**Daily Log Project M.Sc. ECMM510**

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**Project Name: Change Detection for protecting UNESCO World Heritage**

**Internal Supervisor: Dr. Milto Miltiadou**

**External Supervisor: Dr. Athos Agapiou**

**Daily Log of Activity**

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| Date | Activity | Outcomes | Comments |
| *14/01/2025 (Pre)* | *MSc Research Project Introduction Seminar* | *Initial exploration and shortlisting of potential projects to go towards – Introduction to main project deliverables and deadlines* | *Noticed a few projects with the UNESCO project specifically standing out as the most interesting to pursue.* |
| *16/01/2025 (Pre)* | *Project Inquiry and Supervisor Approval Meeting* | *Approval to be on the project* | *Had an initial meeting with Milto, during which I received approval to join the project.* |
|  |  | Project Starts |  |
| 03/03/2025 -13/03/2025 (Week 1-2) | Initial Exploration into UNESCO world heritage sites and urbanism and its impacts | Explored related literature gaining a general understanding of a few potential directions this project can go in – with a primary outcome of UNESCO sites being divided into 3 categories that would majorly set the direction of the project: these being Natural Sites, Cultural Sites within Urban Areas, and Cultural Sites outside Urban Hubs.   More on related literature:  - Exploration into how monitoring is performed, with Landsat, Sentienl-1/2 were also compared - Exploration on Land Use Classification and Land Use Change were briefly explored. | This gave a good initial introduction towards the project and directions to explore; from reading the literature it was found that it would be best to look in the direction of exploring urban expansion towards sites outside of (or close to but not within) urban hubs – as this is where monitoring this threat would likely be most valuable.   Whereas sites within urban hubs a more pro-active approach towards designs and planning would be more affective – and in the case of this project being remote sensing it would only be post- or mid- construction that this project would notice any changes, as such would be less valuable. |
| 06/03/2025 (Week 1) | Initial Group Meeting *(Weekly Meeting)* | Initial Meeting officially kickstarting the project and started project proposal. | N/A – introduction to others, with useful brief discussions towards each of our projects. |
| 13/03/2025 (Week 2) | Initial Meeting with Athos | Further introduction to project, incredibly useful as this opened the direction the project can take. | Incredibly useful meeting for my understanding of the importance of project like this one – one key takeaway was the mention of how remote sensing for monitoring inaccessible sites such as those within warzones/similar. |
| Meeting for Project Proposal Outline *(Weekly Meeting)* | A draft outline for the project proposal was created, with recommendations on | N/A |
| 18/03/2025 (Week 3) | Google Earth Engine Lecture | Further introduction to Google Earth Engine (GEE). | Very useful to understand the kind of that that I will be dealing with.   This gave me an initial understanding of direction for data collection. However, I don’t know JavaScript, and it’s also far more limited in terms of data manipulation, so the Python API would be a better path to pursue for greater versatility later. |
| 21/03/2025 (Week 3) | Discussion on Site Selection and later data collection *(Weekly Meeting)* | Discussion on site selection, and polygon selection around sites for PlotToSat and then ML (for project pipeline). | No site was selected this week; some exploration had taken place however this did not yield any results – as per looking for sites that had significant changes within the urban landscape in their surroundings. |
| Site Exploration | Focused on using easily assessable tools at this point, such as *Esri | World Imagery Wayback* and manually checking, however this was tedious an slow. | This was too tedious, so need to find a more elegant solution that allows for checking the UNESCO sites quicker. |

