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Natural vision is a bidirectional process. The human brain combines image data from the eyes with conceptual information from memory. Traditional artificial neural networks are primarily feed-forward, and although they are an effective tool for image processing, they are not especially useful for understanding natural vision. Over two summers, I worked with an undergraduate on several unusual neural networks that were specifically designed to include bi-directional information flow. We were interested in determining whether they could experience hallucinations, that is, can the feed-back connections superimpose features of an image from memory onto the image coming from the eye. We used Mathematica as the primary tool. We were able to formulate a bi-directional network and training process that was biologically reasonable, computationally feasible, and mostly comprehensible to an undergraduate. We trained it on simple videos of moving dots, and identified hints of stray features in its internal state, suggesting that it can indeed experience hallucinations. Mathematica was a good tool for this project, since it can process images and perform advanced calculations. The learning curve turned out to be appropriate for this student, who had minimal prior programming experience. (Received January 08, 2017)