

A Tour of TensorFlow



Peter Goldsborough

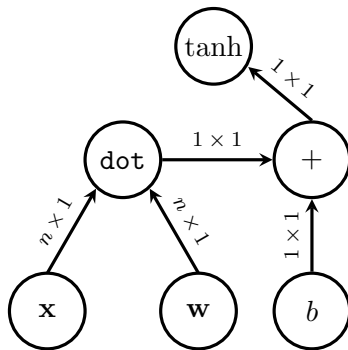
May 31, 2016

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Computational Paradigms

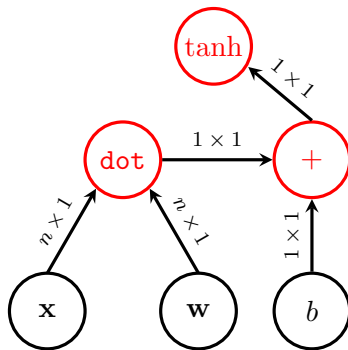
Computational Paradigms



Computational Graphs

$$\hat{y} = \tanh(\mathbf{x}^T \mathbf{w} + b)$$

Computational Paradigms

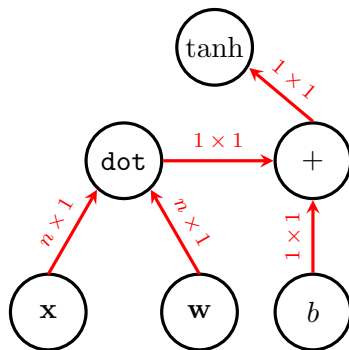


$$\hat{y} = \tanh(\mathbf{x}^T \mathbf{w} + b)$$

Computational Graphs

1. Operations

Computational Paradigms

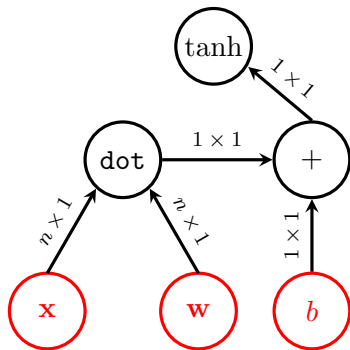


$$\hat{y} = \tanh(\mathbf{x}^T \mathbf{w} + b)$$

Computational Graphs

1. Operations
2. Tensors

Computational Paradigms

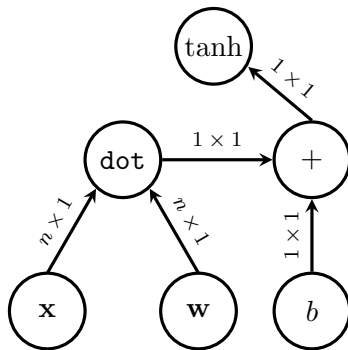


$$\hat{y} = \tanh(\mathbf{x}^T \mathbf{w} + b)$$

Computational Graphs

1. Operations
2. Tensors
3. Variables

Computational Paradigms



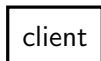
$$\hat{y} = \tanh(\mathbf{x}^T \mathbf{w} + b)$$

