



Computer Vision

Teaching Machines to Recognize Images



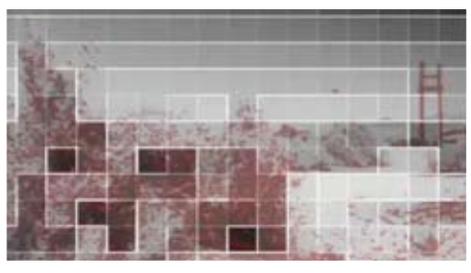
China Lake, CA (Naval Air Warfare Center Weapons Division) -- UAVs (unmanned aerial vehicles) record millions of images over dangerous territory but need to figure out what's important. Scientists and engineers are working on teaching UAVs and other robots to recognize and find people and objects. When a computer can figure out what the pixel patterns in a digital image stand for, that is called pattern recognition. Researchers are developing computer systems to recognize images using minimal visual data.

"The robots will ultimately be able to identify obstacles in their path--be able to know what the obstacle is, where it is, and how to get around it." **Rodney Heil, robotics engineer**

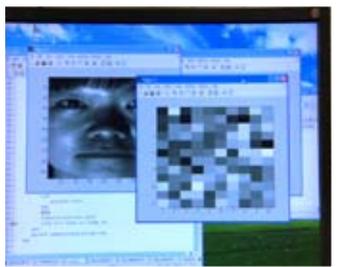
Framework	Standards
Middle School	<ul style="list-style-type: none"> STL - 2.M ➤ Technological systems include input, processes, and output. STL - 3.E ➤ A system developed for one setting may be applied to another setting. STL - 17.H ➤ Information systems allow information to be transferred. STL - 17.I ➤ Communication systems receive, encode, transmit, and decode information.

Content Illustrated

- Seeing through the "eyes" of a robot.



Content



Life Science

- People see with stereo vision.
- The human brain can recognize complex images, such as faces, as they turn and change. Humans are better than computers at recognizing the same person seen from different angles.

Technology

- Pattern recognition technology is used by the post office for sorting mail. A picture of the envelope is taken. Optical character readers extract out the zip code to sort and direct the mail into one pile or another.
- It is easier for computers to read and sort numbers than it is for them to read and identify images from photographs.

Engineering

- Pattern recognition is the ability of a computer to recognize a particular thing from a pattern of pixels. Engineers and scientists are figuring out how to teach computers to recognize people and objects from low-resolution images—images that use few pixels. They want computers to recognize objects like cars, people, buildings, and particular places.
- Engineers are making robots that can see with stereoscopic vision. The robots have two cameras, like two eyes, that triangulate the visual information. A goal is to have the robot identify an obstacle, know what and where it is, and how to get around it.

Math

- Visual information and data, including facial features, can be represented numerically and in equations for communication with computers. Programming for pattern recognition and computer vision takes a lot of math.
- Using triangulation, a robot can figure out the distance of things between objects.

Guiding Questions

To think about as you watch:

- When you look at a picture of the front, side, and back of a particular person, animal, or object, how do you know that all the pictures are of the same entity?
- How does your depth perception change when you close one eye?

Suggested Activities

- Play this webisode in connection with other webisodes involving GPS and triangulation (for example, *Virtual Human and Where in the World?*).
- Write a series of numbers, letters, or symbols using pixels. What's the minimum number of pixels you could use and still keep the letter, number, or symbol recognizable?

Keywords

computer vision
low resolution
optical character
recognition
pattern recognition
pixel
robotstereoscopic
vision
triangulate

- *Computer Vision* can be found online at www.ndep.us/Computer-Vision. Visit www.ndep.us/LabTV for a list of process skills modeled in webisodes.