

# Train your ML models at scale

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### **Rise of large-scale models**

"a picture of a very clean living room"



aws





Stable Diffusion, Rombach et al.



StackGAN, Zhang et al. <sup>© 20</sup>

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### Large-scale models lead to better results



Scaling Laws for Neural Language Models Kaplan et al., 2020



### Challenges with training large-scale models



# SageMaker accelerates large-scale model training



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### Large-scale training on SageMaker

#### **OPTIMIZED DISTRIBUTED TRAINING LIBRARIES & FRAMEWORKS**

TensorFlow O	PyTorch	🙁 Hugging Face	SageMaker Distributed Training Libraries	Bring your own library (e.g. DeepSpeed, Megatron)
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#### AMAZON SAGEMAKER TRAINING

Large Scale Cluster Orchestration	NCCL Health Checks	Resilient training	SageMaker Compiler	Warm pools	SSH to container
Data loading	Debugger	Profiling	Experiment tracking	Hyperparameter optimization	Pay for what you use

#### **ML COMPUTE INSTANCES & ACCELERATORS**

NVIDIA GPUS<br/>A100, V100, K80, T4, A10AWS Nitro400/800 Gbps<br/>EFA NetworkingCPU instancesAWS Trainiumaws

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### Amazon SageMaker ephemeral training clusters



aws

### Train with your own deep learning model

```
from sagemaker.pytorch import PyTorch
estimator = PyTorch(entry_point = './cifar10.py',
            role = role,
            framework_version = '1.13',
            py_version = 'py38',
            instance_count = 1,
            instance_type = 'ml.g5.xlarge',
            hyperparameters = {'epochs': 50, 'batch_size': 32},
            metric_definitions = [{'Name': 'train:loss', 'Regex': 'loss: (.*)'}])
```

estimator.fit("s3://bucket/path/to/training/data")



### Accelerate local ML code conversion to training jobs

```
from sagemaker.remote_function import remote
@remote(instance_type="ml.g4dn.xlarge",dependencies = "./environment.yml")
def train_hf_model(
    train_input_path,test_input_path,s3_output_path = None,
    *,epochs = 1, train_batch_size = 32, eval_batch_size = 64,
    warmup_steps = 500,learning_rate = 5e-5
    ):
    model_name = "distilbert-base-uncased"
    model = AutoModelForSequenceClassification.from_pretrained(model_name)
    ...
    return os.path.join(s3_output_path, model_dir), eval_result
```





### Replicate experimental results by default

#### pytorch-training-2022-04-14-20-33-18-654

Job settings

Clone Create model package Stop

Create model

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2.amazonaws.com/pytorch-training:1.10.0-gpu-py38	•							
		Maximum wait time for managed spot training(s)						
Input mode		-						
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### **Hosted TensorBoard**

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#### Automated TensorBoard app management

provides a pre-configured and managed TensorBoard interface, which can save data scientists time by eliminating the need to install and configure TensorBoard on their own.

#### Scalable

designed to meet the needs of large-scale distributed machine learning workloads by having the UI automatically hosted on memory optimized r5 instances

#### Automated data management

easily configure TB data uploaded to S3 with the training job by passing an API argument (TensorBoardOutputConfig)

#### Security

provides a secure and reliable environment for storing and processing machine learning data



### LG's Tilda, the AI artist powered by EXAONE





"... we could optimize distributed training and were able to train the model faster by 59% ...."

Seung Hwan Kim, Vice president and vision lab leader at LG AI Research



### Sharded data parallelism with tensor parallelism

```
smp_parameters = {
    "ddp": True,
    "fp16": True,
    "prescaled_batch": True,
    "sharded_data_parallel_degree": 4,
    "tensor_parallel_degree": 4
}
```

### Falcon

#### Technology Innovation Institute trains the state-of-the-art Falcon LLM 40B foundation model on Amazon SageMaker

by Dr. Ebtesam Almazrouei, Olivier Cruchant, and Will Badr | on 07 JUN 2023 | in Amazon SageMaker, Artificial Intelligence, Intermediate (200) | Permalink | 🗩 Comments | Amazon SageMaker, Artificial Share

*This blog post is co-written with Dr. Ebtesam Almazrouei, Executive Director–Acting Chief Al Researcher of the Al-Cross Center Unit and Project Lead for LLM Projects at TII.* 





### **Getting Started**



#### Product page

aws.amazon.com/sagemaker/train/



### **Technical Documentation**

docs.aws.amazon.com/sagemaker/latest/dg/how-it-works-training.html



### SageMaker examples on GitHub

github.com/aws/amazon-sagemaker-examples



### Training LLMs on Amazon SageMaker: Best Practices

https://aws.amazon.com/blogs/machine-learning/training-large-language-models-on-amazon-sagemaker-best-practices/





# Thank you!

#### Gal Oshri





