Plant Seedlings Classification

Using Instagram and ImageNet pretrained deep convolutional networks for seedling species image classification

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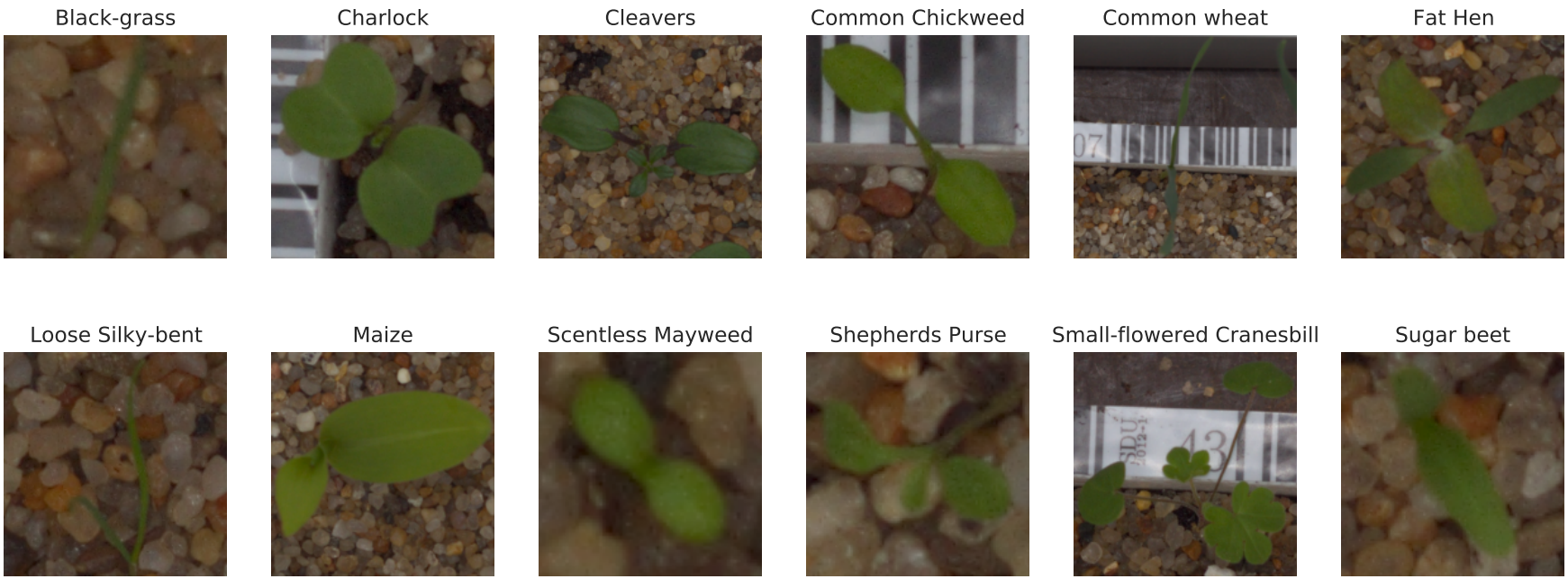
Introduction

- Image Classification field is dominated by deep convolutional networks
- Problem: Long time to train
- One Solution: Pretrained models using Imagenet and Instagram
- Application of pretrained model for Plant Seedling Kaggle competition

