

Visualizing Deep Learning with Tensorboard and PyTorch





Joe Papa

Hello!

Linked 

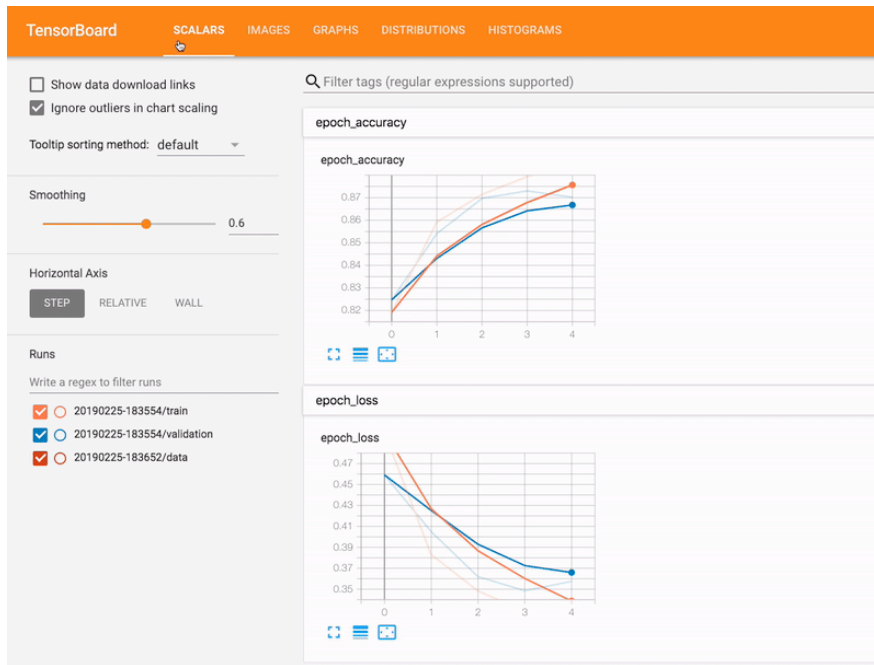
**Connect on LinkedIn
for slides & code**
linkedin.com/in/MrJoePapa

- **Chief AI Engineer**, Mobile Insights
- Founder, **INSPIRD.ai**, Master Trainer & Mentor
- 25 years experience in R&D, former **Verizon Wireless, Bell Labs**
- Led AI teams at **Booz Allen & Perspecta Labs**
- DSP, Wireless Comms, RF, Deep Learning, Computer Vision, NLP
- DoD, Telecom, Retail, Ecomm, Restaurant, Healthcare, Finance

What is Tensorboard?

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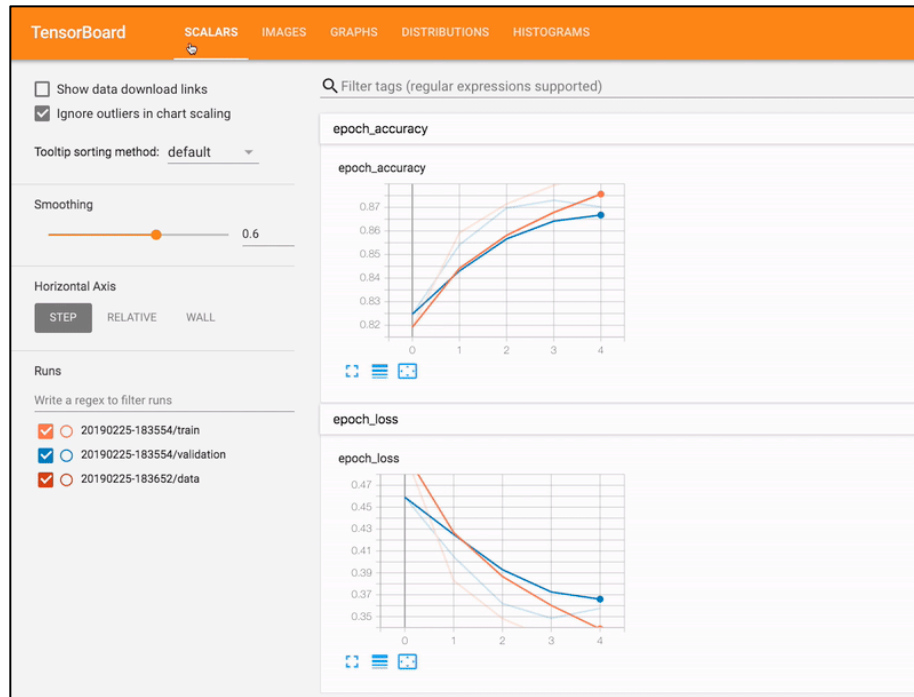
- Tensorboard is TensorFlow's visualization toolkit
- This tool helps you improve your machine learning models by tracking experimentation parameters, visualizing metrics, displaying model graphs, and more
- Can now be used with PyTorch



