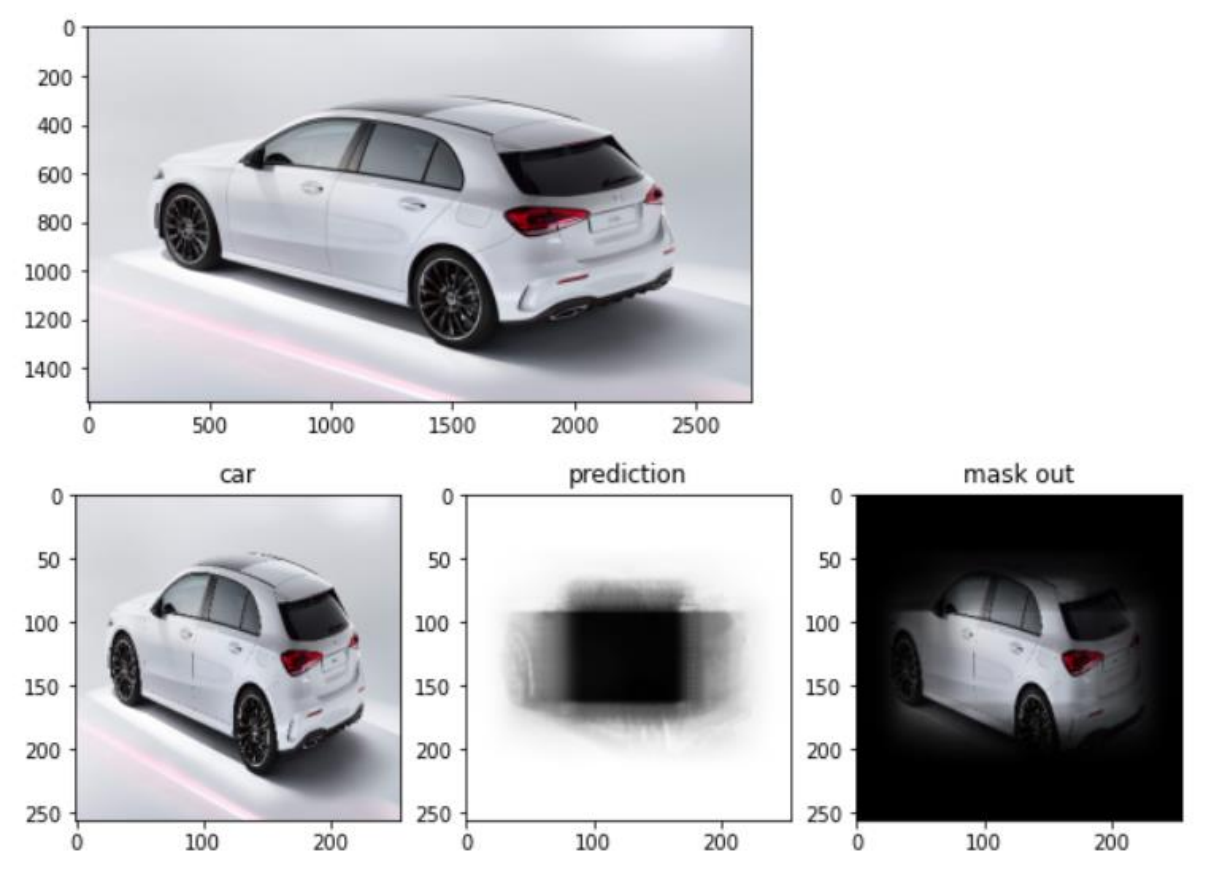
(ref: Ronneberger et al., 2015)

RESULTS

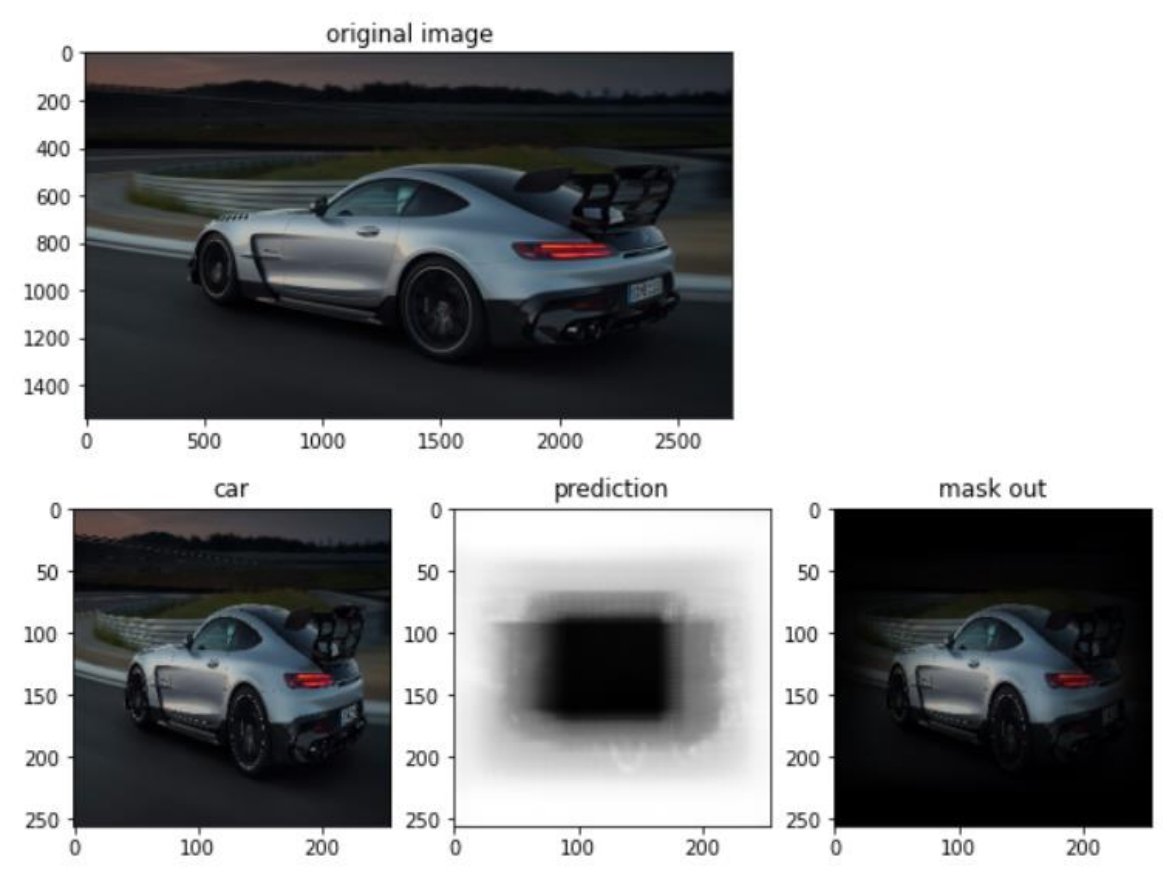


Test dataset
loss: 0.2288
accuracy: 0.9013

EXAMPLES (1/2)



EXAMPLES (2/2)



FUTURE WORK:

- Using image segmentation for estimating cloud cover – which may be a great application in many fields such as rain and related weather prediction!

THANK YOU!