Superconverging a zero deforestation model

Schneider Electric European Hackathon

Group: AI bloopers
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Challenge

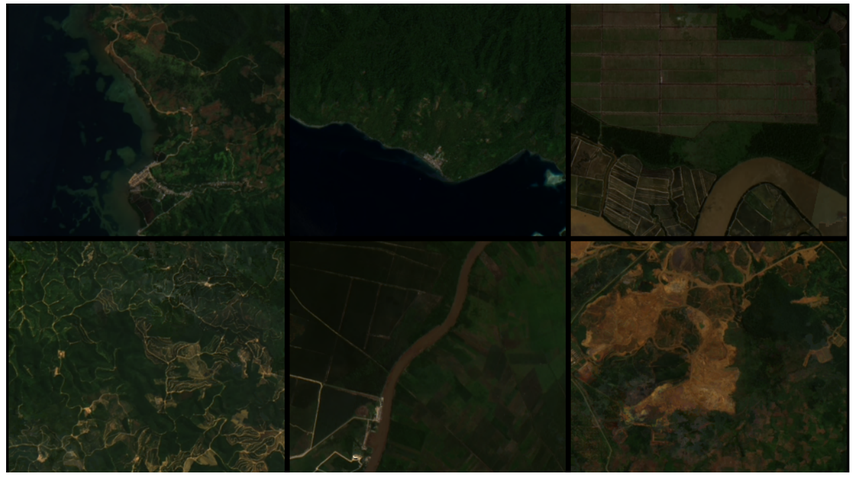
Deforestation occurs for a variety of reasons and has many devastating consequences.

Proposal: Via CNNs, we use satelite images of the earth's surface to detect areas in the midst of deforestation and prevent its expansion.

How we did it?

The first tests were on images alone, but with the EDA, we quickly realized that using metadata could provide benefits due to its richness of information.

Therefore, a combination of **satelite images** + **metadata:**



Samples of Image used

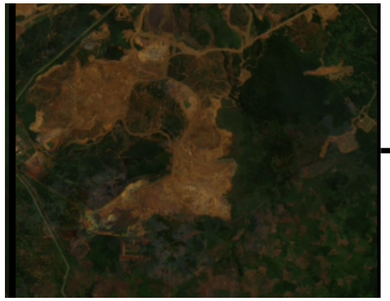
(credit: https://nuwe.io/)

OneHot encode for the year
+ latitude and longitude

Tabular data

Pipeline

Input image as .jpg



- Optimizer: AdamP
- Max Lr: 3e-4
- Scheduler: One Cycle LR

CNN Models

Input metadata

- Longitude
- Latitute
- OneHot encoded year

Linear (18,512)
BatchNorm(512)
DropOut(0.3)
Linear(512,128)
BatchNorm(128)

