Deep Learning

Vazgen Mikayelyan

YSU, Krisp

October 21, 2020

Outline

Batch Normalization

- Problem:
  - The distribution of each layer's input changes during training.

Batch Normalization

- Problem:
  - The distribution of each layer's input changes during training.
- Solution:
  - Fix the distribution of inputs into subnetwork.

Batch Normalization

- Problem:
  - The distribution of each layer's input changes during training.
- Solution:
  - Fix the distribution of inputs into subnetwork.
- Effects:
  - Improve accuracy.
  - Faster learning.
  - Availability of high learning rates.

Batch Normalization

Input: Values of x over a mini-batch: $\mathcal{B} = \{x_{1...m}\}$;
Parameters to be learned: γ, β

Output: $\{y_i = \text{BN}_{\gamma,\beta}(x_i)\}$

$$\mu_{\mathcal{B}} \leftarrow \frac{1}{m} \sum_{i=1}^{m} x_i \qquad \text{// mini-batch mean}$$

$$\sigma_{\mathcal{B}}^2 \leftarrow \frac{1}{m} \sum_{i=1}^{m} (x_i - \mu_{\mathcal{B}})^2 \qquad \text{// mini-batch variance}$$

$$\widehat{x}_i \leftarrow \frac{x_i - \mu_{\mathcal{B}}}{\sqrt{\sigma_{\mathcal{B}}^2 + \epsilon}} \qquad \text{// normalize}$$

$$y_i \leftarrow \gamma \widehat{x}_i + \beta \equiv \text{BN}_{\gamma,\beta}(x_i) \qquad \text{// scale and shift}$$

1. Can we do stochastic gradient descent in this case?

1. Can we do stochastic gradient descent in this case?
2. What to do during the test?

1. Can we do stochastic gradient descent in this case?
2. What to do during the test?
3. What about biases?

Outline

Tensorflow vs Keras

1. Tensorflow is an open-source deep learning library developed by Google, with TF 2.0 being officially released in late 2019.

Tensorflow vs Keras

1. Tensorflow is an open-source deep learning library developed by Google, with TF 2.0 being officially released in late 2019.
2. Tensorflow has a large ecosystem of related components, including libraries like Tensorboard, Deployment and Production APIs ans support various programming languages.

Tensorflow vs Keras

1. Tensorflow is an open-source deep learning library developed by Google, with TF 2.0 being officially released in late 2019.
2. Tensorflow has a large ecosystem of related components, including libraries like Tensorboard, Deployment and Production APIs ans support various programming languages.
3. Keras is a high-level Python library that can use a variety of deep learning libraries underneath, such as: Tensorflow, CNTK or Theano.

Tensorflow vs Keras

1. Tensorflow is an open-source deep learning library developed by Google, with TF 2.0 being officially released in late 2019.

2. Tensorflow has a large ecosystem of related components, including libraries like Tensorboard, Deployment and Production APIs ans support various programming languages.

3. Keras is a high-level Python library that can use a variety of deep learning libraries underneath, such as: Tensorflow, CNTK or Theano.

4. Tensorflow 1.x had a complex python class system for building models and due to the huge popularity Keras and Pytorch, when TF 2.0 was released, TF adopted Keras as the official API for TF.

Tensorflow vs Keras

1. Tensorflow is an open-source deep learning library developed by Google, with TF 2.0 being officially released in late 2019.

2. Tensorflow has a large ecosystem of related components, including libraries like Tensorboard, Deployment and Production APIs ans support various programming languages.

3. Keras is a high-level Python library that can use a variety of deep learning libraries underneath, such as: Tensorflow, CNTK or Theano.

4. Tensorflow 1.x had a complex python class system for building models and due to the huge popularity Keras and Pytorch, when TF 2.0 was released, TF adopted Keras as the official API for TF.

5. While Keras still also reemains as a separate library from Tensorflow, it can also now officially be imported through TF, so there is now need to additionally install it.