

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: RAČUNALNIŠKI PRAKTIKUM
Course title: COMPUTER PRACTICUM

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Varstvo okolja in ekotehnologije, 2. stopnja	/	1.	/
Environmental Protection and Eco-technologies, 2 nd level	/	1 st	/

Vrsta predmeta / Course type

Obvezni predmet / Obligatory course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
20	0	20	0	80	4

Nosilec predmeta / Lecturer:

dr. Urša Kanjir

Jeziki /

Predavanja / Lectures: Slovenščina / Slovenian

Languages:

Vaje / Tutorial: Slovenščina / Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Za uspešno opravljanje študijskih obveznosti se predpostavlja:

- osnovno računalniško znanje,
- poznavanje programov Microsoft Office (Word za urejanje besedil, Excel za osnovno delo s preglednicami in PowerPoint za pripravo predstavitev),
- veščine uporabe interneta,
- znanje angleškega jezika.

Prerequisites:

The following are required for successful completion of study obligations:

- basic computer skills,
- knowledge of Microsoft Office programs (Word for word processing, Excel for basic work with spreadsheets, and PowerPoint for preparing presentations),
- internet skills,
- knowledge of the English language.

Vsebina:

- **Osnove obdelave okoljskih podatkov** (predstavitev osnovnih elementov: kaj je surov/obdelan podatek, katere tipe podatkov poznamo, kako podatke zbiramo, urejamo, analiziramo in prikazujemo z uporabo informacijske tehnologije).
- **Pregled orodij in programskih jezikov** (predstavitev osnovnih orodij za obdelavo okoljskih podatkov in programskih jezikov, ki jih bomo uporabljali pri predmetu. Poudarek bo na programskem jeziku *Python*, predstavitev njegovih osnov za začetno rokovanje. Predstavili bomo ključne lastnosti in prednosti GIS orodja *QGIS*).

Content (Syllabus outline):

- **Fundamentals of environmental data processing** (introduction to basic elements: what constitutes raw and processed data, types of data, and methods for collecting, organising, analysing, and displaying data using information technology).
- **Overview of tools and programming languages** (introduction to essential tools for processing environmental data and the programming languages used in the course. The focus will be on the Python programming language, with an introduction to its basics for initial use. Key features and advantages of the GIS tool QGIS will also be presented).

- **Zbiranje in predpriprava podatkov** (iz različnih virov bomo zbrali okoljske podatke ter jih vnesli in uvozili v računalniške sisteme, npr. pridobitev časovnih vrst različnih okoljskih podatkov, kot so meteorološki podatki) Ti podatki bodo kasneje ustrezno razvrščeni, filtrirani in predpripravljeni za obdelavo).
- **Analiza in evalvacija podatkov** (uporaba osnovnih statističnih metod za interpretacijo podatkov in izbira ustreznih algoritmov za obdelavo izbranih podatkov. Preverjanje kakovosti in veljavnosti podatkov).
- **Prikaz in interpretacija podatkov** (vizualizacija podatkov s kartami, grafi, tabelami in diagrami. Interpretacija rezultatov glede na širši okoljski/družbeni pomen, primerjava z že obstoječimi rezultati).
- **Dokumentacija analiz in podatkov** (zagotavljanje sledljivosti, ponovljivosti in kakovosti podatkov ter njihovih analiz. Dokumentacija vključuje opis virov podatkov, metapodatke, zapisane postopke čiščenja in preoblikovanja ter kodo ali metodologijo analize, kar omogoča razumevanje konteksta in veljavnosti končnih ugotovitev. Poudarek bo na uporabi orodja *Quarto* – Jupyter Notebook. Priprava končnega poročila obdelave podatkov).
- **Verzioranje podatkov** (sledenje spremembam v kodi in dokumentih ter shranjevanje podatkov in rezultatov, s poudarkom na odprti znanosti).