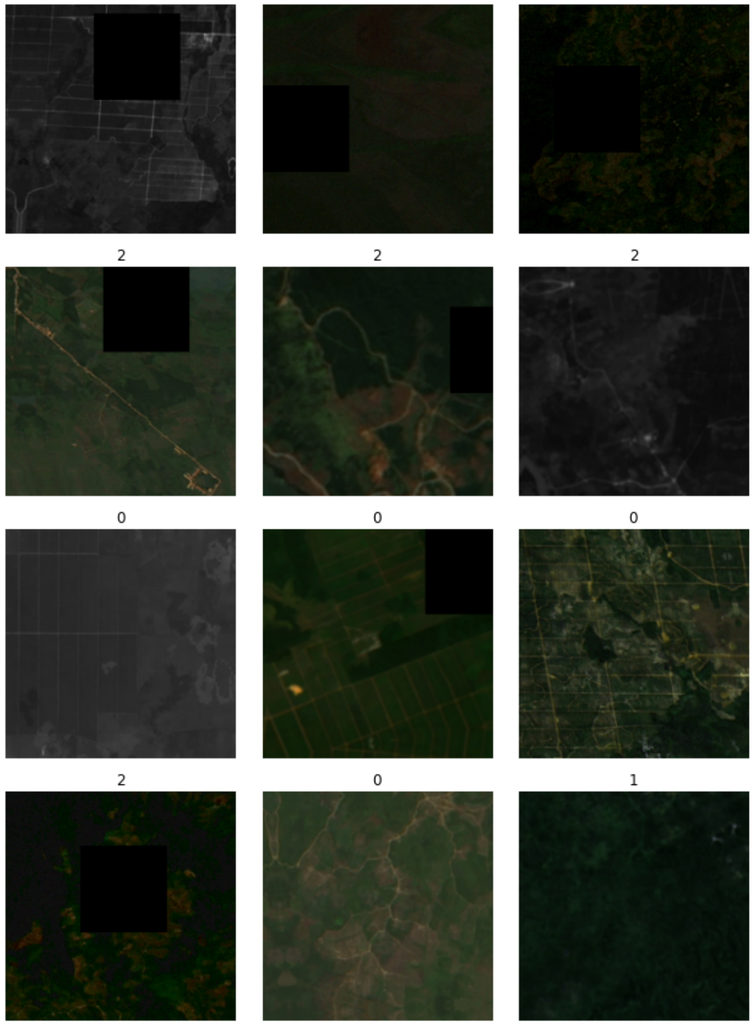
Concat

TTA

Ensemble +Thresholding

.json prediction

- TTA x 10
- Batch size: 32
- 0.9/0.1 train test split
- 10 Epochs



Albumentations

Data Augmentation

- RandomResizedCrop
- Rotate
- Flip
- Affine
- RandomBrightnessContrast
- One of
  - ColorJitter
  - HueSaturationValue
- ToGray
- ShiftScaleRotate
- One of
  - Blur
  - GaussNoise
- IAASharpen
- Cutout

Taking inspiration from Contrastive Learning the composition of simple augmentations for learning good representations, gray and color distortions were adopted.

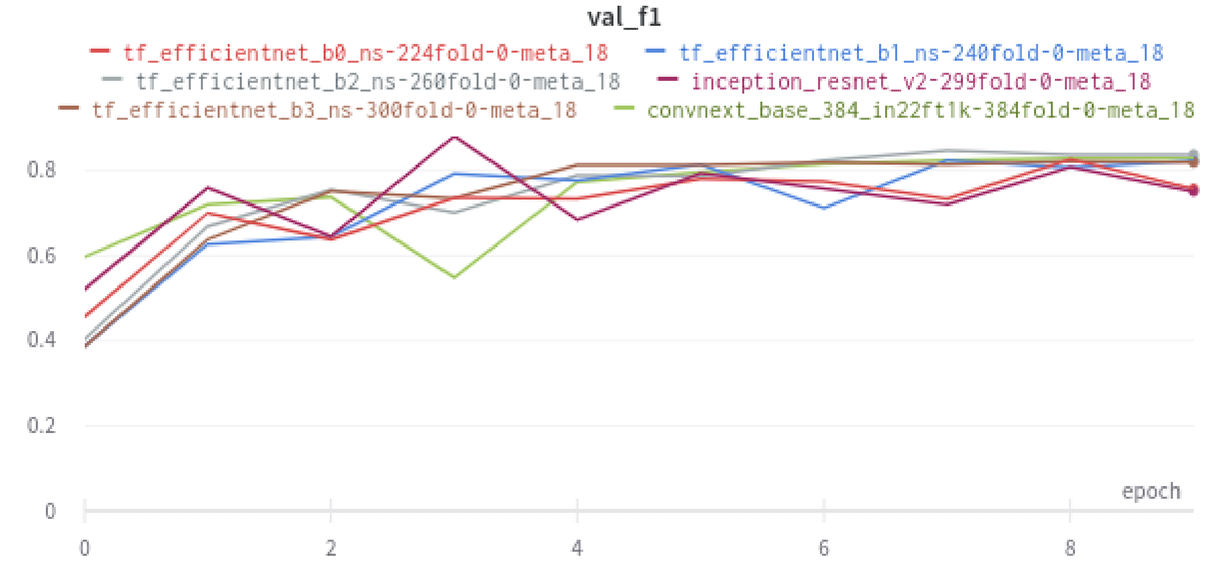
Additionally, key to the locality of the augmentation was a heavy cropping strategy, where random resized crops were fed into the models followed by random brightness and contrast changes including color jitter, random flipping, random rotation, random scaling, and random blur/noise/sharpen changes.