Loss & Accuracy Curves

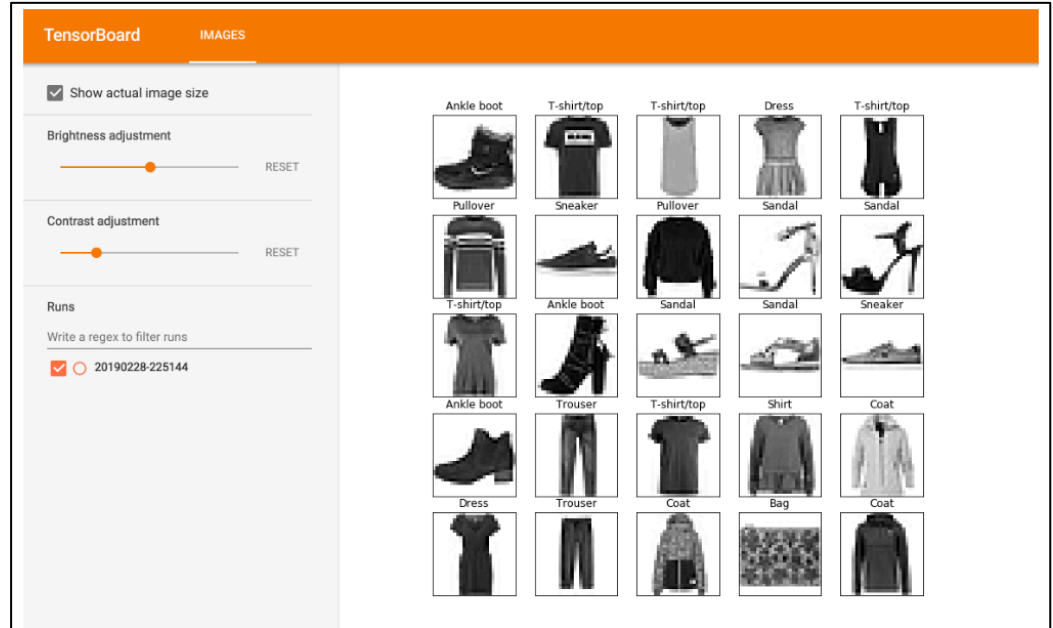
- Visualize loss and accuracy during training

```
[1, 2000] loss: 2.195
[1, 4000] loss: 1.868
[1, 6000] loss: 1.666
[1, 8000] loss: 1.569
[1, 10000] loss: 1.499
[1, 12000] loss: 1.471
[2, 2000] loss: 1.397
[2, 4000] loss: 1.377
[2, 6000] loss: 1.363
[2, 8000] loss: 1.331
[2, 10000] loss: 1.304
[2, 12000] loss: 1.300
Finished Training
```