Poglavitne teme:

- Predmet vključuje teoretične osnove in praktične vaje, ki se nanašajo na obdelavo merjenih okoljskih podatkov. Študentom bo zagotovil potrebno teoretično ozadje in praktična znanja, ki so nujna za sodobne okoljske znanosti, pri čemer bodo razumeli surove podatke, s katerimi se ukvarjajo, in jih obdelali v smiselne informacije. Pri predmetu bodo študenti predelali osnovni nabor orodij, ki jih potrebujejo za okoljske analize, monitoring in poročanje. Ob tem se bodo naučili tudi dokumentirati, slediti in verzionirati svoje rezultate. Predavanja bodo temeljila na primerih, praktične vaje pa na realnih podatkih. Predmet bo temeljil na pristopu odprte znanosti (odprtokodni programi in shranjevanje rezultatov na odprtokodnih platformah).

- **Data collection and pre-processing** (collection of environmental data from various sources, entry and import into computer systems, e.g., obtaining time series of different environmental data such as meteorological data. This data will then be classified, filtered, and pre-processed for further analysis).
- **Data analysis and evaluation** (application of basic statistical methods for data interpretation and selection of suitable algorithms for processing selected data. Verification of data quality and validity).
- **Data display and interpretation** (visualisation of data using maps, graphs, tables, and diagrams. Interpretation of results in terms of broader environmental and social significance, and comparison with existing results).
- **Documentation of analyses and data** (ensuring traceability, repeatability, and quality of data and analyses. Documentation includes descriptions of data sources, metadata, records of cleaning and transformation procedures, and the code or methodology of the analysis, enabling understanding of the context and validity of the final findings. The focus will be on using the *Quarto* – Jupyter Notebook tool. Preparation of the final data processing report).
- **Data versioning** (tracking changes in code and documents, storing data and results, with an emphasis on open science).

Main topics:

- The course covers theoretical foundations and practical exercises related to processing measured environmental data. It provides students with the theoretical background and practical skills necessary for modern environmental sciences, enabling them to understand raw data and process it into meaningful information. Students will learn the essential tools for environmental analysis, monitoring, and reporting. They will also learn to document, track, and version their results. Lectures will use case studies, and practical exercises will use real data. The course follows an open science approach, using open-source software and storing results on open-source platforms.

Temeljna literatura in viri / Textbooks:

Obvezna / Required:

Knjige / Books:

1. Zuur, A. F., Ieno, E. N., & Smith, G. M. (2007). *Analysing Ecological Data*. Springer Nature.
2. McKinney, W. (zadnja izdaja). *Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter*. O'Reilly.
3. QGIS Documentation (zadnja izdaja). *User Guide & Training Manual* (spletno).

Revije / Periodicals:

- Pregledni članki, izbor v tekočem letu/Review articles, yearly selection.

Priporočena / Recommended:

1. The Turing Way Community. *The Turing Way: A Handbook for Reproducible, Ethical Data Science*. (spletno)
2. Bruce, P., Bruce, A., & Gedeck, P. (zadnja izdaja). *Practical Statistics for Data Scientists*. O'Reilly.

Cilji in kompetence:

Predmetno specifični cilji in kompetence:

- Študent/ka razume osnovne pojme okoljskih podatkov (surov/obdelan podatek, tipi podatkov, viri, merilni proces, negotovost),
- usvoji osnovni potek obdelave okoljskih podatkov: zajem → uvoz → čiščenje → predpriprava → analiza → prikaz → interpretacija → poročanje,
- razvije osnovno računalniško pismenost za obdelavo podatkov s poudarkom na programskem jeziku Python,
- nauči se uporabljati orodja in metode za obdelavo okoljskih podatkov,
- spozna in uporablja ključne funkcionalnosti QGIS za pregled, osnovno obdelavo in prikaz prostorskih okoljskih podatkov;
- zna zbrati podatke iz izbranih virov (npr. meritve, javne baze, prenosi, časovne vrste meteoroloških podatkov) in jih pripraviti za analizo;
- uporabi osnovne statistične pristope za opis, primerjavo in interpretacijo okoljskih podatkov ter preveri kakovost in veljavnost podatkov;
- pripravi razumljive vizualizacije (grafi, tabele, diagrami, karte) in rezultate smiselno umesti v okoljski/družbeni kontekst;
- pripravi dokumentirano in ponovljivo analizo ter izdelava končno poročilo obdelave podatkov;
- nauči se uporabljati osnovne pristope verzioniranja za sledenje spremembam kode/dokumentov in za deljenje rezultatov v duhu odprte znanosti.