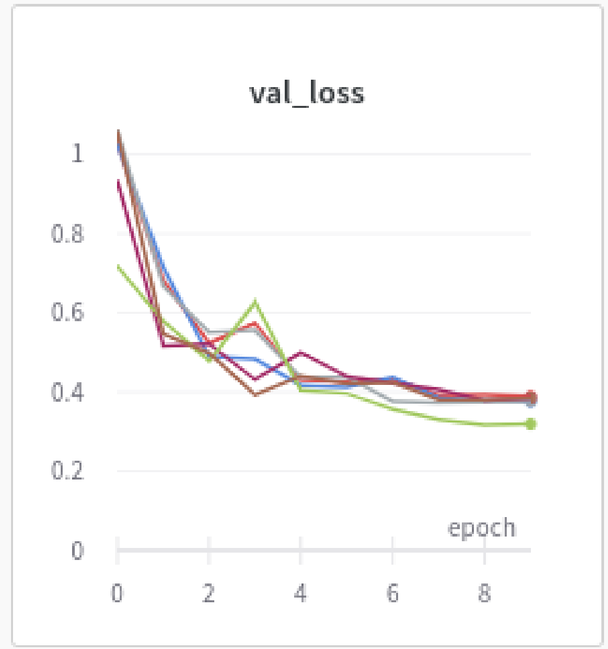
Results

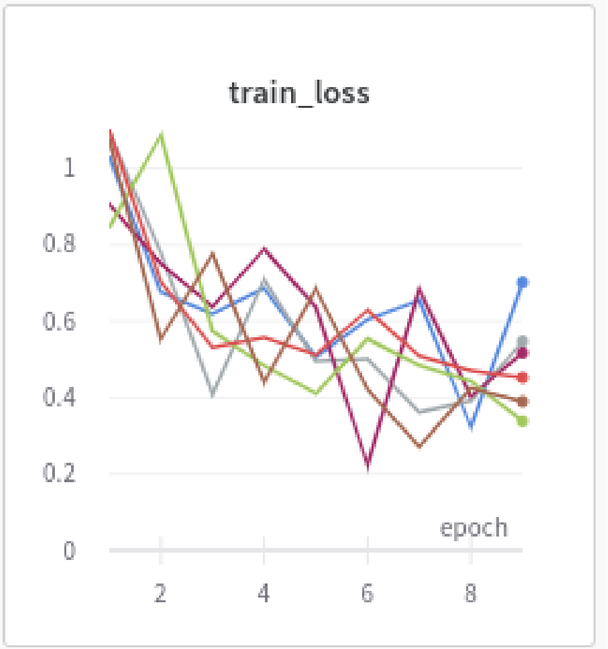
Following the challenge instructions, the F1 score with macro was used in order to find the best models for comparison

val_f1

0.8376	tf_efficientnet_b2_ns-260fold-0-meta_18
0.8291	convnext_base_384_in22ft1k-384fold-0-meta_18
0.8261	tf_efficientnet_b0_ns-224fold-0-meta_18
0.8219	tf_efficientnet_b3_ns-300fold-0-meta_18
0.8079	inception_resnet_v2-299fold-0-meta_18
0.8068	tf_efficientnet_b1_ns-240fold-0-meta_18





