



**TITLE OF THE
Curricula/Module**

**SATELLITE IMAGE
PROCESSING**

TUIT/Uzbekistan

June, 2020

Curriculum/Module DESCRIPTION

TUIT/Uzbekistan 25 (June/2020)	
TITLE OF THE Curricula/Module	Code
Satellite image processing	2.02

Teacher(s)	Department
Coordinating: <ul style="list-style-type: none"> • Temurbek Kuchkorov Others: <ul style="list-style-type: none"> • Zamira Allamuratova • Nozima Atadjanova 	Computer systems, Computer engineering faculty

Study cycle	Level of the module	Type of the module
BA/ <u>MA</u> /PhD	Master	

Form of delivery	Duration	Language(s)
offline	15 weeks	UZ/EN

Prerequisites	
Prerequisites: To know: <ul style="list-style-type: none"> – Basics of digital image processing – Basics of programming skills (C/C++, Java or Python) Possess: <ul style="list-style-type: none"> – Image processing basics and using programming languages with OpenCV library 	Co-requisites (if necessary):

ECTS (Credits of the module)	Total student workload hours	Contact hours	Individual work hours
4	120	45	75

Aim of the module (course unit): competences foreseen by the study programme		
<p>Satellite Image Processing is an important field in research and development and consists of the images of earth and satellites taken by the means of artificial satellites. The satellite imagery is widely used to plan the infrastructures, to monitor the environmental conditions, agricultural fields or to detect the responses of upcoming disasters. This course aims to learn digital image processing tasks and methods, as well as OpenCV basics for satellite image processing. Spatial image formation and remote sensing technologies are also included in this course. To implement acquiring skills in land cover analysis by using Sentinel-2 data, students will learn how to use Land Monitoring Service platform in agricultural statistics.</p>		
Learning outcomes of module (course unit)	Teaching/learning methods	Assessment methods
To know: <ul style="list-style-type: none"> – Digital image processing. Basics operations on images by using OpenCV library; – Spatial imagery and satellite image processing techniques. Resolutions of spatial images; – Formation of satellite images using remote sensing technique. 	Lectures, independent study of the material	Quiz

<p>To be able to:</p> <ul style="list-style-type: none"> – To perform basic operations, read and display images, changing brightness and contrast of satellite images; – To use different methods of image filtering such as histogram equalizations, blurring and using morphological operations; – Formation of satellite images and using platforms (Sentinel-2, Landsat-8) to create satellite images. – To use methods of satellite image analysis and classification. 	Implementation of the training project	Presentation of an educational project
<p>Possess:</p> <ul style="list-style-type: none"> – To use satellite image formation platforms and preprocessing of spatial images; – Using image-processing techniques for land monitoring through satellite images. 	Implementation of the training project	Presentation of an educational project

Themes	Contact work hours							Time and tasks for individual work	
	Lectures	Consultations	Seminars	Practical work	Laboratory work	Placements	Total contact work	Individual work	Tasks
Introduction to image processing. OpenCV basics	14	0	0	7	0	0	21	42	<p>Introduction to satellite image processing. Applications in different fields.</p> <p>Digital image processing. Image formation. Types of images.</p> <p>Read and display images. Point operations in image processing. Using OpenCV library.</p> <p>Image enhancement. Types of image filtering. Changing brightness and</p>

									<p>contrast of images.</p> <p>Histogram equalizations, blurring and using morphological operations.</p> <p>Intellectual analysis of images. Image classification.</p> <p>Intellectual analysis of images. Image segmentation.</p>
Formation of spatial images. Satellite imagery basics	8	0	0	4	0	0	12	28	<p>Formation of spatial images. Image resolutions. Spatial resolution of satellite images. Spatial vs. spectral resolution</p> <p>Overview the multi-spectral imaging tools. Working with satellite imagery.</p> <p>Using high spatial resolution data. Sentinel-2 and Landsat-8 for Agriculture system.</p> <p>Satellite image filtering and preprocessing methods. Satellite image analysis.</p>
Satellite image analysis and classification	4	0	0	2	0	0	6	40	<p>Land cover mapping and monitoring. Land cover classification systems.</p>

