Deep Learning on Kubeflow

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What is Kubeflow?

- an open-source platform
- based on Kubernetes
- simple, portable and scalable deployments of ML
- integration of existing tools and libraries

Includes components for

- model developing, training, serving
- hyperparameter tuning
- pipelines

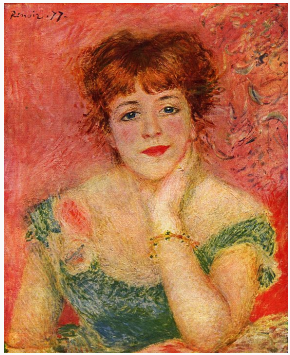
Use case

Goal

- Train a CNN model to distinguish between works of 10 painters

Dataset

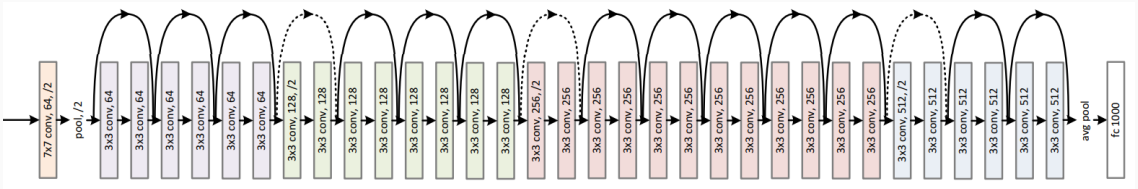
- "Painter by Numbers" from Kaggle.com
- Original size 83GB
- Images dimensions $477 - 7444$ px
- Selected & resized:
  - 340 MB
  - 388 images $\times$ 10 artists
  - images smallest dimension 448 px
- Test set 20 images (5%)



Use case

Model

- ResNet 50
- Transfer learning with weights from ImageNet (1000 classes)
- Input size 224×224 px
- Image augmentation: shift, rotation, flip



Tasks/Milestones

- Preprocess the data
- Create the model (transfer learning)
- Create the Docker image
- Train the model on KF using TFJobs on CPUs
- Save the trained model
- Train the model on KF using TFJobs on GPUs
- Distributed training on multiple pods
- Serve the model

Technologies

- Create the model: TF → Keras
- Containers: Docker and Kubernetes
- Manage pods (TFJobs): kubectl + ksonnet → kubectl + kustomize → kubectl
- Manage KF deployment: GCP console, gcloud + gsutil
- Manage data: PVC → GCS bucket
- Monitoring: Tensorboard
- Manage the model: TF Serving → Jupyter Notebook

Analysis & reflexion

- **Keras** simplifies work with CNN models but have several restrictions:
  - cannot work directly with GCS bucket
  - does not (directly) support distributed learning
- **Tensorflow** requires additional learning time
- **Kubeflow** is very raw
  - rapid changes, low backward compatibility
  - requires learning of all underlying technologies
- $\Rightarrow$ **Kubeflow does not suit for research in data science**

References

- https://www.kubeflow.org/docs/
- https://github.com/kubeflow/examples
- https://www.kaggle.com/c/painter-by-numbers/
- Kaiming He, Xiangyu Zhang, Shaoqing Ren, Jian Sun. Deep Residual Learning for Image Recognition, arXiv:1512.03385
- https://keras.io/
- https://www.tensorflow.org/guide
- https://kubernetes.io/docs/

Thank you for your attention!