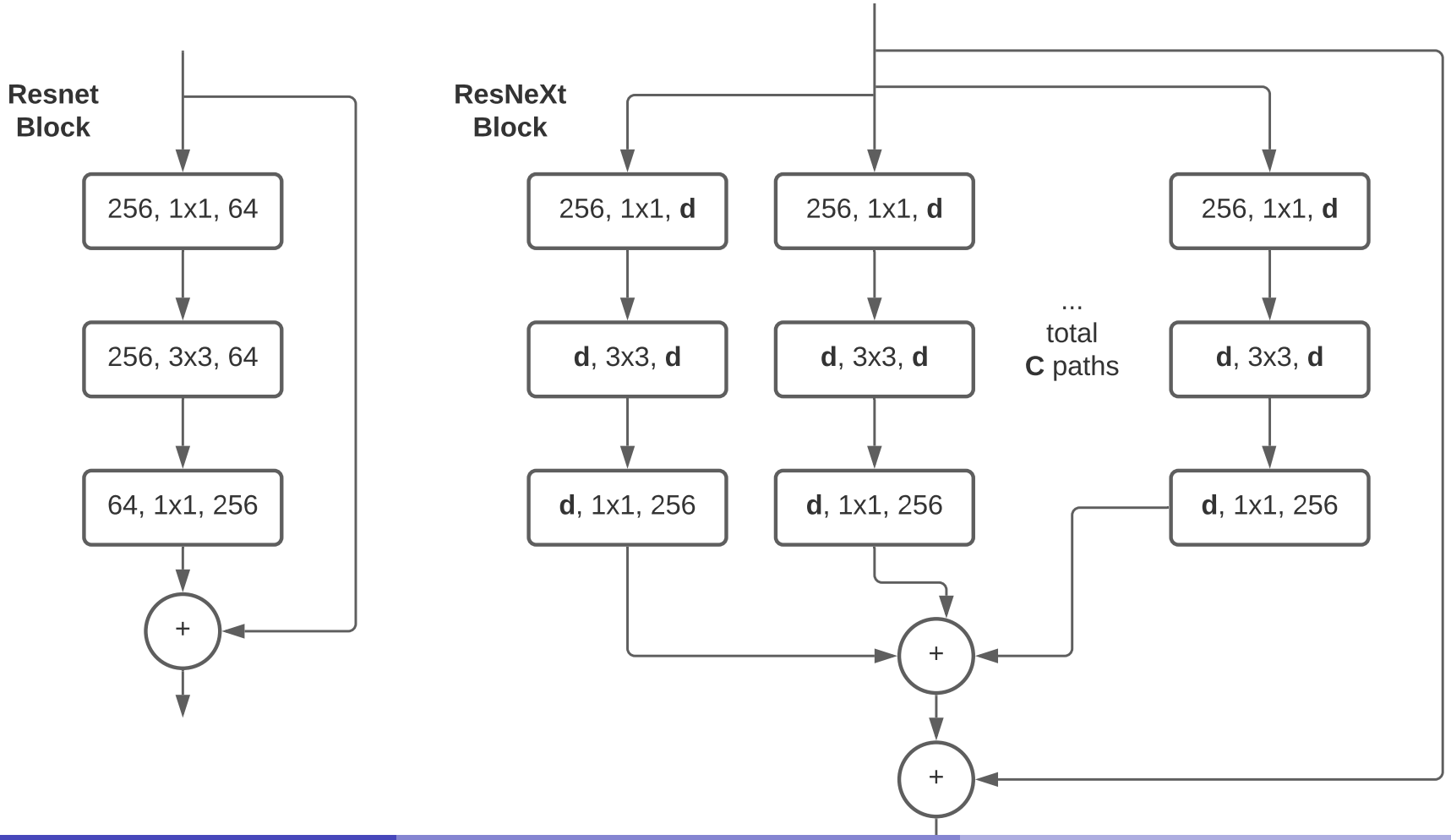
Data preprocessing

- 12 weed and crop species
- The train data contains 4750 annotated species (25% as validation data)
- Test data: 794 unannotated images