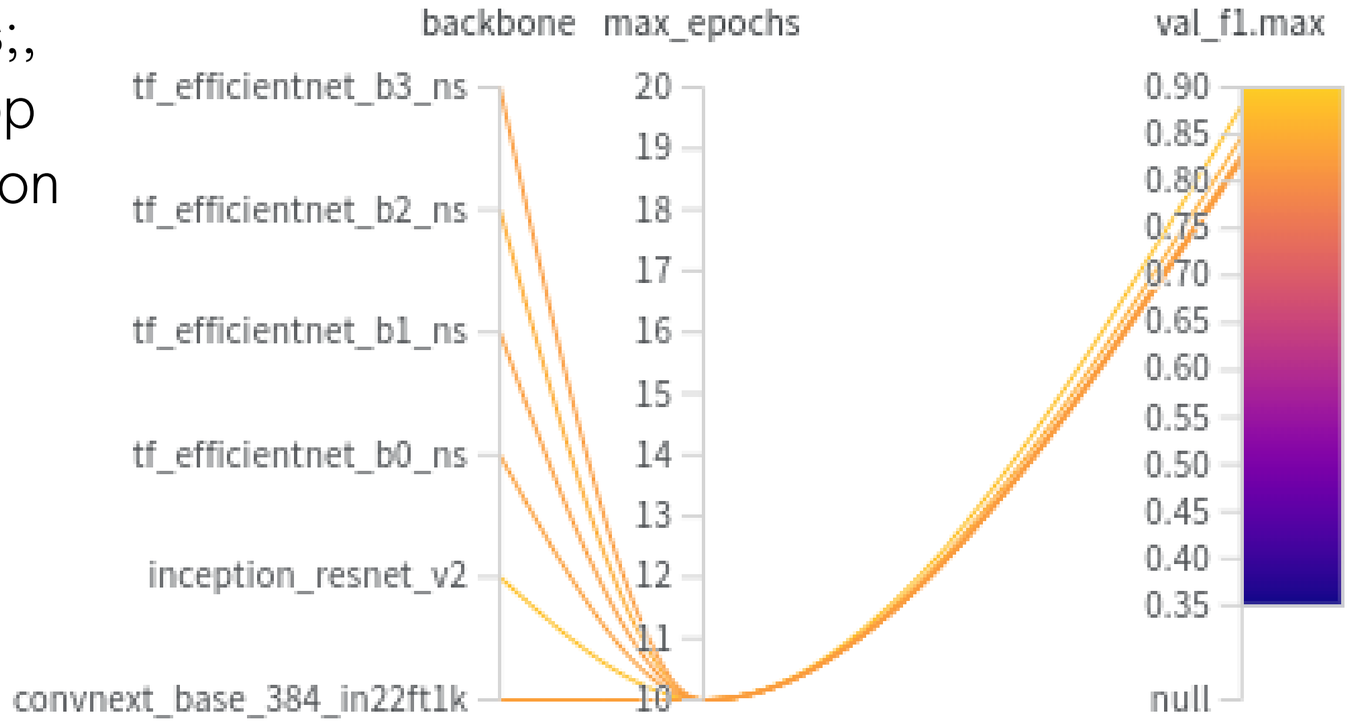


Ensemble

Since a multi-resolution approach has shown improvements in other scenarios;, ensemble learning was used with the top models in order to enhance the prediction and take advantage of the diversity provided by multiple models.

