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| **112(1)/2023 Fall Semester TIGP-ESS課程資訊表****112(1)/2023 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) |

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| Digital Image and Social Change |

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| 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 solve hydro-meteorological extremes with appropriate remote sensing data and AI techniques
2. develop multi-step remote sensing workflows to solve hydro-meteorological extremes problems
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| 授課內容Course Description | This is a course that covers the topics of extreme weather events, specifically typhoons, droughts, and floods, and how remote sensing and artificial intelligence techniques can be used to assess and monitor these events. The course covers the atmospheric and oceanic factors that contribute to the development of typhoons, as well as the vulnerability of different regions to typhoons. Additionally, the course covers the use of machine learning algorithms, such as the Grid-based Long-Short Term Memory (LSTM) method and Random Forest combined with Boruta feature selection, for typhoon track prediction and tropical cyclone classification. The course also covers the monitoring of drought using satellite imagery and data assimilation, and the assessment of drought vulnerability in different regions. Finally, the course covers the use of remote sensing, specifically satellite remote sensing and Synthetic Aperture Radar (SAR) data, for flood monitoring and damage assessment. Throughout the course, students will have the opportunity to work on a project proposal related to water cycle and drought. |
| 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% |
| 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) |
| 課程進度與內容Lecture outline and content |
| 週次week | 主題Topic | 授課教師/指定閱讀或作業Instructor/Readings or assignments |
| **1** | **Overview*** Extreme weather
* Hydro-meteorological extremes assessment by RS and AI techniques: Typhoons and droughts
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| **2** | **Typhoons (1/6)*** Overview of Typhoons and Remote sensing
* Fujiwhara effect
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| **3** | **Typhoons (2/6)*** Grid-based Long-Short Term Memory (LSTM) method for typhoon track prediction
* Vulnerability of Vietnam to typhoons: A spatial assessment based on hazards, exposure and adaptive capacity
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| **4** | **Typhoons (3/6)*** Evaluation of urban greenspace vulnerability to typhoon in Taiwan
* 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)
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| **5** | **Typhoons (4/6)*** Association between typhoon frequency and drought in Taiwan, 1981-2020
* Geometric clustering analysis of typhoon track and its impact on Northwest Pacific countries
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| **6** | **Typhoons (5/6)*** Association between typhoon frequency and drought in Taiwan, 1981-2020
* Geometric clustering analysis of typhoon track and its impact on Northwest Pacific countries
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| **7** | **Typhoons (6/6)*** Random Forest combined with Boruta feature selection for Tropical cyclone classification
* Student project proposal
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| **8** | **Mid Exam** |  |
| **9** | **Water cycle and Drought (1/6)*** Overview of Drought and Remote sensing
* Drought monitoring by satellite imagery
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| **10** | **Water cycle and Drought (2/6)*** Drought monitoring by data assimilation
* Water availability and Land-use
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| **11** | **Water cycle and Drought (3/6)*** Assessment of Surface Moisture and Evapotranspiration Variability
* Forecasting of drought
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| **12** | **Water cycle and Drought (4/6)*** Drought events and their impacts on vegetation productivity in the upper Blue Nile basin of Ethiopia
* Application of ANN in forecasting a standardized precipitation evapotranspiration index for the Upper Blue Nile basin
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| **13** | **Water cycle and Drought (5/6)*** Assessment of drought vulnerability in Taiwan
* Diurnal evaluation of temperature-soil moisture dryness index (TMDI) for surface soil moisture and evapotranspiration analysis
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| **14** | **Water cycle and Drought (6/6)*** Spatio-temporal drought assessment employing multiple water-related indices
* Spring drought in Taiwan during the last four decades, from 1982 to 2021
* Using temperature-soil moisture dryness index for rapid evapotranspiration estimation
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| **15** | **Flood (1/2)*** Overview of Flood and Remote sensing
* Satellite remote sensing of floods for disaster response assistance
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| **16** | **Flood (2/2)*** Applications of SAR data for flood damage assessment
* Rapid evaluation of flood-related rice crop loss based on Sentinel 1 SAR data
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| **17** | **Student project presentation** |  |
| **18** | **Final Exam** |  |
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| 課程所屬學制(Educational System): 博士班(Doctoral Program) |
| 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 |
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| 強度指數Overall ratingof 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)  |

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