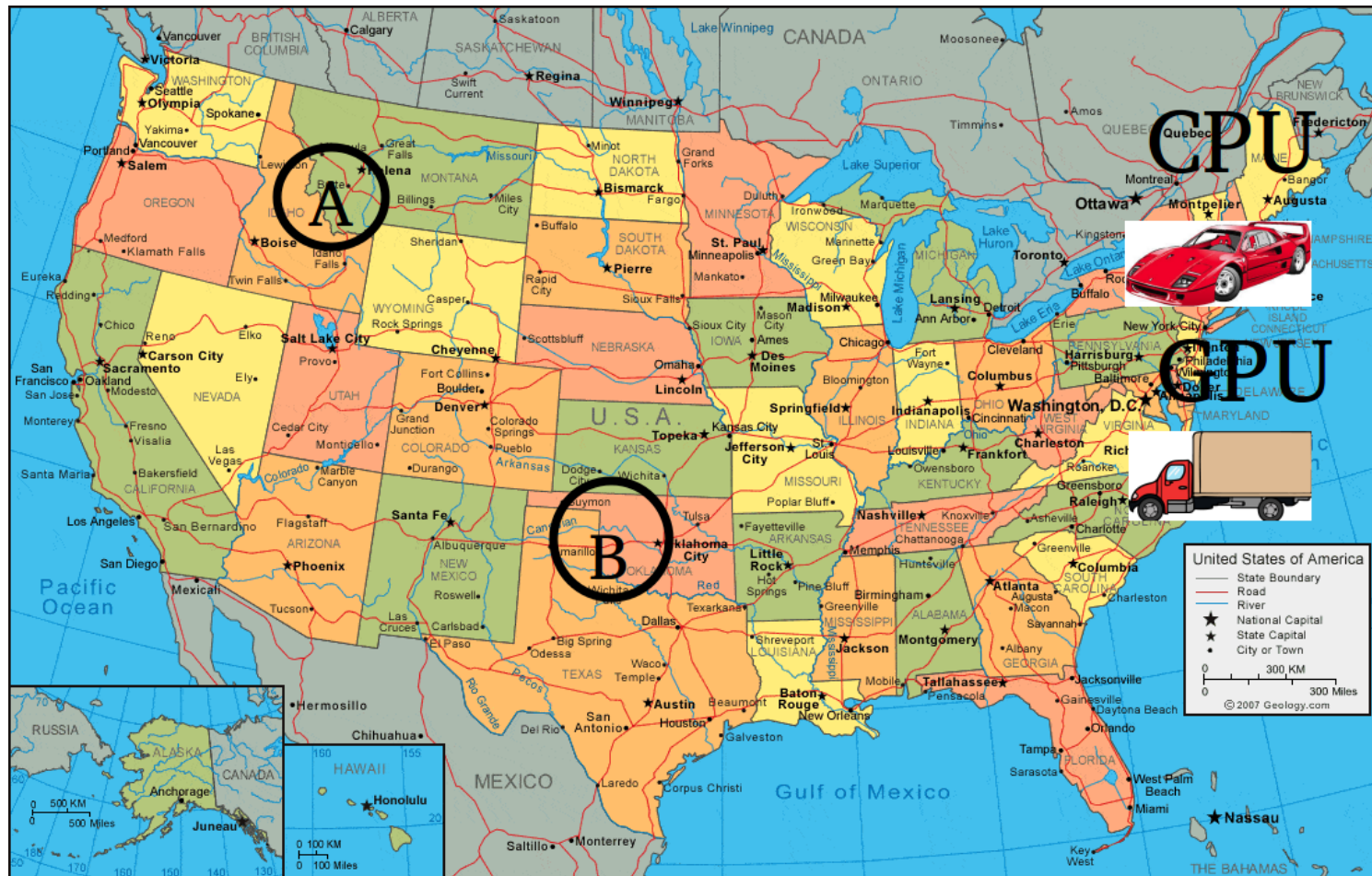


# Deep Learning Hardware, Libraries, and First Steps

What you need to know to get  
serious about deep learning

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# What makes GPUs so fast?



# Why NVIDIA GPUs? Software.

- Matrix multiplication optimized for over 10 years
- Convolution optimized over 4 years in intensive research
- cuDNN and cuBLAS extended and improved over many years
- Developing new software for AMD GPUs, ASICs, FPGAs, TPUs, Xeon Phi etcetera would take many years
- Performance advantages negligible

# GPU

- If you start to do deep learning or if you want to compete on Kaggle.com: GTX 1060
- If you work with large data sets which also have large input size (250GB of color images +  $250^2$  pixels; or video): NVIDIA Titan X or GTX Titan X
- Otherwise the best all-rounders are GTX 1070 and GTX 1080

# General hardware

- Get a SSD especially if you work with images
- CPU does not matter for deep learning performance, buy a cheap one
- RAM does not matter for deep learning performance
- Buy motherboard with PCIe 3.0 if you can

# Software

```
TensorFlow (78) *****
Keras (34) *****
Theano (20) *****
Torch (16) *****
Caffe (13) *****
DL4J (9) *****
CNTK (5) *****
MXNet (4) *****
Paddle (4) *****
DSSTNE (3) ***
Other (3) ***
H2O (2) **
Lasagne (2) **
Neon (2) **
Block (1) *
Chainer (1) *
Dali (1) *
Marvin (1) *
Veles (1) *
```

# Using deep learning in startups

- 80% of time spend on messy data and “making it work”
- Old vs very new algorithms
- Inference often more problematic than training
- Practical experience most valuable, e.g. Kaggle and hackathons
- Read papers on a need-to-know basis and keep up with hyped research
- TensorFlow + Flask + GTX 1070

# Big data/small data and industry

- Data can be messy, but main challenge is to go from prototype to application
- Good rule: Product should work without deep learning; best to improve existing product
- Learning to train models important; Kaggle experience valuable
- Focus on practical experience, rather than reading papers
- GPU memory can be a problem: NVIDIA Titan X or GTX Titan X. Keras is your friend. TensorFlow is good. Use Cognitive Toolkit (CNTK) for large DL



# Using Deep Learning on Kaggle.com

- Feature engineering still most important
- Understand “how data behaves” for certain algorithms
- Read “How I did it”-threads from winners
- Replicate past winners solutions
- Try to get a good score on many competitions quickly

# Starting in research

- Read, read, read
- Learn to adapt architectures and train them
- Understand how training behavior changes when you exchange components
- Become good at adding new high-level code
- Learn math on a need-to-understand basis
- GTX 1070/1080 or NVIDIA Titan X (CV)
- TensorFlow, Torch7, Caffe, Brainstorm

# Bibliography

- [Why are GPUs well-suited to deep learning?](#)
- [Are FPGAs the next step?](#)
- [GPU in depth advice](#)
- [Deep learning hardware guide](#)
- [Hackernews poll for deep learning software](#)
- [Deep learning usage in google search](#)
- [What makes a successful Kaggle competitor](#)
- [Overview over Caffe/Torch/TensorFlow/Theano](#)