

```

        'sec/batch'))
    print (format_str % (datetime.now(), step, loss_value,
                        examples_per_sec, sec_per_batch))

    if step % 100 == 0:
        summary_str = sess.run(summary_op)
        summary_writer.add_summary(summary_str, step)
        # Save the model checkpoint periodically.

    if step % 1000 == 0 or (step + 1) == FLAGS.max_steps:
        checkpoint_path = os.path.join(FLAGS.train_dir, 'model.ckpt')
        saver.save(sess, checkpoint_path, global_step=step)

```

Challenge for the Reader

You now have all the pieces required to train this model in practice. Try running it on a suitable GPU server! You may want to use tools such as `nvidia-smi` to ensure that all GPUs are actually being used.

Review

In this chapter, you learned about various types of hardware commonly used to train deep architectures. You also learned about data parallel and model parallel designs for training deep architectures on multiple CPUs or GPUs. We ended the chapter by walking through a case study on how to implement data parallel training of convolutional networks in TensorFlow.

In [Chapter 10](#), we will discuss the future of deep learning and how you can use the skills you’ve learned in this book effectively and ethically.

The Future of Deep Learning

In this book, we have covered the foundations of modern deep learning. We've discussed a wide variety of algorithms, and delved deeply into a number of sophisticated case studies. Readers who've been working through the examples covered in this book are now well prepared to use deep learning on the job, and to start reading the large research literature on deep learning methods.

It's worth emphasizing how unique this skill set is. Deep learning has had tremendous impact in the technology industry already, but deep learning is beginning to dramatically alter the state of essentially all nontech industries and to even shift the global geopolitical balance. Your understanding of this epochal technology will open many doors you may not have envisioned. In this final chapter, we will briefly survey some of the important applications of deep learning outside the software industry.

We will also use this chapter to help you answer the question of how to use your new knowledge effectively and ethically. Deep learning is a technology of such power that it's important for practitioners to think about how to use their skills properly. There have already been numerous misuses of deep learning, so it behooves new practitioners to pause before building sophisticated deep learning systems to ask whether the systems they are building are ethically sound. We will attempt to provide a brief discussion of ethical best practices, but caution the area of software ethics is complex enough that brief discussions are unlikely to do it full justice.

Finally, we will examine where deep learning is going. Is deep learning the first step toward building artificially general intelligences, computational entities that have the full range of abilities of humans? There exist a wide range of expert opinions, which we survey.