Technische Universität Berlin

Examination

Optical Remote Sensing

Computer Vision &
Remote Sensing

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Name: …….. **Student ID**:……..

Duration: 2 hours **Auxiliary Material**: NO

Berlin, 18th February 2016

Important:

- Answers have to be written in English, only.
- Write short and concise answers. Use sentences.
- Draw your sketch using the **full width of the page**. Place all useful information needed to understand your sketch, even if not asking. ***Small sketches will not be considered***.
- For calculation, do not give only the numerical result. Show all intermediate steps.
- Answers shall be ordered following the question numbering. **DO NOT MERGE QUESTIONS**.
- Altogether a total of **75 points** can be obtained.

Part A: General Questions	**(41 P)**
1. What is remote sensing? (Give a short but detailed answer).	**(4 P)**
2. Atmospheric Window (a) Draw ***roughly*** the atmospheric window. On the sketch, place approximately the different region: UV, visible blue, visible green, visible red, near IR, thermal IR, microwave (wavelength ranges are not required). (b) Explain why optical remote sensing is possible from satellite.	**(6 P)** *4 p* *2 p*
3. Spectral signature. (a) Define spectral signature. (b) Draw roughly the spectral signature of: 1) healthy green vegetation, 2) bare soil, and 3) water. For each case, indicate the lowest and highest reflectance.	**(8 P)** *2 p* *6 p*
4. Resolutions: (a) What is spectral resolution? (b) What is spatial resolution? (c) What is temporal resolution?	**(6 P)** *2 p* *2 p* *2 p*
5. Imagery: (a) Why do we see objects in different colours? (b) Satellite can have many bands. How many of them could we visualise simultaneously? (c) What is the true colour visualisation? (d) What is false colour visualisation? Why is it useful?	**(9 P)** *2 p* *1 p* *2 p* *4 p*

6.	Hyperspectral imagery: (a) What is hyperspectral remote sensing? (b) What is the advantage compared to multispectral data? (c) Define SAM (Spectral Angle Mapper).	**(8 P)** *2 p* *2 p* *4 p*

Part B: Sensor — (18 P)

A satellite has the following properties: It is an opto-electronical sensor having 6000 CCD elements with a size of 10 µm each. The ground pixel size is about 10x10m. The sensor is mounted on a satellite, flying at an altitude of 800 km. Answer the following questions:

1.	What is an opto-electronical sensor (use a sketch, indicate all necessary parameters)?	**3 p**
2.	Calculate the size of the swath. A detailed answer is expected.	**2 p**
3.	Deduce from above the focal length of the system. A detailed answer is expected.	**2 p**
4.	What are the differences with an opto-mechanical sensor?	**4 p**
5.	In both types of sensor, how can multispectral imaging be achieved technically?	**2 p**
6.	Orbits (a) What means near-polar sun-synchronous orbit? (b) What is the other type of orbit for imaging satellite? (c) Give one example of satellite for each type of orbit.	**(5 P)** *2 p* *1 p* *2 p*

Part C: Data analysis — (16 P)

We have the following 3x3 images with grey values varying from 0 to 7.

1	3	2
3	4	7
4	5	4

Image 1 (To be modified)

5	7	6
3	4	7
6	5	7

Image 2 (Reference)

1.	Draw a one-dimensional histogram for both images.	*2 p*
2.	The histogram of image 1 should look like the one of image 2 (a) Which technique could be used? (b) Display the new image as table. Indicate all steps. (c) Show that the new histogram is similar to the histogram of image 2.	**(6 P)** *1 p* *4 p* *1 p*
3.	Supervised classification (a) Explain step by step the principle of supervised classification. (b) What do you have to do as user? (c) Give 2 methods of supervised classification.	**(8 P)** *4 p* *2 p* *2 p*

Lot's of luck and do your best!