

A Tour of TensorFlow



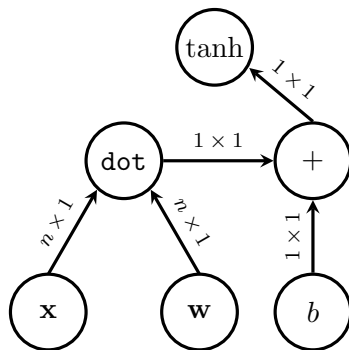
Peter Goldsborough

October 1, 2016

Contents

Computational Paradigms

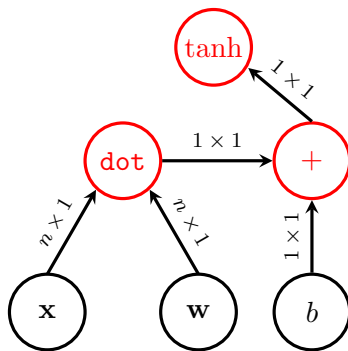
Computational Paradigms



Computational Graphs

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

Computational Paradigms

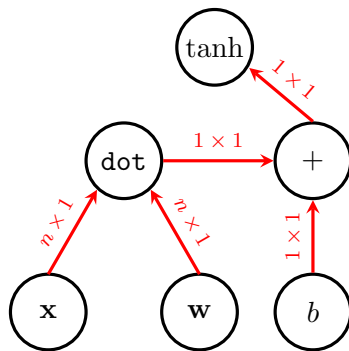


$$\hat{y} = \tanh(\mathbf{x}^\top \mathbf{w} + b)$$

Computational Graphs

1. Operations

Computational Paradigms

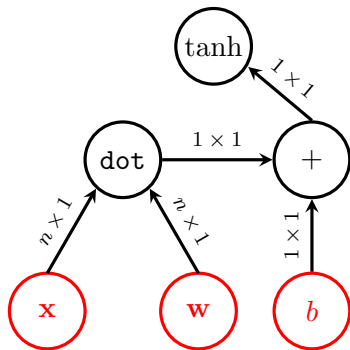


$$\hat{y} = \tanh(\mathbf{x}^T \mathbf{w} + b)$$

Computational Graphs

1. Operations
2. Tensors

Computational Paradigms

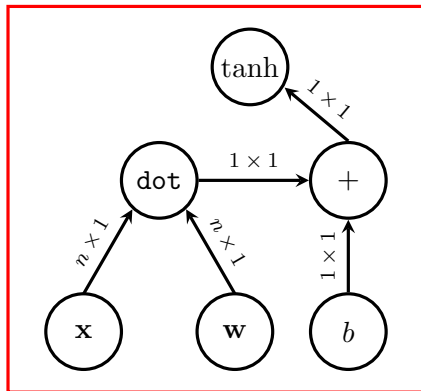


$$\hat{y} = \tanh(\mathbf{x}^T \mathbf{w} + b)$$

Computational Graphs

1. Operations
2. Tensors
3. Variables

Computational Paradigms



Computational Graphs

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

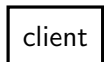
$$\hat{y} = \text{session.run}(\tanh(\mathbf{x}^T \mathbf{w} + b))$$