Objectives and competences:

Specific competences:

- Students understand the basic concepts of environmental data (raw/processed data, data types, sources, measurement process, uncertainty),
- they learn the basic process of environmental data processing: collection → import → cleaning → pre-processing → analysis → visualisation → interpretation → reporting,
- develop basic computer literacy for data processing with emphasis on the Python programming language,
- learn to use tools and methods for processing environmental data,
- learn and use key QGIS functionalities for reviewing, basic processing, and displaying spatial environmental data,
- are able to collect data from selected sources (e.g. measurements, public databases, transfers, time series of meteorological data) and prepare it for analysis,
- use basic statistical approaches to describe, compare, and interpret environmental data and verify the quality and validity of data,
- prepare clear visualisations (graphs, tables, diagrams, maps) and place the results in an environmental or social context,
- prepare a documented and repeatable analysis and produce a final data processing report;
- learn to use basic versioning approaches to track changes in code and documents, and to share results in the spirit of open science.

Splošne kompetence:

- Obvladanje in razumevanje temeljnih pojmov, metod in postopkov obdelave okoljskih podatkov,
- osvojitev uporabe osnovnih računalniških in programskih orodij ter tehnologij,
- sposobnost izvajanja individualne analize prostorskih podatkov.

General competences:

- Mastering and understanding basic concepts, methods, and procedures for processing environmental data,
- learning to use basic computer and software tools and technologies,
- Ability to perform individual analysis of spatial data.

Predvideni študijski rezultati:**Znanje in razumevanje:**

Študent/ka bo ob zaključku predmeta sposoben/na:

- razlikovati med surovimi in obdelanimi okoljskimi podatki ter pojasniti ključne značilnosti merjenih okoljskih podatkov (viri, napake/negotovost, omejitve),
- opisati in utemeljiti celoten potek obdelave podatkov od zajema/uvoza do analize, prikaza, interpretacije in poročanja,
- načrtovati in izvesti obdelavo realnih okoljskih podatkov tako, da je postopek sledljiv, ponovljiv in preverljiv.

Prenosljive/ključne spretnosti in drugi atributi:

Študent/ka bo sposoben/na:

- izbrati, izvesti in utemeljiti osnovne analitske postopke in raziskovalno vprašanje ter kritično presoditi kakovost/veljavnost rezultatov,
- rezultate jasno komunicirati (strukturirano poročilo in ustna predstavitev/zagovor) in argumentirati sprejete odločitve v obdelavi;
- delovati odgovorno pri ravnanju s podatki (transparentnost, navajanje virov, osnovna podatkovna etika) ter uporabljati prakse, ki omogočajo ponovno uporabo rezultatov,
- pridobljena znanja in izkušnje prenesiti na sorodne naloge pri študiju in delu (samostojno reševanje problemov, učinkovita uporaba IT orodij).

Intended learning outcomes:**Knowledge and understanding:**

Upon completion of the course, students will be able to:

- distinguish between raw and processed environmental data and explain the key characteristics of measured environmental data (sources, errors/uncertainty, limitations),
- describe and justify the entire data processing flow from collection/import to analysis, display, interpretation, and reporting,
- plan and perform the processing of real environmental data in a way that is traceable, repeatable, and verifiable.

