Computer Vision

All documents are allowed. The different sections below are independant. Answers should be justified and should be possibly short.

1 Projective Geometry (3 points)

1. What are the benefits of the projective geometry with respect to the Euclidean Geometry ?
2. How do we go from a projective space to an affine space ?
3. What is an invariant for a group of transformation and why does affine transformations preserve parallelism ?

2 Surface modeling (4 points)

We are given a 3D modeling system composed of n cameras. Cameras are fixed and calibrated and we consider the 3D modeling process using information extracted from the images.

- We first assume that the silhouettes $S_{i\in[1..n]}$ of an observed object, and only the silhouettes, are available:
  1. What kind of model can we obtain ?
  2. When n goes to infinity what becomes the model ?
  3. Propose an algorithm that computes this model based on a space discretization into voxels (the algorithm will be sketched only).
- We consider secondly the photometric information:
  1. Can we improve the models computed before ? if yes how ?
  2. In the case of a Lambertian surface and if we assume the calibration to be exact can we obtain a model of the observed object which is exact up to the discretization ?

3 Motion modeling (3 points)

Modeling motion consists in obtaining, from images, information on the motion of a moving object in the scene.

1. Explain the difference between a learning based approach and a generative approach based on a parametric model.
2. What is the strategy used with the microsoft kinect device ?