Execution Model

Execution Model

Actors

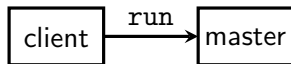
Execution Model



Actors

1. Client

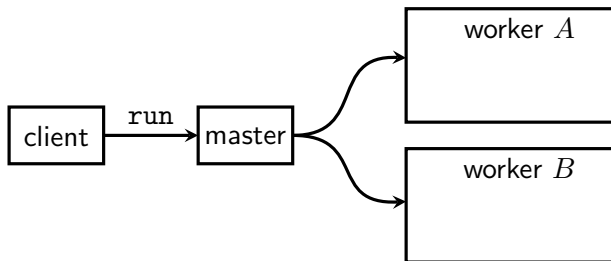
Execution Model



Actors

1. Client
2. Master

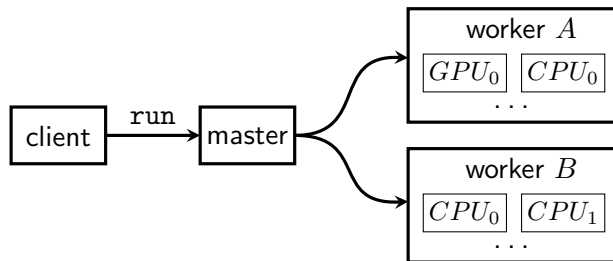
Execution Model



Actors

1. Client
2. Master
3. Workers

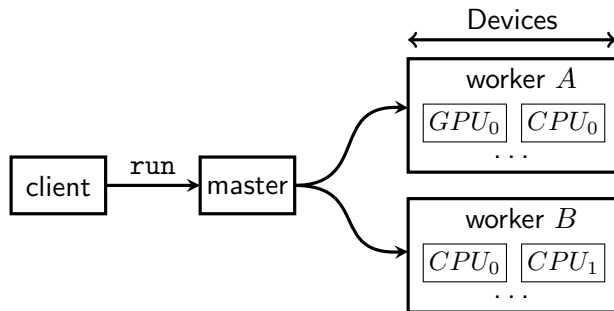
Execution Model



Actors

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

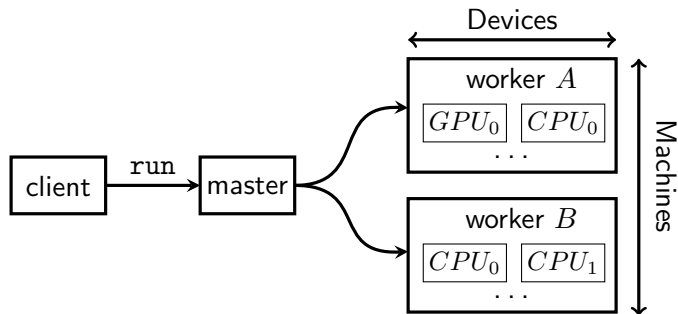
Execution Model



Actors

1. Client
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Execution Model

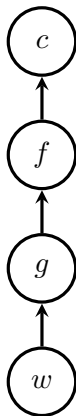


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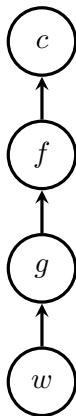
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Back Propagation in TensorFlow

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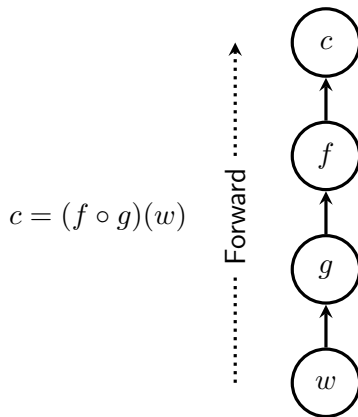


Back Propagation in TensorFlow



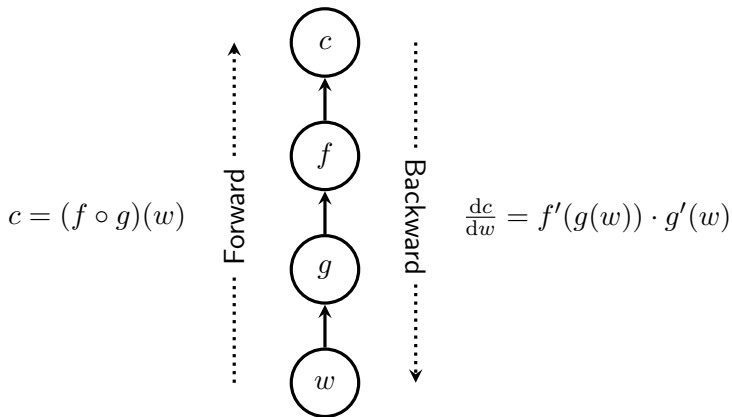
Symbol to Number Differentiation

Back Propagation in TensorFlow



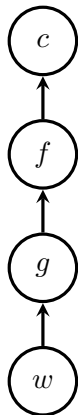
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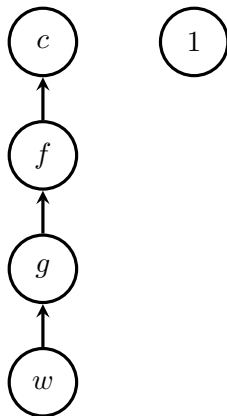
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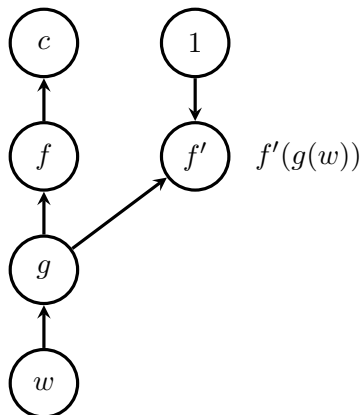
Symbol to Symbol Differentiation

