Sample Questions: ATIV Exam

1. Suppose we take the (full) SVD of a size 12000 x 30 matrix A. Give the sizes and special properties of the resulting matrices.

   Solution: $A = U\Sigma V^T$
   U is 12000 x 12000
   Σ is 12000 x 30
   V is 30 x 30
   U and V are unitary matrices (i.e. rotation matrices), meaning their columns are orthogonal (mutually perpendicular) unit vectors.
   Σ is a diagonal matrix

2. It is possible to blur an image using a linear filter. Give two examples.

   Solution: Yes. Moving Average and Gaussian filter.

3. What operations does a Euclidean transformation of a square constitute? What is the maximum degree of freedom of a 3D Euclidean transformation?

   Solution: Rotations and translations. A 3D Euclidean transformation can have a maximum of 6 degrees of freedom (3 for rotation and 3 for translation).

4. Given that optical flow is computed on a video sequence with recurrent shadows, will the computation be impacted?

   Solution: Yes. The computation of optical flow assumes pixel brightness of the object in the scene to be constant throughout the video sequence. Recurrent shadows will degrade its accuracy.

5. Given a pair of images in the following setup, can you comment (without computation) whether the epipoles are going to inside/outside the image?

   Solution: The position of epipoles is dependent on the relative angle between image planes. Parallel images planes (zero rotation between image planes) have epipoles at infinity (outside the image). As the angle between image planes increases, the chances of epipoles to lie within the image increase.

Important: The paper will have more than 5 questions. In the exam, you can bring a piece of paper as an allowed cheat-sheet.