Tested methods

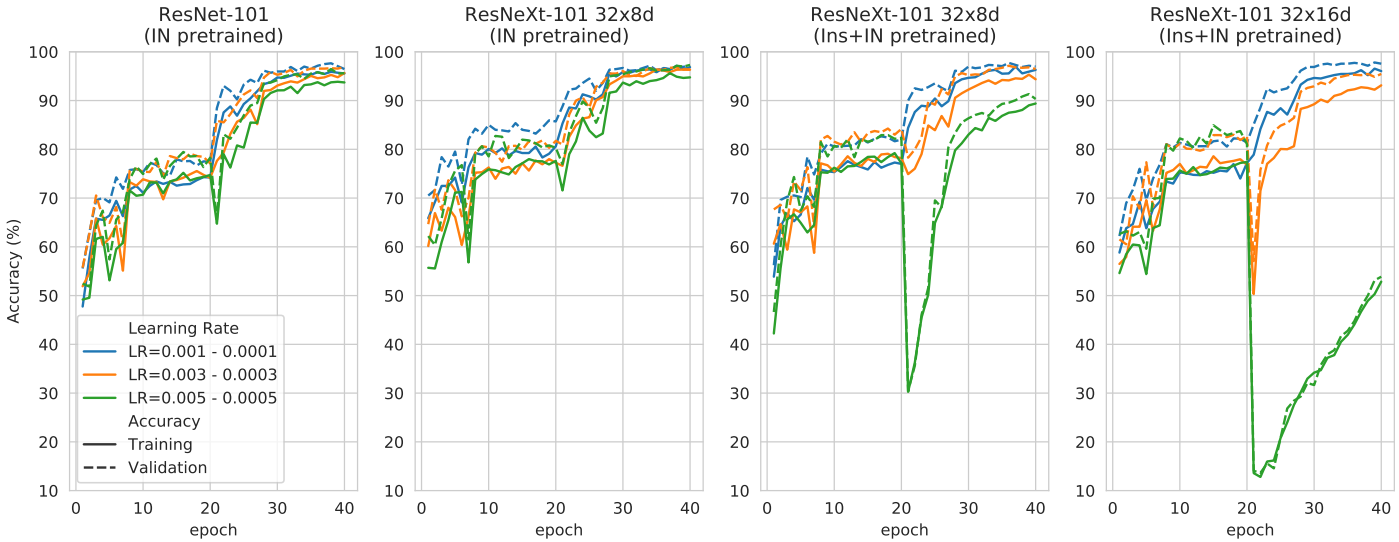
- ResNet101 with ImageNet pretrained
- ResNeXt-101-32x8d - ImageNet pretrained
- ResNeXt-101-32x8d - Instagram + ImageNet pretrained
- ResNeXt-101-32x16d - Instagram + ImageNet pretrained



Training

- Data augmentation:
  - Random Crop
  - Random horizontal flip
  - Random resize
- Training in two stages
  - 20 epochs training the last linear layer
  - 20 epochs training the complete neural network
- Learning rate decrease every 7 epochs