Transferable/key skills and other attributes:

Students will be able to:

- select, perform, and justify basic analytical procedures and research questions, and critically assess the quality and validity of results,
- clearly communicate results in a structured report and oral presentation and justify decisions made in the analysis,
- act responsibly when handling data, ensuring transparency, proper citation of sources, and adherence to basic data ethics, and use practices that enable the reuse of results,
- transfer acquired knowledge and experience to related tasks in study and work, including independent problem solving and effective use of IT tools.

Metode poučevanja in učenja:**Oblike dela:**

- Predavanja (20 ur) bodo potekala s sodelovalnim učenjem na praktičnih primerih in se bodo povezovala z vajami (20 ur). Vaje bodo potekale v skupinah, kjer bodo različne skupine študentov/k zbrale in obdelale izbrane okoljske podatke na izbranem območju. Po vsaki obdelavi in sintezi podatkov bo v sklopu predavanj potekala

Learning and teaching methods:**Forms of teaching:**

- Lectures (20 hours) will use collaborative learning based on practical examples and will be linked to practical work (20 hours). The exercises will be conducted in groups, with different groups of students collecting and processing selected environmental data in a chosen area. After each data processing and synthesis, the lectures will include interpretation of the acquired data and

<p>interpretacija pridobljenih podatkov in informacij ter povezovanje z novimi učnimi vsebinami.</p> <ul style="list-style-type: none"> • Študenti/ke bodo na koncu individualno izvedli en realen mini projekt z izbranimi okoljskimi podatki (npr. satelitski podatki, meteorološki podatki, hidrološki podatki, hrup, promet ...) ter oddali repozitorij s kratkim poročilom in predstavili svojo nalogo s kratko predstavitevijo. <p>Metode dela:</p> <ul style="list-style-type: none"> • Izobraževanje bo potekalo v obliki problemsko usmerjene razlage z demonstracijo postopkov, kratkimi navodili in usmerjanjem dela. Zaželen bo dialog s študenti in diskusija ob preučevanju praktičnih primerov, refleksija. • Vključeno bo tudi aktivno skupinsko delo, kjer bomo sodelovalno reševali probleme. • Pri individualnem projektnem delu študentov bo poudarjeno reševanje realnih problemov na konkretnih študijskih primerih. 	<p>information, and connect this to new learning content.</p> <ul style="list-style-type: none"> • At the end, students will individually complete a real mini-project using selected environmental data (e.g., satellite data, meteorological data, hydrological data, noise, traffic, etc.), submit a repository with a short report, and present their task in a brief presentation. <p>Teaching methods:</p> <ul style="list-style-type: none"> • The training will consist of problem-oriented explanations with demonstrations of procedures, brief instructions, and work guidance. Dialogue with students, discussion of practical examples, and reflection will be encouraged. • Active group work will also be included, where problems will be solved collaboratively. • In individual project work, students will focus on solving real problems using specific case studies.
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Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
<p>Pogoj za pristop k izpitu:</p> <ul style="list-style-type: none"> - Pri predmetu je obvezna vsaj 80 % prisotnost. Študent/ka mora samostojno izdelati aplikativno seminarsko nalogo in jo predstaviti ter zagovarjati na zaključni predstavitvi. <p>Končna ocena je sestavljena iz:</p> <ul style="list-style-type: none"> - Aplikativne seminarske naloge, - predstavitev in zagovor projekta. <p>Ocenjevalna lestvica:</p> <ul style="list-style-type: none"> ▪ zadostno 6: 60–67 % ▪ dobro 7: 68–75 % ▪ prav dobro 8: 76–83 % ▪ prav dobro 9: 84–90 % ▪ odlično 10: 91–100 % 	<p>60 % 40 %</p>	<p>A prerequisite for access to the exam:</p> <ul style="list-style-type: none"> - At least 80% attendance is mandatory for this course. Students must independently complete a applied seminar paper and present and defend it at the final presentation. <p>Final evaluation consists of:</p> <ul style="list-style-type: none"> - Applied seminar assignments, - Project presentation and defense. <p>Grading scale:</p> <ul style="list-style-type: none"> ▪ Sufficient D (6): 60–67% ▪ Good C (7): 68–75% ▪ Very good B (8): 76–83% ▪ Very good B+ (9): 84–90% ▪ Excellent A (10): 91–100%