The following were our **top six pretrained models**:

- EfficientNet B3, B2, B1, B0 with Noisy Student weights
- ConvNext Base
- Inception resnet v2



Tools used

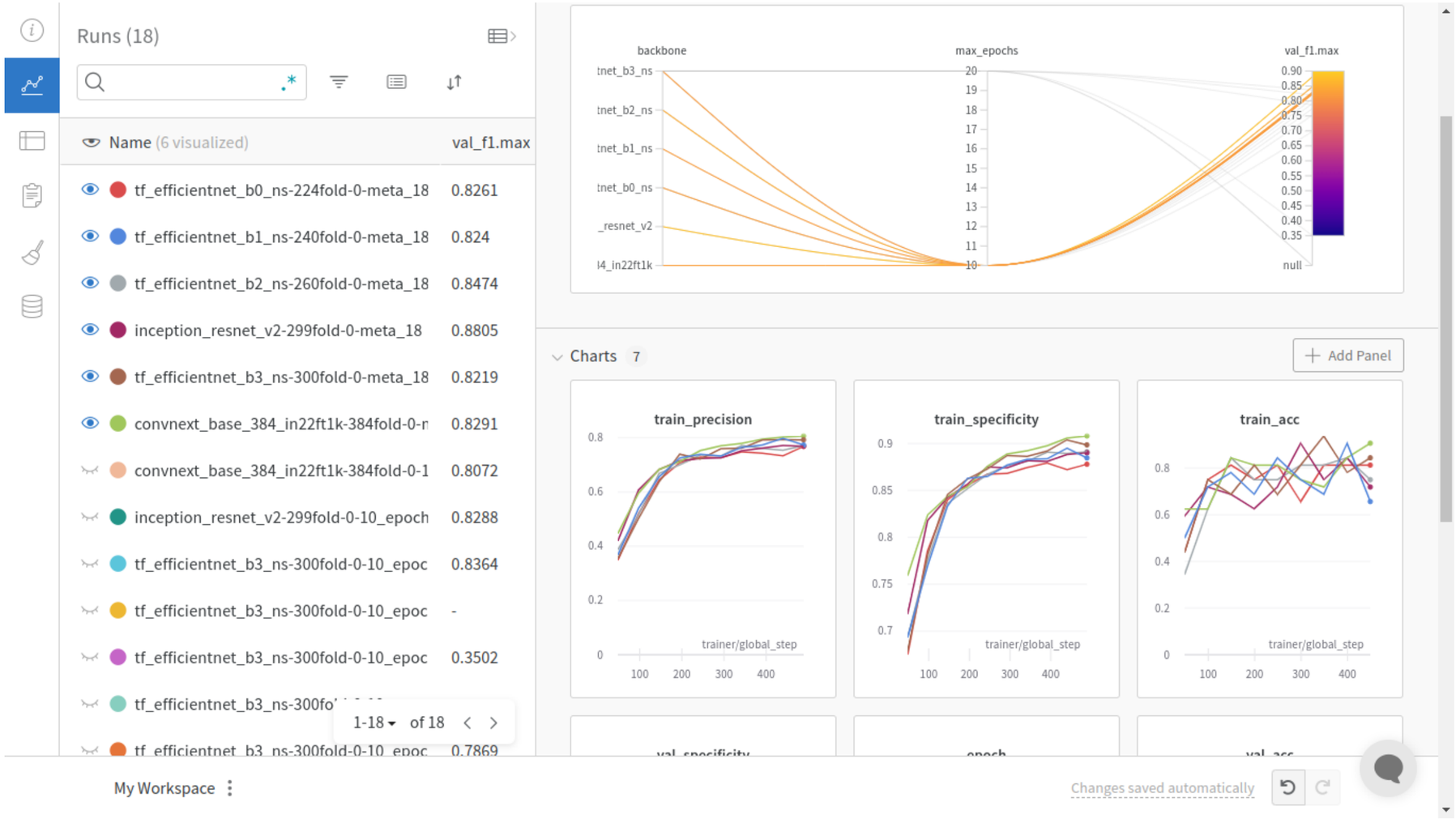
W&B

