



Examination:

Optical Remote Sensing

Computer Vision &
Remote Sensing

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Name:

Matr.-Nr.:

Duration: 2 hours

Auxiliary Material: No

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Part A: Sensors (22p)

You are working in a company, which constructs optical remote sensing satellites. Your boss asks you to design a satellite, which is well suited for classification of land use over agricultural areas. The satellite should have 4 channels and will be operated at 800 km height with a velocity of 7000 m/s.

1. Draw a sketch showing the principal inner layout of an opto-mechanical sensor. **(5p)**
2. In order to achieve the requirement of your boss:
 - (a) At which wavelength would you place the spectral channels? **(2p)**
 - (b) Why? **(2p)**
3. How can multispectral imaging be achieved technically, i.e. how can the 4 channels be acquired simultaneously? **(2p)**
4. Now comes the moment to define the different resolutions:
 - (a) What are spatial resolution and radiometric resolution? **(5p)**
 - (b) Propose some reasonable values for the planned field of application. (Justify your answer) **(2p)**
5. You also have to deliver a routine in order to separate the data into 4 semantic classes: healthy vegetation, vegetation, no vegetation, water. Note that the method should work even if there is no ground-truth available.
 - (a) Propose a very simple algorithm to achieve the goal. **(4p)**

Part B: Data analysis (23p)

You are working in a remote sensing company. Your boss asks you to perform a multispectral classification of an area, using data provided by the designed satellite. Unfortunately the region is located in the overlap part of two images.

1. Geometrical transformation:
 - (a) Explain how you can estimate the parameters of a geometrical transform (a 2nd order polynomial function should be used), which warps one of the images onto the other so that both images fit geometrically? **(2p)**
 - (b) How many parameters need to be estimated? **(1p)**

2. After interpolating the second image with the derived function, both images fit geometrically, but still their brightnesses are different - due to different acquisition times of the data.
 - (a) Which technique could be used to adapt the brightness onto each other. **(1p)**
 - (b) Justify your choice. **(2p)**
3. On the prepared dataset, you want to apply an unsupervised ISODATA / K-MEANS segmentation.
 - (a) Explain step-by-step the principle of this technique (what the algorithm is doing in each step). **(5p)**
 - (b) What is the difference between ISODATA and K-MEANS approaches **(1p)**
 - (c) What do you have to do as a user. **(1p)**
4. Supervised techniques:
 - (a) List the advantages and disadvantages of using an unsupervised methods compared with supervised classification technique. **(3p)**
 - (b) What do you need for applying a supervised classification techniques. **(2p)**
 - (c) Denote two different supervised classification methods. **(1p)**
5. What are thematic classes and what are spectral classes? **(1p)**
6. After applying an unsupervised and a supervised classification, you are not satisfied with the results.
 - (a) How can you improve your classification results? **(2p)**
 - (b) Denote two techniques. **(1p)**

Altogether **45 points** can be obtained. A short and accurate style should be intended.

Pay attention to write a clear and comprehensible text. Always justify your answers!

Lot's of luck and do your best!