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| Searching for a Coordinator/Partner for | **The Green Deal – Farm to Fork** |
| Topic | **LC-GD-6-1-2020:**  **Testing and demonstrating systemic innovations in support of the Farm-to-Fork Strategy** |
| Subtopic | Subtopic A. Achieving climate neutral farms by reducing GHG emissions and by increasing farm-based carbon sequestration and storage.    Subtopic B. Achieving climate neutral food businesses by mitigating climate change, reducing energy use and increasing energy efficiency in processing, distribution, conservation and preparation of food. |
| Organisation Details | **ADAPT Centre/University College Dublin**  ADAPT, the world-leading SFI Research Centre for Digital Media Technology focuses on developing next generation digital technologies that transform how people communicate by helping to **analyse**, **personalise** and **deliver** digital data more effectively for businesses and individuals. ADAPT researchers are based across seven leading Irish Higher Education Institutions: Trinity College Dublin, Dublin City University, University College Dublin, Technological University Dublin, Maynooth University, Cork Institute of Technology and Athlone Institute of Technology. ADAPT's transformative tools allow you explore video, text, speech and image data in a natural way across languages and devices, helping companies unlock opportunities that exist within digital content to re-imagine how to connect people, process and data to realise new economic value. |
| How we can contribute to this topic | The partner[[1]](#footnote-1) is an expert in machine learning and deep learning, and has worked extensively on the use of machine learning techniques for atmospheric studies. Our core competencies include image processing, computer vision, machine learning, deep learning, remote sensing, atmospheric study, weather forecasting, solar and renewable energy forecasting, climate science, energy studies. We can assist in Subtopic A and Subtopic B in the following manner:  Subtopic A  We can assist a consortia by providing our expertise in the areas of machine learning, computer vision and remote sensing. In this EU Green Deal, our brief idea is to use ground-based cameras and other sensor devices to understand and estimate the amount of atmospheric pollutants and other greenhouse gases. We intend to analyze and estimate the amount of atmospheric pollutants using a set of diverse sensors, ranging from low-cost PM2.5 and PM10 sensors, cameras, and satellite data (viz. Sentinel-5P, ERA5 reanalysis data). Recently, we have performed a systematic study on the impact of COVID-19 on Irish Air Quality[[2]](#footnote-2). Air pollution has been a long-existing problem for most of the major metropolitan cities of the world. In the recent wake of the COVID-19 pandemic, there has been a renewed interest in revisiting the problem of low air quality. Several countries implemented strict lockdown measures reducing vehicular traffic and other economic activities, in order to reduce the spread of COVID-19. In order to analyse the impact of the lockdown on air quality in Dublin, we looked at the averages of one of the most common gaseous pollutants caused by automobile exhaust: Nitrogen Dioxide (NO2). These figures were gathered from one of ESA’s earth observation satellites, Sentinel-5P. Overall, we were able to notice a significant drop in the concentration of NO2 levels across Dublin owing to the lockdown measures implemented across the nation.  Subtopic B  Owing to the growing concern of global warming and over-dependence on fossil fuels, there has been a huge interest in recent years in the deployment of Photovoltaic (PV) systems for generating electricity. The output power of a PV array greatly depends, among other parameters, on solar irradiation. However, solar irradiation has an intermittent nature and suffers from rapid fluctuations. This creates challenges when integrating PV systems in the electricity grid and calls for accurate forecasting methods of solar irradiance. In this subtopic of the EU Green Deal, we attempt to use a multi-modal approach of using data from various sensors to better understand such fluctuations in solar irradiance. We use time-series data of measured solar irradiance, together with clear-sky solar irradiance, to forecast solar irradiance upto a period of 20 minutes. We use techniques derived from time-series theory, to model the seasonality of solar irradiance[[3]](#footnote-3), as captured in solar sensors. In addition to using weather data, we also derive solar analytics information from images, captured via ground-based sky cameras. Unlike solar pyranometers and other regular meteorological sensors, ground-based sky images have additional information about the continuous evolution of clouds over time. We use these cloud/sky images to propose a solar radiation estimation model[[4]](#footnote-4) that can accurately capture the short-term fluctuations of solar irradiance. |
| Other information | The details of one of the related past projects completed by the partner are as follows:  **Cloud Imaging for Satellite Communication** is a Ministry of Defense (MINDEF) Singapore project, whose main objective is to analyze and understand the impact of clouds in satellite communication links using ground-based, high-resolution digital cameras[[5]](#footnote-5). This is a collaborative work between University College Dublin (UCD), along with Nanyang Technological University Singapore, Advanced Digital Sciences Center (ADSC), Singapore, and National University of Singapore. The central theme of this project is to use conventional cameras to capture images of a scene and derive essential information about its content. In particular, we focus our attention on images captured by ground-based sky cameras. Ground-based sky cameras, popularly known as Whole Sky Imagers (WSIs), are now extensively used by remote sensing analysts. They are useful in a variety of applications: signal attenuation analysis, local weather prediction, or solar and renewable energy forecasting. They complement conventional weather satellite images with higher temporal and spatial resolutions. The WSIs capture images of the earth’s atmosphere at regular intervals of time. In this project, we analyze this huge amount of captured image data and propose several algorithms and methodologies for various applications. |
| Previous Horizon 2020 projects | ADAPT is involved in a series of H2020 projects and other national and international framework programmes. We currently coordinate IA, RIA, MSCA ITNs, MSCA Cofunds and CEF. |
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1. The partner in this document is referred to the research group led by Soumyabrata Dev, ADAPT SFI Research Centre, Dublin, Ireland. More details on the group can be found here: <https://soumyabrata.dev/theia/> [↑](#footnote-ref-1)
2. More details on this study can be found here: <https://www.adaptcentre.ie/news/dewansh-kaloni-impact-of-covid-19-on-irish-air-quality> [↑](#footnote-ref-2)
3. S. Dev\*, T. AlSkaif\*, M. Hossari, R. Godina, A. Louwen, and W. van Sark, Solar Irradiance Forecasting Using Triple Exponential Smoothing, Proc. International Conference on Smart Energy Systems and Technologies (SEST), 2018 (\* Authors contributed equally). [↑](#footnote-ref-3)
4. S. Dev, F. M. Savoy, Y. H. Lee, S. Winkler, Estimation of solar irradiance using ground-based whole sky imagers, Proc. IEEE International Geoscience and Remote Sensing Symposium (IGARSS), July 2016. [↑](#footnote-ref-4)
5. More details on this project along with related publications here: <https://soumyabrata.dev/cloud/> [↑](#footnote-ref-5)