HVCA - Exercise 1

March 16, 2015

Deadline: April 6, 2015

1. Consider a vertical line l_1 that is moving up and to the right with velocity $v_1 = (3, 2)$ and a horizontal line l_2 that is moving down and to the right with velocity $v_2 = (1, -2)$. Plot the constraint lines corresponding to the two lines and indicate the intersection of constraints velocity and the vector average velocity (10 points).

2. Given two lines, l_1, l_2 with orientations θ_1, θ_2 and velocities v_1, v_2. Give an analytical equation for the intersection of constraints and vector average velocities. Solve all the way. (20 points)

3. Give an analytical equation for the velocity of the intersection formed between a moving line $l_1$with orientation θ_1 and velocity v, and a static line l_2 with orientation θ_2 . Solve all the way. (20 points)

4. Consider a line with orientation θ moving horizontally to the right with velocity v. We observe the line behind a circular aperture. (15 points)

   (a) What is the location of the terminators of the line as a function of time?

   (b) What is the velocity of each terminator of the line as a function of time?

   (c) What is the vector average of the terminator velocities, where the average is taken over the entire period the line is visible? Explain your answer.

   (d) What would you predict the perceived motion of the line will be? Compare this to your percept by looking at "justline.avi" (available at the course website), through an aperture that you create by cutting a circular hole in a piece of paper.

5. Repeat question 4 but with an elliptical aperture with aspect ratio a. Discuss your results. (10 points)

6. Consider the vector sum rule. Given two lines with normal velocities v_1, v_2 this rule computes the pattern velocity as $v = v_1 + v_2$. Design an

experiment to test whether this rule is used by human observers. Do any of the stimuli discussed in the lecture contradict this rule? Compare with IOC and VA. (20 points)

7. Propose a different rule (for the perceived velocity of two moving lines) that makes sense to you. Design experiments to differentiate this rule from IOC and VA. (5 points)