									Satellite image classification for detailed crop mapping. The supervised classification of satellite imagery. Ground data.
Implementation of satellite image processing in Precision Agriculture	4	0	0	2	0	0	6	25	Implementation of satellite image processing in Precision Agriculture. “Global Land Service” platform and services. Cost effectiveness in agricultural statistics.
Total	30	0	0	15	0	0	45	135	

Assessment strategy	Weight in %	Deadlines	Assessment criteria
Running control	50	10 week	preliminary presentation of the project
Final exam	50	15 week	Final quiz

Compulsory literature/ Author	Year of issue	Title	No of periodical or volume	Place of printing. Printing house or internet link
Lemoine, G., Defourny, P., Gallego, J. and others	2017	Handbook on Remote Sensing for Agricultural Statistics		GSARS Handbook: Rome. http://www.fao.org/3/ca6394en/ca6394en.pdf
Richard Szeliski	2010	Computer Vision: Algorithms and Applications		Springer http://szeliski.org/Book/
Tinku Acharya, Ajoy K. Ray	2005	Image Processing Principles and Applications		A John Wiley & Sons, Mc., publication
R.Usmanov, T.Kuchkorov, A.Abdusalomov	2018	Kompyuter ko'rishi (Computer Vision) o'quv qo'llanma		T.: «Aloqachi»
Additional literature				
Jordi I., Arthur V., Marcela A., Benjamin T., David M. and Isabel R.	2017	Operational High Resolution Land Cover Map Production at the Country Scale Using Satellite Image Time Series		Article, https://www.mdpi.com/2072-4292/9/1/95
SUHET, ESA Standard Document	2015	Sentinel-2 User Handbook		https://sentinel.esa.int/documents/247904/685211/Sentinel-2_User_Handbook

Internet links

Remote Sensing and Digital Image Processing of Satellite Data

(https://www.youtube.com/watch?v=EcLPYfiin_A)

<https://www.pyimagesearch.com/2018/07/19/opencv-tutorial-a-guide-to-learn-opencv/>

<https://agromonitoring.com/api>

<https://www.satimagingcorp.com/services/>

<https://land.copernicus.eu/global/products/lc>

<https://www.coursera.org/learn/spatial-analysis-satellite-imagery-in-a-gis#syllabus>

<https://www.coursera.org/learn/spatial-data-science#syllabus>

ANOTATION /course summery

This course forms the skills for selecting and applying various methods of image processing and remote sensing techniques, applying modern services of spatial imagery in land monitoring for precision agriculture. The knowledge obtained as a result of mastering the discipline is necessary for solving practical problems in the field of formation of spatial images using remote sensing, satellite image filtering and analyzing and processing satellite images.

List of **themes and short description**

Themes	Contact work hours
<p>Introduction to image processing. OpenCV basics</p> <p>Introduction to satellite image processing. Applications in different fields. Digital image processing. Image formation. Types of images. Read and display images. Point operations in image processing. Using OpenCV library. Image enhancement. Types of image filtering. Changing brightness and contrast of images, histogram equalizations, blurring and using morphological operations Intellectual analysis of images. Image classification and segmentation.</p>	18
<p>Formation of spatial images. Satellite imagery basics</p> <p>Formation of spatial images. Image resolutions. Spatial resolution of satellite images. Spatial vs. spectral resolution. Overview the multi-spectral imaging tools. Working with satellite imagery. Satellite image filtering and preprocessing methods. Using high spatial resolution data. Sentinel-2 and Landsat-8 for Agriculture system.</p>	12
<p>Satellite image analysis and classification</p> <p>Satellite image analysis. Remote sensing basics and main tasks. Land cover mapping and monitoring. Land cover classification systems. Satellite image classification for detailed crop mapping. The supervised classification of satellite imagery. Ground data.</p>	9
<p>Implementation of satellite image processing in Precision Agriculture</p> <p>Implementation of satellite image processing in Precision Agriculture. Satellite image classification for detailed crop mapping using remote sensing. “Global Land Service” platform and services. Cost effectiveness in agricultural statistics.</p>	6
Total	45