Learning Rate tuning



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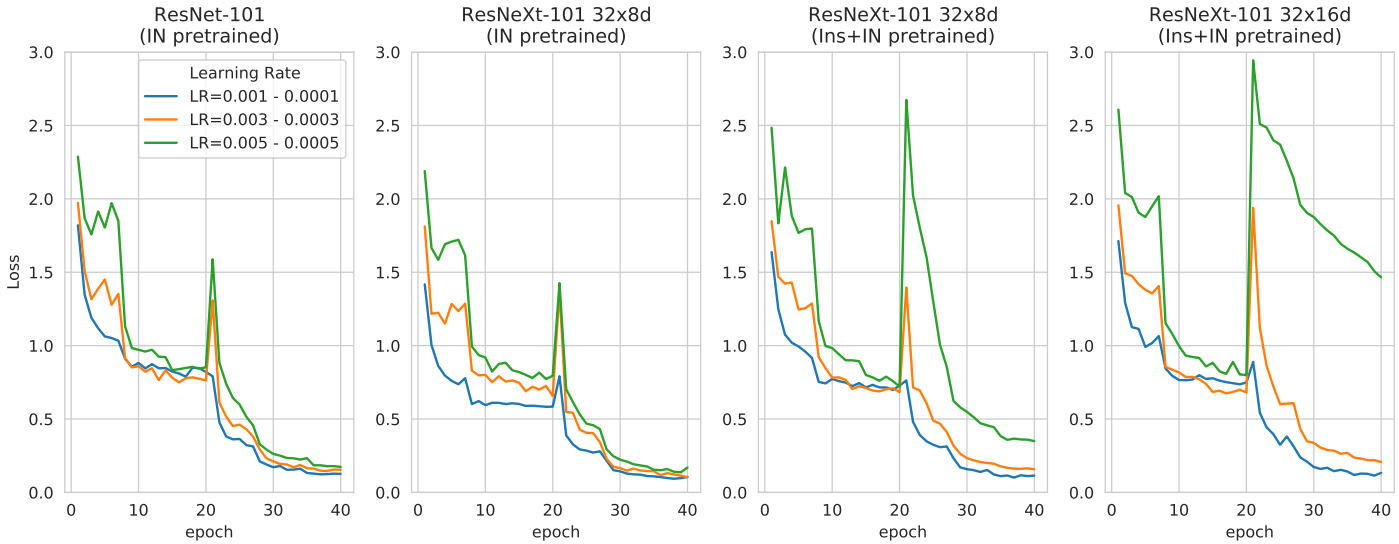
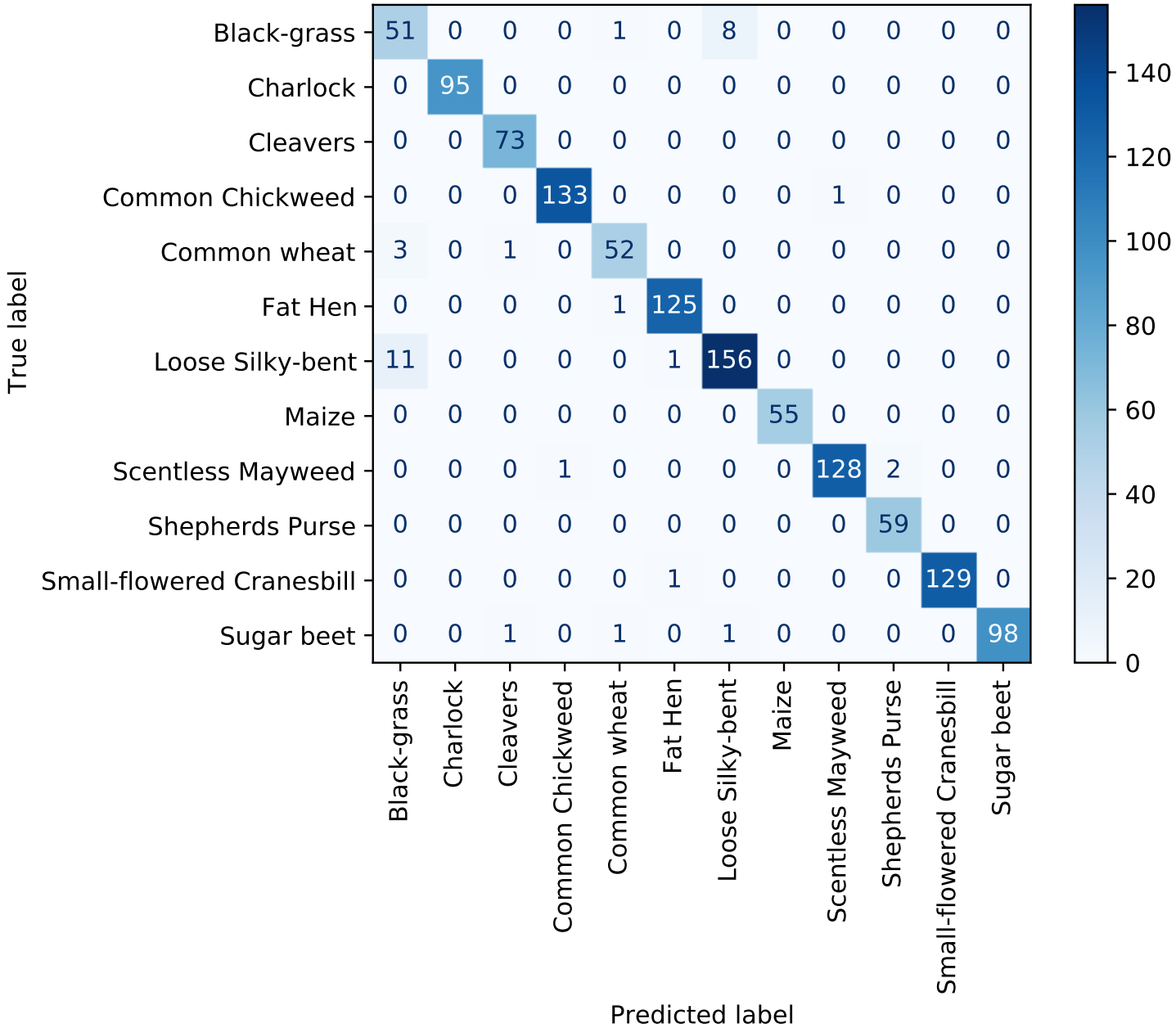