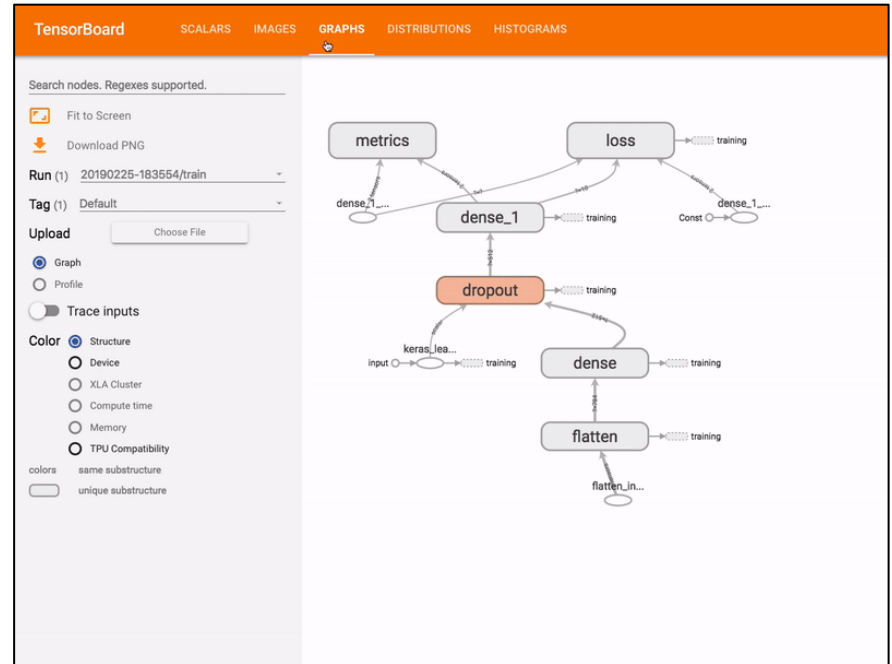
Visualize Data

- Visualize Images, Text, Audio
- Sample training data for mislabeling
- Visualize classification errors



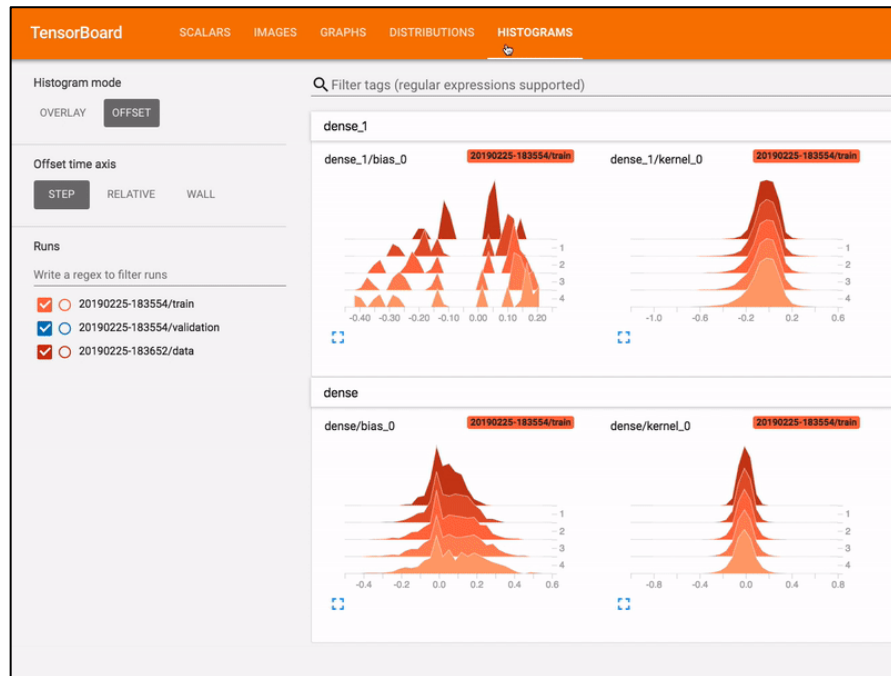
Visualize Model Graphs

- Visualize layers and activations
- Check model correctness



Weight/Bias Distributions & Histograms

- Check for diminishing & exploding gradients
- Is Batch Normalization needed?