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| 24/03/2025 (Week 4)  27/03/2025  28/03/2025 | Site Exploration with GEE and GEEMAP tools | Created a tool to aid in site exploration where I would take the site locations from the UNESCO  Explored sites initially around the Levant, 1 site in Crete and looked at pins within Romania, the UK and little bit within Spain – mainly stuck to looking at the Levant at first though however a site with large scale changes (excluding Palestine) were not really spotted.   Further exploration into the neighbouring countries – Egypt (briefly) and Iraq (heavily) identified a site in Smarra containing what I can assume to be older parts of the city and palaces from the Abbasid Caliphates (from approx. ~800s). | Would personally like to look more into the ancient cities within the area however, those appear to mostly be out of the way of Uran Areas or only have minor activity around them (excluding Ur. Where there is an airport right next to it. A day to perform further exploration would be nice – but might not be possible until the 7th of April as the project needs to move on)   A simple version of tiling was achieved but more as a coincidence while trying to load the images faster- was achieved by creating multiple tasks for GEE by tiling then requesting those segments as separate tasks then collating the image – no further exploration has been done as it was not useful to the aim of site exploration.   Initial exploration on ‘S2’ but moved to ‘S2\_HARMONIZED’ as there was less variety in image intensity (brightness) – used B4, B3 and B2 bands (RGB) |
| Group Meeting focusing on the Ethics and Risk Assessment for the project proposal.  *(Weekly Meeting Pt.1)* | Discussion on Risk assessments within the Project Proposal. A need for feasibility for parts of the project and where to move onto (contingencies) if parts do not work out as planned. | “FAIR” – Findable Accessible, Interoperable and Reusable.  Deliverables – actual deadlines for this project + parts of the project (that will be made open source)  Risk for project being noise in the data causing potential misclassification – contingency is to increase the resolution (larger polygon) so that the classifier becomes more accurate. |
| Codebase expansion – explore using polygons to collect region | Added ability to select time-span and date for selected polygons on `geemap` to collect and view for comparisons. This greatly expanding my ability to search around sites rather than it collecting just the surroundings around a UNESCO site point. | This allowed to further explore the surrounding areas of sites, Samarra is still the best choice up to this point.  This gives me a way greater |
| Meeting to discuss site findings and further discussion on creation of a project pipeline. *(Weekly Meeting Pt.2)* | Site at Smarra selected as primary site of interest. | Samarra Archaeological City, due to the scale of this site, only this site is going to be selected rather than multiple smaller sites, as it has a bunch of monuments in account of it being a mostly abandoned ancient city.   Project pipeline for the project proposal is now the next area the needs to be progressed. |
| 31/03/2025 – 06/04/2025 *(Week 4)* | Created initial project proposal document, including draft sections and an early pipeline. | Created the document overall structure with early content across all key sections | All major sections have been created; however, this is not filled in other than initial notes, but these give a good guideline for the direction to go in. The project pipeline style has been created (in latex) however its way too early to fill in, so this will be looked at closer to the end of the proposal. |
| 07/04/2025 – 13/04/2025 *(Week 5)* | Focus on exploring existing literature | Gained detailed understanding of Samarra’s background and significance to Islamic history as a well-preserved Abbasid city; identified key sources including an EAMENA damage study and two site-focused books. | Found no land-use change prediction studies for Samarra specifically, however it is brought up a lot as the main source of damage towards the site.  All other studies focusing on Samarra other than the EAMENA, were very limited, and focused specific aspects of the site. As such this is a very clear research gap for the site.  This leads the next direction to explore the literature for land-use change and it’s classification. |
| Focus on existing methods for land-use change detection and classification and satellite monitoring. | Reviewed LULC methods (RF, SVM, CNNs like U-Net); explored prediction models (Markov, Cellular Automata, LSTM); identified suitable satellite data (Landsat, Sentinel-1/2). | Work is currently in highly note-based form and has not yet been formally written up, as such this is the next direction to follow. However, this does give the direction for the methodology being to be Land-Use Change and Prediction – this also avoids the rehashing the recent EAMENA study and ensures that the direction this project follows fills a good research gap for the site. |
| 14/04/2025 -  20/04/2025 *(Week 6)* | Refinement of the Literature review and starting the methodology. | Organised previous week’s findings into a more structured literature section and began outlining and filling in the methodology focused on land-use change and prediction. | Next step is to complete and integrate the aims and objectives section (within the introduction), ensuring it all flows, does not overlap/repeat within the introduction, literature review and methodology for a cohesive project structure. |
| Focus on write-up flow across the document. | Refined aims and objectives to better reflect project direction. Then began to update the introduction, literature review and methodology to both better reflect these refined aims and objectives. | This was not fully completed, and the methodology is still a mix of first section drafts and notes for the section, so this needs to be refined, and the Discussion and Project Pipeline sections need to be completed.   The literature review and introduction have come a long way, but further refinement is still needed at this stage. |
| 21/04/2025 -  27/04/2025 *(Week 7)* | Refinement of the document and a focus on Methodology, Project Pipeline and Discussion sections (timeframe) | Refined the document further with rearrangements of the literature review and introduction due to there being too much of an overlap when it came the historical background for the site. The UNESCO section was rewritten as well due to the overlap with the Introduction + Literature Review to be more concise.  Methodology was refined into phases, with sub goals for each phase, going from data collection and pre-processing, classification and creation of land-use change maps for then use in creating predictive models (also discussion within these phase sections on measures of how to assess these classifiers and predictive models).  Made a first draft version of the project pipeline using the same style from earlier on. | The introduction and literature review at this point are getting close to ready for a first draft full review.  The methodology section has come a long way, the section on site selection is taking up too much space and repeats too much from, as such that needs to be refined to save space and improve readability.  The project pipeline has had some work done to it, to improve readability, and further discussions on what the deliverables are going to be on it needed to be added, alongside each subphase. |
| 28/04/2025 -  04/05/2025 *(Week 8)*  *Project Proposal Deadline* | Finalisation of the Project Proposal | Reduced the section on site selection down massively, whilst keeping its core information still intact.  Rewrite the literature review section for LULC classification and prediction, and this section reads closer to a discussion on what exists and what options there are to explore. The mirrored phase section in the methodology was also written to better reflect how classification will be used to create maps, and these maps will be analysed on their own, and fed into predictive models.  Finalised the Discussion section (very short)  Finalised and made major adjustments to the Project Pipeline to better reflect deadlines and procurables.  Draft was also reviewed by both Milto and Athos – making a note of this here as there has been correspondence primarily between me and Milto throughout the whole project proposal creation process, but this was the final and first full draft review, and last minor changes were made before submission. | This indicates the start of the project implementation and a shift away from writing for the time being.  Phase 1 being data collection and any necessary preprocessing, so that is the next step to go towards. |
| Handed in the Project Proposal | |
| 05/05/2025 – 11/05/2025 *(Week 9)* |  |  |  |
| 12/05/2025 – 18/05/2025 *(Week 10)* |  |  |  |
| 19/05/2025 – 25/05/2025 *(Week 11)* | Attended ML4EO Conference | Machine Learning for Earth Observation conference (ML4EO), generally very valuable for understanding the |  |
| 26/05/2025 – 01/06/2025 *(Week 12)* |  |  |  |
| 02/06/2025 – 08/06/2025 *(Week 13)* |  |  |  |
| 09/06/2025 – 15/06/2025 *(Week 14)* |  |  |  |
| 16/06/2025 – 22/06/2025 *(Week 15)* |  |  |  |
| 23/06/2025 – 29/06/2025 *(Week 16)* |  |  |  |
| 30/06/2025 – 06/07/2025 *(Week 17)* |  |  |  |
| 07/07/2025 – 13/07/2025 *(Week 18)* |  |  |  |
| 14/07/2025 – 20/07/2025 (Week 19) |  |  |  |