Computational Graphs

1. Operations
2. Tensors
3. Variables
4. Sessions

Execution Model

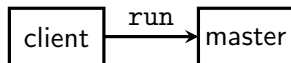
Execution Model



Actors

1. Client

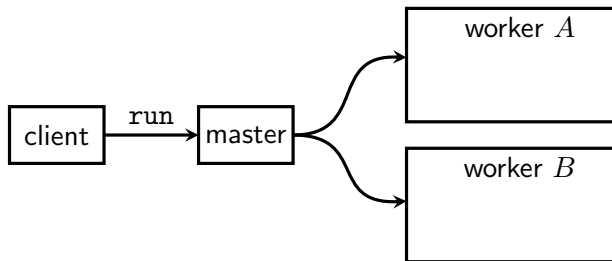
Execution Model



Actors

1. Client
2. Master

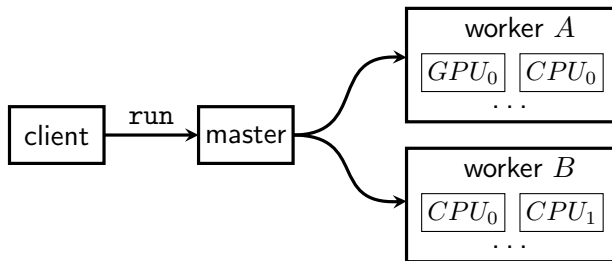
Execution Model



Actors

1. Client
2. Master
3. Workers

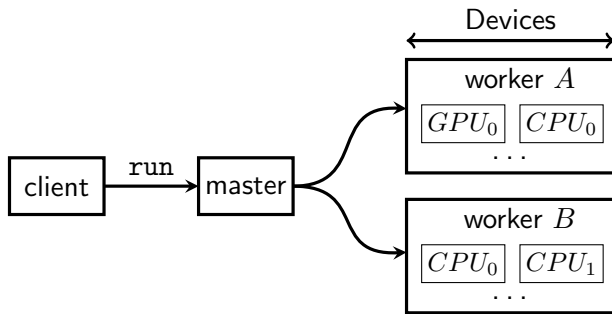
Execution Model



Actors

1. Client
2. Master
3. Workers
4. Devices

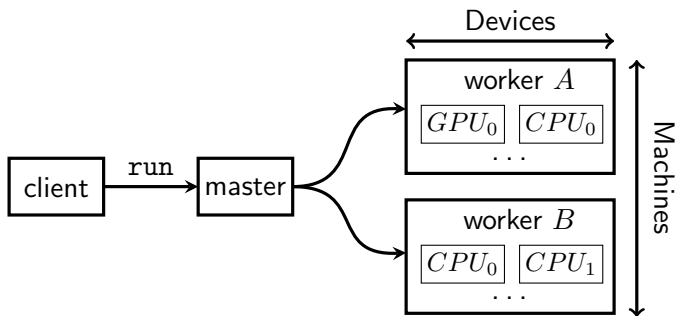
Execution Model



Actors

1. Client
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Execution Model

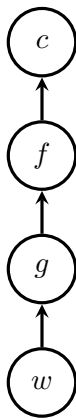


Actors

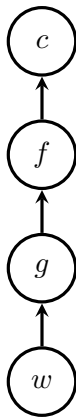
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4. Devices

Back-Propagation in TensorFlow

Back-Propagation in TensorFlow

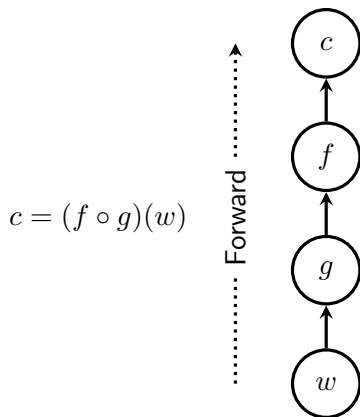


Back-Propagation in TensorFlow



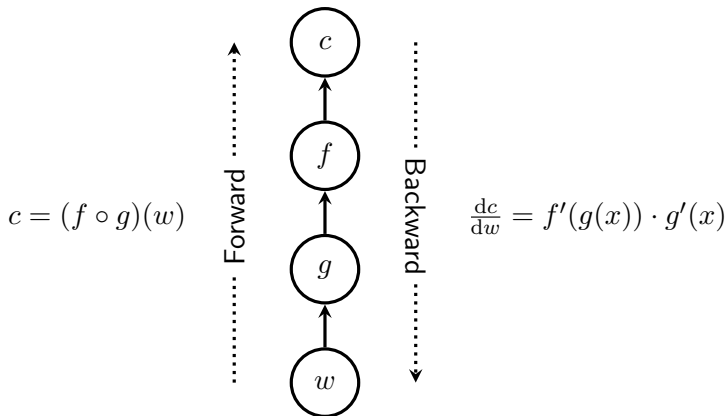
Symbol to Number Differentiation

Back-Propagation in TensorFlow



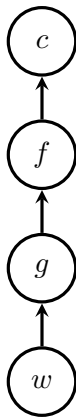
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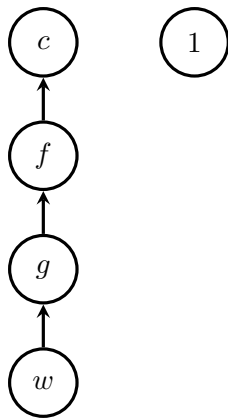
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Back-Propagation in TensorFlow