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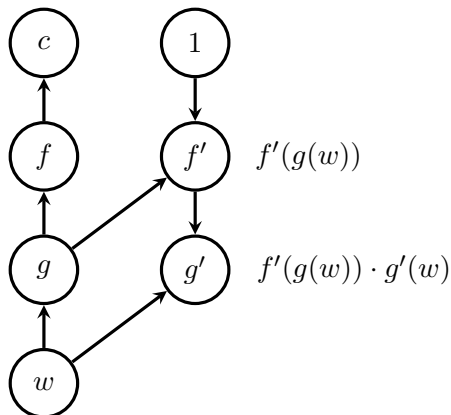
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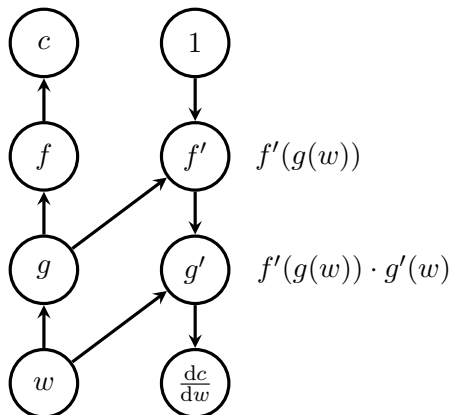
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Symbol to Symbol Differentiation

Visualization Tools

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- ▶ Deep Neural Networks have the tendency of being ... deep

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- ▶ Easy to drown in the complexity of an architecture

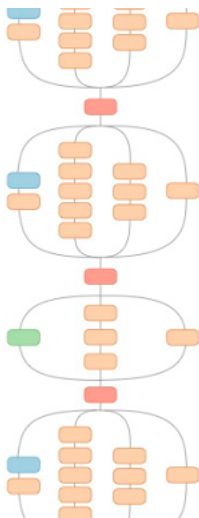
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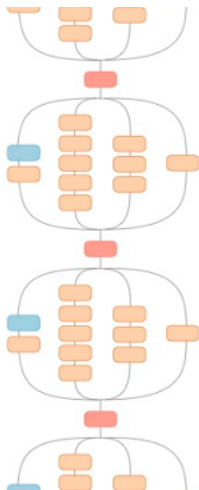
- ▶ Deep Neural Networks have the tendency of being ... deep
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- ▶ > 36,000 nodes for Google's *Inception* model

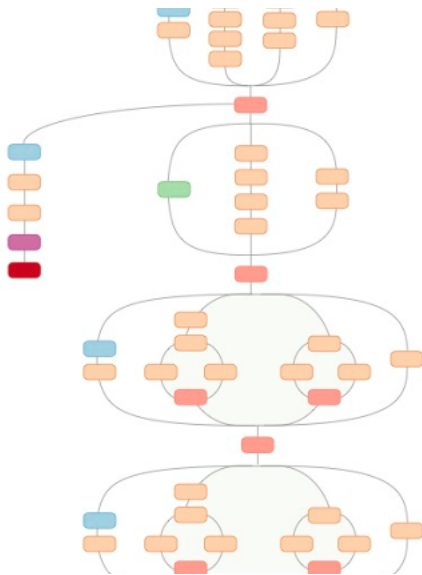
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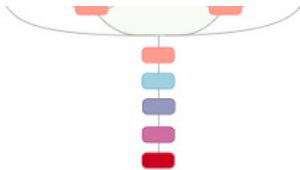
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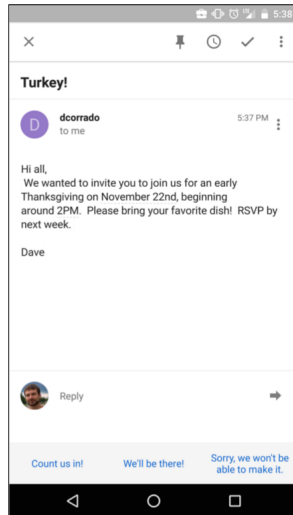
TensorBoard to the Rescue

Use Cases

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

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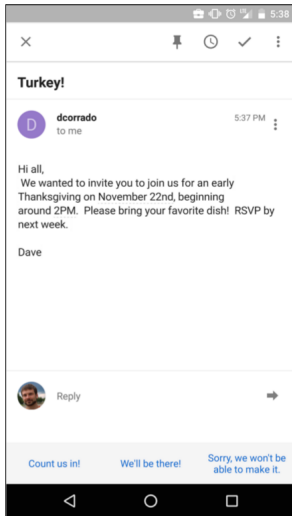
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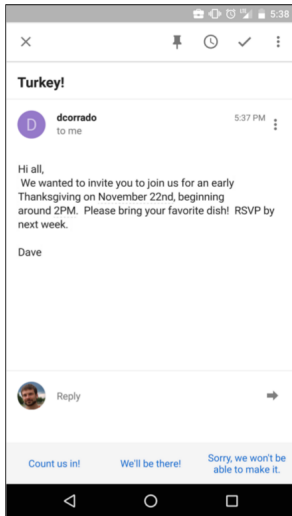
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- ▶ Emails mapped to “thought vectors”



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Use Cases

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- ▶ Emails mapped to “thought vectors”
- ▶ LSTMs synthesize valid replies



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 - ▶ Ability to run on many GPUs.



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Walkthrough

Thank You