Psy 392: Robot & Human Vision. Spring 2014.

Tu, Th: 3-4:15PM
BLDG: Psyc, Rm. 277

Instructor: Z. Pizlo (zpizlo@purdue.edu)
Text: Pizlo et al. (2014) Making a machine that sees like us. Oxford University Press.

Electronic version of the text will be provided.

Visual perception refers to forming three-dimensional (3D) descriptions of the objects and scenes around us on the basis of the information present in two-dimensional (2D) human retinal or robot camera images. Until very recently this problem was considered insoluble because, mathematically, this problem is underconstrained: there are *infinitely* many 3D interpretations that can be formed from any given 2D image. We now know that the human visual system solves this problem by using several powerful predilections (*a priori* constraints) representing, in the human mind, permanent important characteristics of our physical world. The most important predilection is the symmetry of objects: animals are symmetrical because of the way they move, plants are symmetrical because of the way they grow and man-made objects are symmetrical because of the function they serve. Visual mechanisms (algorithms) will be explained through illustrations, animations and demos, rather than by the use of equations. Equations will be made available, so they can be used by honors students who will be required to complete a project in robot vision. Grades will be based on class participation on and a term paper. Below is a list of topics that will be covered. Some demos and animation are here:

http://shapebook.psych.purdue.edu/

A. Philosophy of Science.

1. Nature of explanation.
2. David Marr: brain vs. mind.
3. Common sense in perception.

B. Geometry.

4. Retinal image formation.
5. Human eye vs. camera.
6. Structured light and laser sensors.
7. Perspective and orthographic projection

C. Simplicity, Symmetry and Shape.

8. Complexity of shape.
9. Symmetries. Skewed symmetry – detection
10. Symmetry correspondence
11. Definition of shape.

D. Depth perception.

12. Binocular vision and motion parallax.
13. Depth vs. shape perception.

E. Inverse Problems.

14. Forward and inverse problems.
15. Regularization and Bayesian methods.
16. 3D shape recovery, shape constancy, shape veridicality.
17. FGO – 3D space perception.
18. Stereoacuity, symmetry and shape recovery.