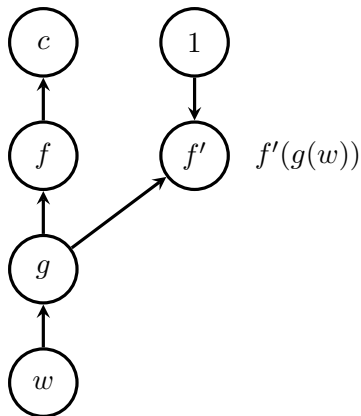
Symbol to Symbol Differentiation

Back-Propagation in TensorFlow



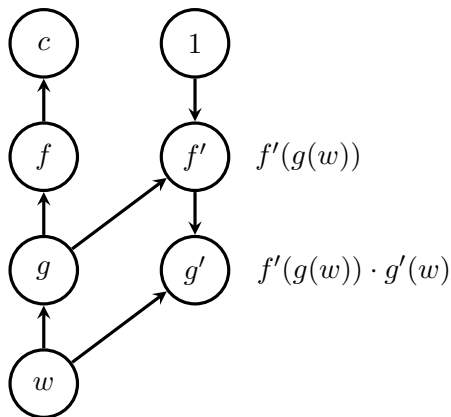
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Back-Propagation in TensorFlow



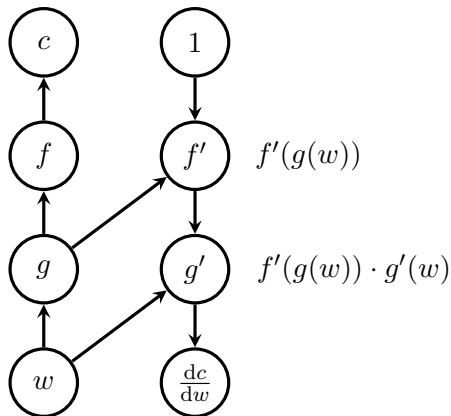
Symbol to Symbol Differentiation

Back-Propagation in TensorFlow



Symbol to Symbol Differentiation

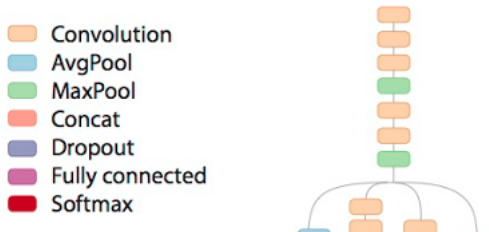
Back-Propagation in TensorFlow

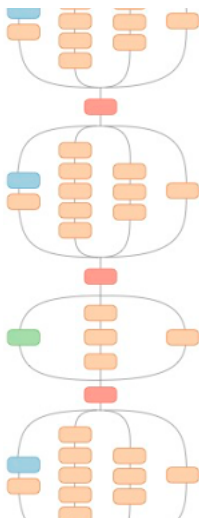


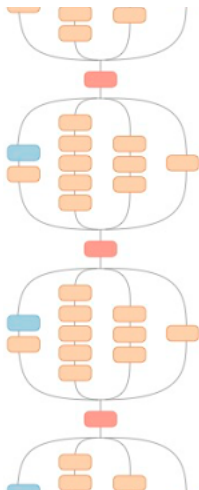
Symbol to Symbol Differentiation

Visualization Tools

- ▶ Deep Neural Networks have the tendency of being ... deep
- ▶ Easy to drown in the complexity of an architecture
- ▶ > 36,000 nodes for Google's *Inception* model









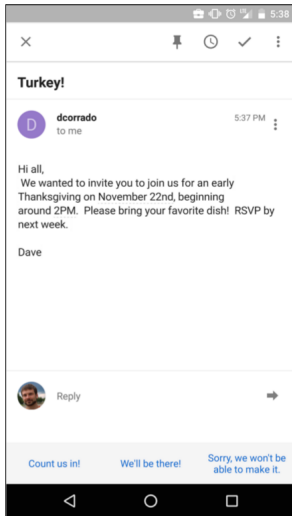


Source: <http://googleresearch.blogspot.de/2016/03/train-your-own-image-classifier-with.html>

TensorBoard to the Rescue

Use Cases

- ▶ Smart email replies in Google *Inbox*
- ▶ Emails mapped to “thought vectors”
- ▶ LSTMs synthesize valid replies



Source: <http://googleresearch.blogspot.de/2015/11/computer-respond-to-this-email.html>

Use Cases of TensorFlow

- ▶ Google DeepMind now using TensorFlow
- ▶ Already for *AlphaGo*
- ▶ According to a DeepMind SWE reasons are:
 - ▶ Integration with Google Cloud Platform,
 - ▶ Python,
 - ▶ Support for TPUs,
 - ▶ Ability to run on many GPUs.



Source: <https://deepmind.com/css/images/opengraph/alphago-logo.png>

Walkthrough

Thank You