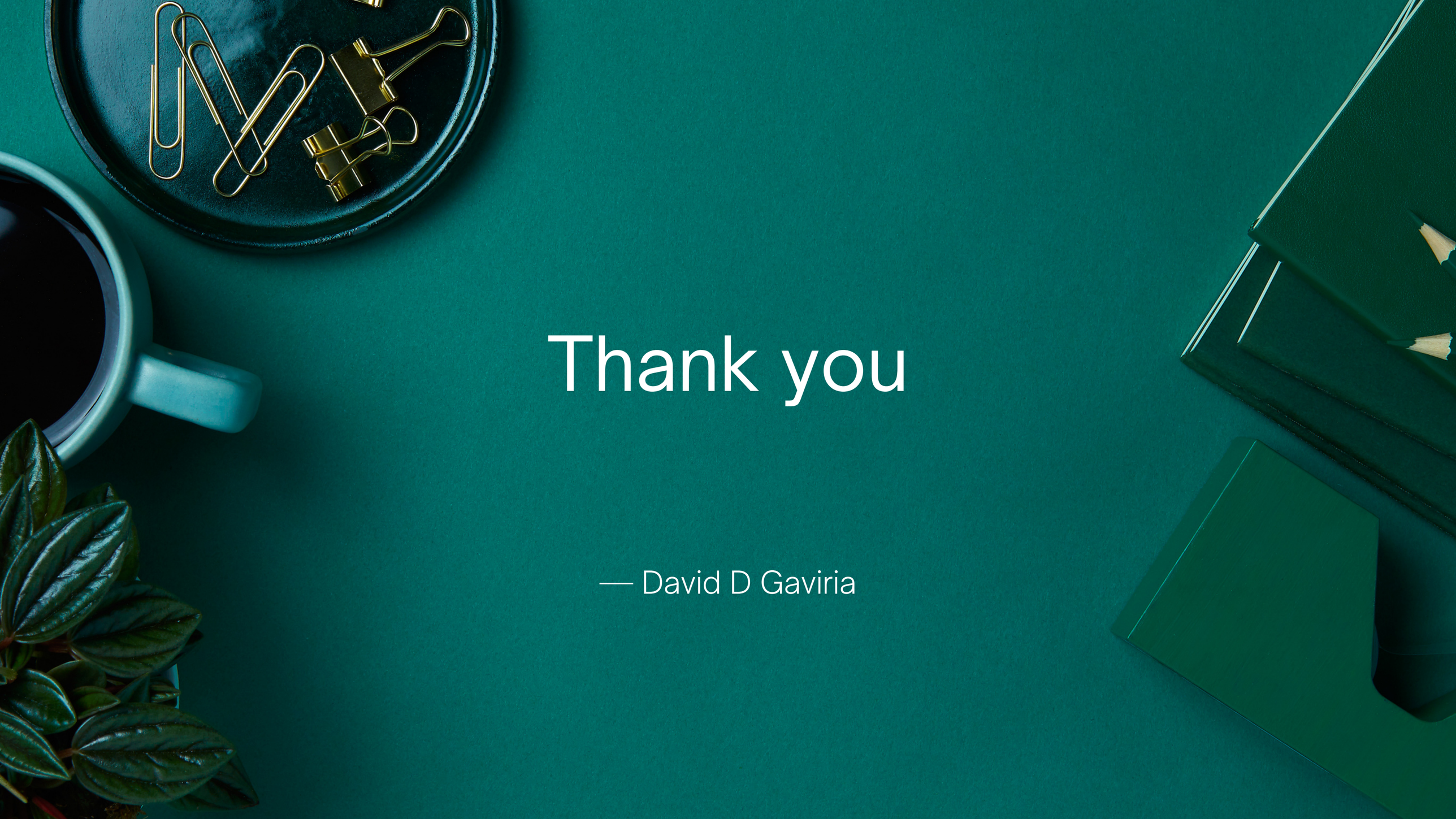
PyTorch Lightning

colab

With online tools like Pytorch Lightning, Colab, and Weights and Biases it was easier to compare the results on the fly!

Click here for the report





Thank you

— David D Gaviria