Hyperparameter Experimentation

- Which hparams perform the best?
- Automatically maintained after each run

TensorBoard

SCALARS

HPARAMS

INACTIVE

Hyperparameters

☒ num_units

☒ 16.000

☒ 32.000

☒ dropout

Min

-infinity

Max

+infinity

☒ optimizer

☒ adam

☒ sgd

Metrics

☒ Accuracy

Min

-infinity

Max

+infinity

Status

☒ Unknown

☒ Failure

☒ Success

☒ Running

Sorting

TABLE VIEW

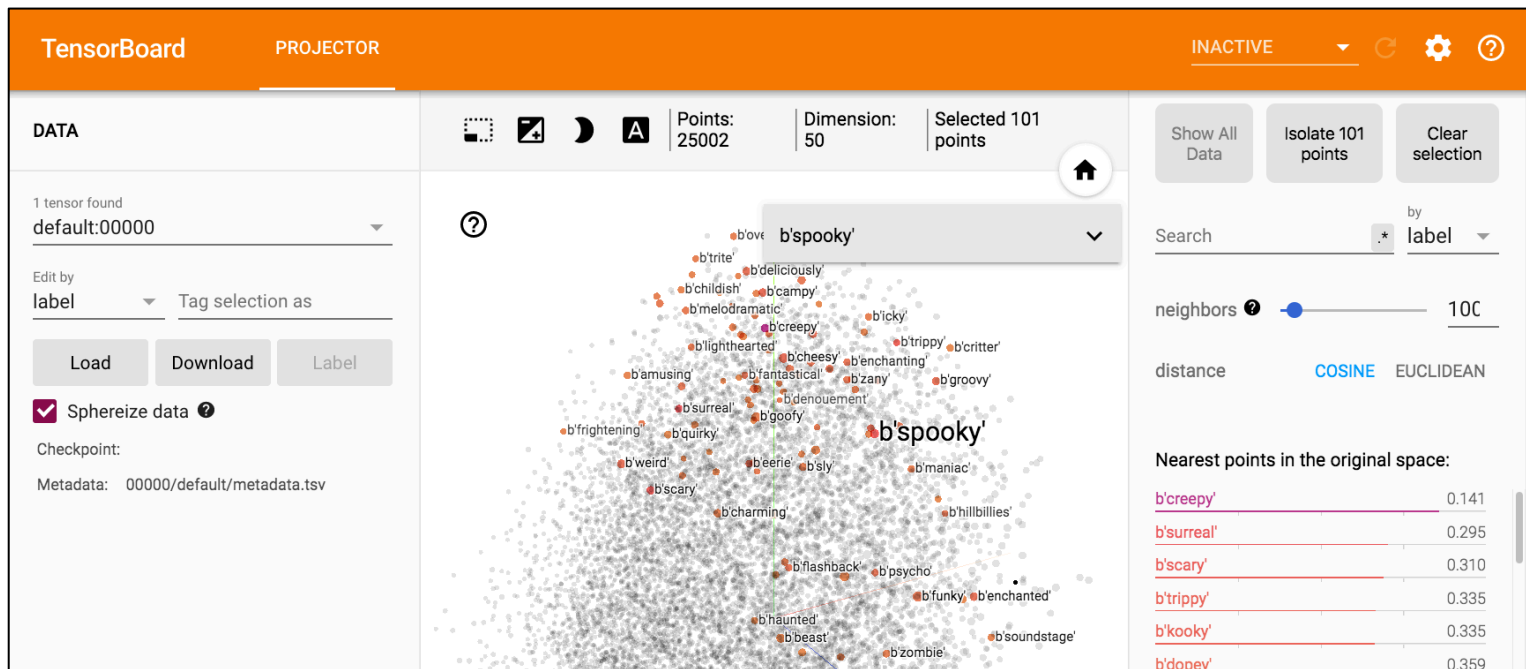
PARALLEL COORDINATES VIEW

SCATTER PLOT MATRIX VIEW

Session Group Name	Show Metrics	num_units	dropout	optimizer	Accuracy
3df0d7cf35bec5a...	<input type="checkbox"/>	32.000	0.20000	sgd	0.77550
3ec2aed9e07589f...	<input type="checkbox"/>	32.000	0.20000	adam	0.82650
53bf5bec9190fa...	<input type="checkbox"/>	16.000	0.20000	adam	0.81540
5b97f3c2967245b...	<input type="checkbox"/>	16.000	0.10000	adam	0.83210
6826c7fa3322d82...	<input type="checkbox"/>	32.000	0.10000	adam	0.83950
7684dcc13358fd0...	<input type="checkbox"/>	16.000	0.20000	sgd	0.76830
7b29a731e3daca...	<input type="checkbox"/>	32.000	0.10000	sgd	0.78530
ae235909ec4e4d...	<input type="checkbox"/>	16.000	0.10000	sgd	0.77700

Projector

- View 3-D Embeddings
- <https://projector.tensorflow.org/>



How to use Tensorboard with PyTorch

Let's start with a simple example



Google Colab Demo

SummaryWriter methods

- add_scalar
- add_scalars
- add_custom_scalars
- add_histogram
- add_image
- add_images
- add_figure
- add_video
- add_audio
- add_text
- add_graph
- add_embedding
- add_pr_curve
- add_mesh
- add_hparams
- flush, close

Thank you!

For a copy of today's slides and code, reach out to me on LinkedIn,
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**MOBILE
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