Materialni pogoji za izvedbo predmeta :

<ul style="list-style-type: none"> • Predavalnica z multimedijsko opremo • Računalniška učilnica
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Material conditions for subject realization:

<ul style="list-style-type: none"> • Classroom with the multimedia equipment • Computer classroom

Obveznosti študentov:

<ul style="list-style-type: none"> - 80 % udeležba na predavanjih/vajah, - opravljena seminarska naloga, - opravljen zagovor in predstavitev seminarske naloge.
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Student's commitments:

<ul style="list-style-type: none"> - 80 % attendance at lectures/exercises, - completed seminar assignment, - completed defense and presentation of the seminar assignment.
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Reference nosilca predmeta:

Pedagoško delo:

- Vabljeni predavanja v okviru predmetov Geoinformatika in daljinsko zaznavanje (FGG, UL) ter Dendrometrija in daljinsko zaznavanje (BF, UL).
- Somentorica pri enem diplomskem in treh magistrskih delih (bolonjski študij) študentov geodezije na Fakulteti za gradbeništvo in geodezijo UL.

Znanstveno-raziskovalno delo:

- Nosilka predmeta je avtorica številnih objav v uglednih domačih in mednarodnih znanstvenih revijah, kar dokazuje število čistih citatov znanstvenih del v zadnjih 10 letih, CI10: 471.
- Od začetka svoje raziskovalne kariere leta 2009 je aktivno sodelovala v številnih raziskovalnih projektih tako na nacionalni ravni, pod okriljem ARIS, kot tudi na mednarodni ravni (FP7, ESA, EU Urban Innovation Action). Kontinuirano prijavlja projekte, kar zagotavlja nadaljevanje njenih raziskav.
- Uspešno vodenje projektov "Contextualization of EO data for a deeper understanding of river environment changes in Southeast Europe" in "EO4fus: Združevanje podatkov opazovanja Zemlje za kartiranje gozdov", financirana s strani Evropske vesoljske agencije (ESA).

Strokovno delo in izbrane strokovne publikacije:

Je redna udeleženka mednarodnih konferenc, kjer predstavlja rezultate svojih raziskav. Institucionalno je vodila ali sodelovala pri bilateralnih projektih z institucijami iz Združenim kraljestvom (Newcastle University, Spatial Humanities research), Nemčije (KIT, Department of Geography and Geoecology), ZDA (University of Georgia, Department of Geography), Bosno in Hercegovino (Univerza u Sarajevu, Građevinski fakultet). Poleg tega redno deluje kot recenzentka za mednarodne strokovne in znanstvene revije.

Priznanja in nagrade:

- Somentorica magistrske diplome Ane Potočnik Buhvald, ki je bila za svojo delo prejemnica fakultetne Prešernove nagrade.
- ISPRS award »"Recognition of Excellence in Service to ISPRS during 2012-2016«.

Izbrani znanstveni članki / Selected scientific papers:

- MARSETIČ, Aleš, **KANJIR, Urška**. Forecasting vegetation behavior based on planetscope time series data using RNN-based models. IEEE journal of selected topics in applied earth observations and remote sensing. 2024, vol. 17, str. 5015-5025, ilustr., graf. prikazi., zvd. ISSN 1939-1404. <https://ieeexplore.ieee.org/document/10436367/authors#authors>, DOI: 10.1109/JSTARS.2024.3365971. [COBISS.SI-ID 188099843],
- **KANJIR, Urška**, SKUDNIK, Mitja, KOKALJ, Žiga. Določevanje fenoloških faz izbranih drevesnih vrst s časovnimi vrstami posnetkov MODIS = Determining phenological phases of selected tree species with MODIS time-series data. Geodetski vestnik : glasilo Zveze geodetov Slovenije. [Tiskana izd.]. 2023, letn. 67, št. 2, str. 165-180, ilustr. ISSN 0351-0271. https://www.geodetski-vestnik.com/arhiv/67/2/165_Kanjir_Skudnik_Kokalj, DOI: 10.15292/geodetski-vestnik.2023.02.165-180. [COBISS.SI-ID 158191363],
- FASSNACHT, Fabian Ewald, MAGER, Christophe, WASER, Lars T, **KANJIR, Urška**, SCHÄFER, Jannika, POTOČNIK BUHVALD, Ana, SHAFEIAN, Elham, SCHIEFER, Felix, STANČIČ, Liza, IMMITZER, Markus, DALPONTE, Michele, STERENČZAK, Krzysztof, SKUDNIK, Mitja. Forest practitioners' requirements for remote sensing-based canopy height, wood-volume, tree species, and disturbance products. Forestry. 2025, vol. 98, iss. 2, str. 233-252. ISSN 1464-3626. <https://academic.oup.com/forestry/advance-article/doi/10.1093/forestry/cpae021/7676651>, DOI: 10.1093/forestry/cpae021. [COBISS.SI-ID 196540931],
- GREGORIČ BON, Nataša, **KANJIR, Urška**, STANČIČ, Liza. Intersecting big and thick data: approaching landscape changes in rural Vjosa River Valley, Albania. Social sciences & humanities open. 2025, vol. 12, [article no.] 102012, 16 str., ilustr., graf. prikazi, zvd.

Lecturer's references:

Pedagogic activities:

- Guest lectures as part of the courses Geoinformatics and Remote Sensing (FGG, UL) and Dendrometry and Remote Sensing (BF, UL).
- Co-supervisor for one bachelor's thesis and three master's theses (Bologna process) by geodesy students at the Faculty of Civil Engineering and Geodesy, UL.

Scientific and research work:

- The course instructor is the author of numerous publications in prestigious domestic and international scientific journals, as evidenced by the number of pure citations of scientific works in the last 10 years, CI10: 471.
- Since the beginning of her research career in 2009, she has actively participated in numerous research projects both at the national level, under the auspices of ARIS, and at the international level (FP7, ESA, EU Urban Innovation Action). She continuously submits project proposals, which ensures the continuation of her research.
- Successful management of the projects "Contextualization of EO data for a deeper understanding of river environment changes in Southeast Europe" and "EO4fus: Earth Observation data fusion for forest mapping", funded by the European Space Agency (ESA).

Professional work and selected professional publications:

- She regularly participates in international conferences, where she presents the results of her research. She has led or participated in bilateral projects with institutions in the United Kingdom (Newcastle University, Spatial Humanities research), Germany (KIT, Department of Geography and Geoecology), the United States (University of Georgia, Department of Geography), and Bosnia and Herzegovina (University of Sarajevo, Faculty of Civil Engineering). In addition, she regularly acts as a reviewer for international professional and scientific journals.

Awards:

- Co-supervisor of Ana Potočnik Buhvald's master's thesis, which received the faculty's Prešeren Award.
- ISPRS award "Recognition of Excellence in Service to ISPRS during 2012-2016."

ISSN 2590-2911. <https://www.sciencedirect.com/science/article/pii/S2590291125007405?lid=jua9g5tkojjo>, DOI: 10.1016/j.ssaho.2025.102012. [COBISS.SI-ID 256451843],

- SMERDU, Ana, **KANJIR, Urška**, KOKALJ, Žiga. Automatic detection of Japanese knotweed in urban areas from aerial and satellite data. *Management of Biological Invasions*. 2020, vol. 11, iss. 4, str. 661-676, ilustr. ISSN 1989-8649. <https://www.reabic.net/journals/mbi/2020/Issue4.aspx>, DOI: 10.3391/mbi.2020.11.4.03. [COBISS.SI-ID 37173251].