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| **113(1)/2024 Fall Semester TIGP-ESS課程資訊表**  **113(1)/2024 Fall Semester TIGP-ESS course information form** | |
| 科目名稱(中文) | 數位影像與社會變遷 |
| Course Title (English) | |  | | --- | | Digital Image and Social Change | |
| 授課時間  Time | Wed. 2p.m.-5p.m. |
| 授課地點  Location |  |
| 學分數  Course Credits | 3 |
| 主要授課老師 Main Instructors | 劉說安 |
| 聯絡郵件  E-mail | yueian@csrsr.ncu.edu.tw |
| 辦公時間 Office Hours | By appointment |
| 課程目標 Course Objectives | Upon completion of the course, students are expected to be able to:   1. apply acquired knowledge and critical thinking skills to tackle hydro-meteorological extremes and environmental issues with appropriate remote sensing data and AI techniques 2. develop multi-step workflows to solve problems in hydro-meteorological extremes and environmental issues |
| 授課內容 Course Description | This course covers topics of weather extremes and environmental issues, which includes typhoons, droughts, floods, eco-environmental vulnerability, urban greenspace, and urban heat island, and how these events can be assessed and monitored using remote sensing and artificial intelligence techniques. The main research areas to be discussed are typhoons, droughts, and floods. For typhoons, the course will cover environmental factors that contribute to the development of typhoons, as well as the vulnerability of different Asian regions to typhoon hazards. For droughts, the course will cover the use of satellite imagery and data assimilation for drought monitoring, and the assessment of drought vulnerability in different regions. For floods, the course will cover the use of satellite remote sensing, specifically synthetic aperture radar data, for flood monitoring and damage assessment. Finally, the use of remote sensing data for analysis of environmental issues such as eco-environmental vulnerability, urban greenspace, and urban heat island will also be briefly covered. Throughout the course, students will have the opportunity to work on a project related to hydro-meteorological extremes. The techniques used for analysis in each of the main research areas will also be demonstrated for students to learn and apply in their own work. These include the use of satellite imagery such as optical, microwave, and radar, new remote sensing indices for surface water availability analysis, and machine learning and AI algorithms. The students will propose a research topic and later present their own results using the knowledge and techniques learned from the course. |
| 教科書/參考書 Textbooks/References | Journal papers and self-edited texts |
| 自編教材比例  Self-compiled Textbook/References Proportion (if any) | 80% |
| 授課方式 Course Requirements | ■講授(Lecture)；  ■研討(Seminar)；  □實習/實驗(Internship/Experiment)；  □個別指導(Individual Discussion)；  □其他(Other) |
| 評量配分比重 Course Grade | 1. Attitude and daily reports: 40%  2. Attendance: 10%  3. Final report: 50% |
| 對應之永續發展目標(SDGs)(請選擇至多3項與教學內容相關的項目) 翻譯成英文的話就是：  Corresponding Sustainable Development Goals (SDGs) (Please choose up to 3 items related to the teaching content) | □SDG1消除貧窮No Poverty  □SDG2消除飢餓Zero Hunger  □SDG3健康與福祉Good Health and Well-being  □SDG4優質教育Quality Education  □SDG5性別平等Gender Equality  ■SDG6潔淨飲水與衛生Clean Water and Sanitation  □SDG7永續能源Affordable and Clean Energy  □SDG8就業與經濟成長Decent Work and Economic Growth  □SDG9產業永續創新Industry, Innovation, and Infrastructure  □SDG10減少不平等Reduced Inequality  □SDG11永續城市與社區Sustainable Cities and Communities  □SDG12永續消費及生產Responsible Consumption and Production  ■SDG13氣候行動Climate Action  □SDG14水生生態Life Below Water  ■SDG15陸地生態Life on Land  □SDG16和平與正義制度Peace, Justice, and Strong Institutions  □SDG17全球夥伴Partnerships for the Goals |
| 課程類別Course Category | □STEAM  □人文關懷Humanities and Social Sciences  ■跨域課程Interdisciplinary Courses  ■問題導向Problem-Based Learning  □總整課程Integrated Curriculum  □媒體識讀Media Literacy  □創新課程Innovative Curriculum  □自主學習課程Self-Directed Learning  □無None |
| 課程領域Areas | □基礎學科(共同)(Basic subjects (common))  □固態地球科學(Solid earth sciences)  ■水圈科學(Aquatic sciences) [1]  □應用語言(Applied Languages)  ■大氣科學(Atmospheric sciences) [2] |
| 產業領域Areas | □地探科技(Geological monitoring technology)  □氣象科技(meteorological science and technology)  ■太空科技(Space Technology) [1]  □環保科技(environmental protection science and technology)  ■資訊科技(Informational Technology) [2]  □教學研究(Teaching & research)  □地質科技(Geosciences and technology) |

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| 課程進度與內容  Lecture outline and content | | | | |
| 週次  week | 日期  Date | | 主題  Topic | 授課教師/指定閱讀或作業  Instructor/Readings or assignments |
| **1** | **9/4** | | **Overview**   * Hydrological Hazards and Environmental Issues by using Remote Sensing and Artificial Intelligence Techniques |  |
| **2** | **9/11** | | **Typhoons (1/5)**   * Overview of typhoons and remote sensing * Fujiwhara effect |  |
| **3** | **9/18** | | **Typhoons (2/5)**   * Atmospheric and oceanic environmental factors for typhoon development in Western North Pacific (WNP) Ocean and South China Sea: Case study of super typhoon Rai (2021) * Typhoon strength rising in the past four decades |  |
| **4** | **9/25** | | **Typhoons (3/5)**   * Evaluation of urban greenspace vulnerability to typhoon in Taiwan * Vulnerability of Vietnam to typhoons: A spatial assessment based on hazards, exposure and adaptive capacity |  |
