CS 461 FInal Homework

Due 12/15 (note change)

1. a) What are the three approaches to object recognition that we discussed?

   b) For each algorithm, state whether or not it can be applied to:

   i. 2D-2D object recognition
   ii. 2D-3D object recognition
   iii. 3D-3D object recognition

2. In general, computing 3D pose from 3D data requires computing both translation and rotation. However, we were able to separate it into a problem of computing rotation, and then computing translation. What trick did we use? If you want, describe it in terms of the basic 3D-3D pose equation $q_i = R p_i + t$. Where else did we use this trick?

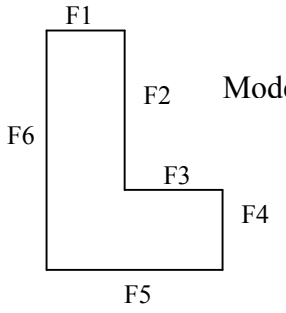
3. In the paper by David Lowe, he developed an algorithm that can be viewed as starting with local features that are not highly invariant and progressing to larger features with more invariance. In this regard:

   a. What transformations (image changes) are SIFT keys designed to be invariant to?

   b. How many sift keys are needed for testing alignment? Under what set of transformations?

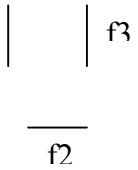
   c. Does the method make use of explicit 3D geometry?

Below is a model and some observed data. I've supplied the tables for the distance and angle constraints for model and data. On the next page is a partial interpretation tree. First, prune any of the *existing* branches at the second level that can be pruned. Finally, add any consistent third level branches to the remaining paths. How many consistent interpretations of this data are there? What are the feature correspondences?



Model

Data



angles	F1	F2	F3	F4	F5	F6
F1	0	3π/2	0	3π/2	π	π/2
F2	π/2	0	π/2	0	3π/2	π
F3	0	3π/2	0	3π/2	π	π/2
F4	π/2	0	π/2	0	3π/2	π
F5	π	π/2	π	π/2	0	3π/2
F6	3π/2	π	3π/2	π	π/2	0

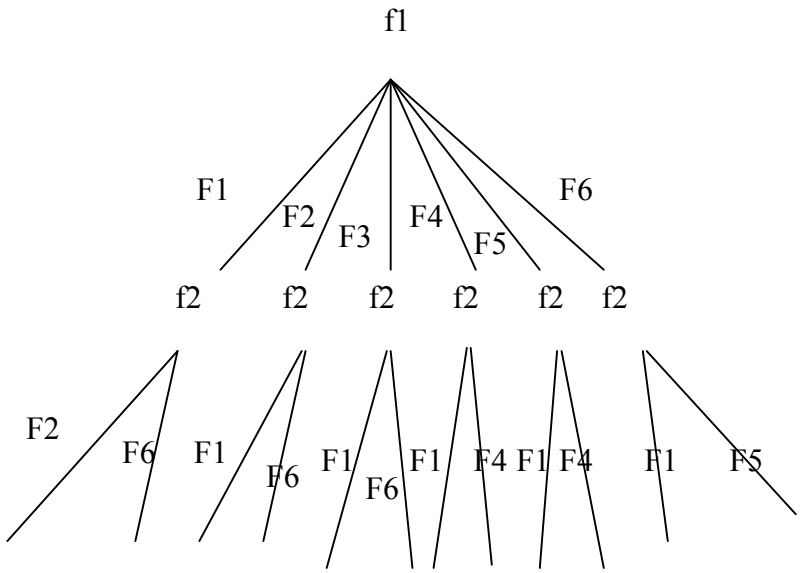
angles	f1	f2	f3
f1	0	π/2	π
f2	3π/2	0	π/2
f3	π	3π/2	0

Angles must be equal

distance	F1	F2	F3	F4	F5	F6
F1	[0,1]	[0,5]	[4,8]	[5,13]	[9,13]	[0,10]
F2	[0,5]	[0,4]	[0,5]	[1,10]	[1,10]	[1,10]
F3	[4,8]	[0,5]	[0,1]	[0,2]	[1,5]	[1,8]
F4	[5,13]	[1,10]	[0,2]	[0,1]	[0,5]	[4,13]
F5	[9,13]	[1,10]	[1,5]	[0,5]	[0,4]	[0,13]
F6	[0,10]	[1,10]	[1,8]	[4,13]	[0,13]	[0,9]

distance	f1	f2	f3
f1	[0,1]	[1,5]	[1,2]
f2	[1,5]	[0,1]	[1,5]
f3	[1,2]	[1,5]	[0,1]

Observed distance must be a subset of model distance


f1
F1
F2
F3
F4
F5
F6
f2
f2
f2
f2
f2
f2
F2
F6
F1
F6
F1
F6
F1
F4
F1
F4
F1
F5