Validation data performance

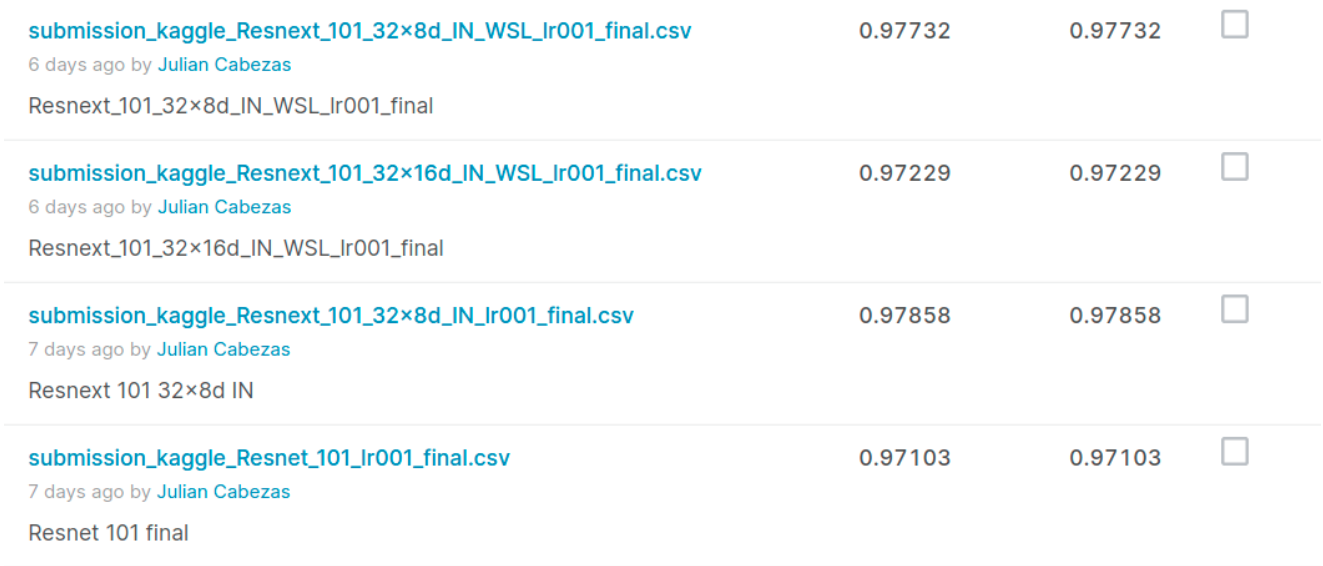
Class	ResNet-101 (IN Pretrained)	ResNeXt-101 32x8d (IN Pre-trained)	ResNeXt-101 32x8d (Ins+IN Pretrained)	ResNeXt-101 32x16d (Ins+IN Pretrained)
Black-grass	76.67%	81.67%	76.67%	85.00%
Charlock	100.00%	100.00%	100.00%	100.00%
Cleavers	95.89%	97.26%	98.63%	100.00%
Common Chickweed	100.00%	98.51%	100.00%	99.25%
Common wheat	96.43%	98.21%	96.43%	92.86%
Fat Hen	100.00%	99.21%	99.21%	99.21%
Loose Silky-bent	95.83%	97.62%	92.26%	92.86%
Maize	98.18%	100.00%	100.00%	100.00%
Scentless Mayweed	97.71%	97.71%	97.71%	97.71%
Shepherds Purse	89.83%	96.61%	94.92%	100.00%
Small-flowered Cranesbill	100.00%	100.00%	98.46%	99.23%
Sugar beet	98.02%	96.04%	99.01%	97.03%
Overall accuracy	**96.80%**	**97.47%**	**96.63%**	**97.14%**

Validation data performance



Test data: Kaggle submission

Model	Mean F1 Score (Overall accuracy)	Simulated Leader-board position
Resnet-101 (IN Pretrained)	0.97103	262/833 (31.45%)
ResneXt-101 32x8d (IN Pretrained)	**0.97858**	**149/833 (17.89%)**
ResneXt-101 32x8d (Ins+IN Pre-trained)	0.97732	173/833 (20.77%)
ResneXt-101 32x16d (Ins+IN Pre-trained)	0.97229	248/833 (29.77%)



Kaggle user: JulianCabezas

Conclusion

- The pretraining using the Instagram data does not produce better results than the ImageNet pretraining in this case
- ResNeXt architecture slightly outperformed equivalent ResNet Neural networks
- Pretrained models can produce competitive, accurate and time efficient predictions for plant seedling classification