| **5** | **10/2** | | **Typhoons (4/5)**   * Association between typhoon frequency and drought in Taiwan, 1981-2020 * Geometric clustering analysis of typhoon track and its impact on Northwest Pacific countries |  |
| **6** | **10/9** | | **Typhoons (5/5)**   * Grid-based Long-Short Term Memory (LSTM) method for typhoon track prediction * Random Forest combined with Boruta feature selection for Tropical cyclone classification |  |
| **7** | **10/16** | | **Water cycle and Drought (1/6)**   * Overview of drought and remote sensing * Drought monitoring by satellite imagery and data assimilation |  |
| **8** | **10/23** | | **Mid Exam**   * Student project proposal |  |
| **9** | **10/30** | | **Water cycle and Drought (2/6)**   * Water availability and Land-use * Forecasting of drought |  |
| **10** | **11/6** | | **Water cycle and Drought (3/6)**   * Assessment of drought vulnerability in Taiwan * Spring drought in Taiwan during the last four decades, from 1982 to 2021 |  |
| **11** | **11/13** | | **Water cycle and Drought (4/6)**   * Normalized difference latent heat index for Remote Sensing of land surface energy fluxes * Crop Response to Disease and Water Scarcity Quantified by Normalized Difference Latent Heat Index |  |
| **12** | **11/20** | | **Water cycle and Drought (5/6)**   * Temperature-soil Moisture Dryness Index for Remote Sensing of Surface Soil Moisture Assessment, Taiwan * Surface Water Availability and Temperature (SWAT): An Innovative Index for Remote Sensing of Drought Observation |  |
| **13** | **11/27** | | **Water cycle and Drought (6/6)**   * Spatio-temporal Assessment of Drought in Ethiopia and the Impact of Recent Intense Droughts * Application of artificial neural networks in forecasting a standardized precipitation evapotranspiration index for the upper Blue Nile basin |  |
| **14** | **12/4** | | **Flood (1/3)**   * Overview of flood and remote sensing * Satellite remote sensing of floods for disaster response assistance |  |
| **15** | **12/11** | | **Flood (2/3)**   * Applications of synthetic aperture radar (SAR) data for flood damage assessment * Quantifying the impacts of 2020 flood on crop production and food security in middle reaches of Yangtze River, China |  |
| **16** | **12/18** | | **Flood (3/3)**   * Application of machine learning algorithms for flood probability predictions * Assessing the influence of human activities on flash flood susceptibility in mountainous regions of Vietnam |  |
| **17** | **12/25** | | **Environmental Issues**   * Global mapping of eco-environmental vulnerability from human and nature disturbances * Greenspace Pattern, Meteorology and Air Pollutant in Taiwan: A Multifaceted Connection * Spatio-temporal patterns and driving forces of surface urban heat island in Taiwan |  |
| **18** | **1/1** | | **Final Exam**   * Student project presentation |  |
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|  | | 課程所屬學制(Educational System): 博士班(Doctoral Program) | |

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| 核心能力I: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式  Please select core abilities and its corresponding assessments of this course |
| 請勾選學程所訂之核心能力(可複選)  ■獨立思考與研究能力Independent thinking and research capacity  ■進階數理及專業知識能力Advanced mathematical and professional knowledge and ability  ■觀測模擬及分析推理能力Observation simulation and analysis of reasoning ability  ■電腦及程式語言運用能力Computer and programming language proficiency  ■國際視野與語文溝通能力International perspective and language communication skills  ■專業倫理及服務學習能力Professional ethics and service-learning ability |
| 核心能力II: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式  Please select the core abilities and its corresponding assessments of this course |
| |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 強度指數 Overall rating of Core Abilities | 1 非常低 Very Low | 2 低 Low | 3 普通 Medium | 4 高 High | 5 非常高 Very High | 評量方式 Corresponding Assessments | | 獨立思考與研究能力 Independent thinking and research capacity | □ | □ | □ | ■ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  ■口頭報告/口試(Presentation/Oral Exam)  ■專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ■出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演  (Products/Creative Performance)  □其他(Others) | | 進階數理及專業知識能力 Advanced mathematical and professional knowledge and ability | □ | □ | ■ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  ■口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ■出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 觀測模擬及分析推理能力 Observation simulation and analysis of reasoning ability | □ | □ | □ | □ | ■ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  ■口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ■出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 電腦及程式語言運用能力Computer and programming language proficiency | □ | □ | □ | □ | ■ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  ■口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ■出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 國際視野與語文溝通能力 International perspective and language communication skills | □ | □ | □ | ■ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  ■口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ■出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 專業倫理及服務學習之能力 Professional ethics and service-learning ability | □ | □ | ■ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  ■口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ■出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | |