

robotic manipulation tasks. Google has demonstrated that reinforcement learning can be deployed to learn robotic object control, using a factory of robotic arms to enable large-scale training on real robots (see [Figure 10-1](#)). It's likely that such enhanced learning techniques for robots will begin filtering into the larger robotics industry over the next few years.



Figure 10-1. Google maintains a number of robotic arms that it uses to test deep reinforcement learning methods for robotic control. This fundamental research will likely find its way to the factory floor in the next few years.

Deep Learning in Agriculture

Industrial farming is already heavily mechanized, with sophisticated tractors deployed to plant and even pick crops. Advances in robotics and in computer vision are accelerating this trend toward automation. Convolutional networks have already been employed to identify weeds for removal with less pesticide. Other companies have experimented with self-driving tractors, automated fruit picking, and algorithmic crop yield optimization. These are mainly research projects for the time being, but these efforts will likely blossom into major deployments over the next decade.

Using Deep Learning Ethically

Most of this book has focused on the effective use of deep learning. We've covered many techniques for building deep models that generalize well on different data types. However, it's also worth spending some time thinking about the societal effects of the systems we build as engineers. Deep learning systems unleash a host of potentially unsettling applications.