Submission: FFT

Real-time monitoring tool for estimating carbon absorption of forests and urban parks

Awase Khirni Syed, Saied Pirasteh, Jonathan Li

Abstract: Human activity in the forests has resulted in a reduction in their ability to act as "carbon sinks" and has been attributed to speed up climate breakdown. This climate breakdown is likely to have a more drastic impact on local and global temperatures. In the last few decades, the amount of carbon absorbed by the world's intact forest ecosystem has fallen and the forests now take up a third less carbon than they did in the late '90s, owing to the effects of higher temperatures, droughts, deforestation and forest fires. Recent literature insights have suggested about the possibility that these forests may become the carbon source by the year 2060. LIDAR technology has been widely used to get accurate data to estimate the level of carbon absorption in the forest and help researchers make real-time simulation modelling to alter the course of these forests from carbon emitters to carbon sinks. This would also help us perform simulation studies in creating urban forest ecosystems that might reverse carbon emissions. Using the LIDAR technology, we can precisely estimate the forest fire fuel by calculating the tree population density and also determining the amount of forest degradation in a specific geographic region. These studies can also estimate an area in the forest human activity has affected that and devise mitigating factors to reduce environmental degradation in real-time. Applying these learning to urban ecosystem would also help in devising policies and ecologically sensitive infrastructure development. The LIDAR technology can monitor forest fire patterns, which could serve as input parameter to predict and model potential fires based on change in the climatic conditions and devise strategies in actual time to avoid them soon. This project's aim is to seamless integrate LIDAR technology to estimate, model and predict carbon absorption rates in real-time and provide curative insights to nurture and create rural and urban forest ecosystem that could serve as "carbon sinks". It uses game-theory to model, predict and improve the carbon absorption rates by simulating various scenarios and suggesting curative actions in real-time.

Submission: FFT

Multi-scale Spatio-temporal Analysis of Foraging Behaviour of Animals using Hyper-Spectral Imaging

Awase Khirni Syed, Saied Pirasteh, Jonathan Li

Abstract: Spatio-temporal scale is an effective method for studying trends in various surface processes. A new methodological paradigm for integrating hyperspectral remote sensing data on different spatial and temporal scales to study mobility and foraging patterns of animals. Animals regularly navigate through their habitat foraging patches, nests, dens, watering holes or movement corridors. Some of these places are often sites of ecological importance. Using hyperspectral imaging technique to analyse the Spatio-temporal patterns of visitation and

foraging can lead to important insights into the history and ecology of animal population in the food chain. In the past, animal movement data has been collected using satellite tracking tags. This study explores the use of hyperspectral imaging data to track, analyse and predict their foraging pattern based on the seasonal variations, daily movements and identifying the role of spatial memory in animals, while foraging through vast natural reserves. Furthermore, a trajectory analysis and comparison with avian foragers and their interactions with land foragers would help us understand predator and prey behavioural predictability. It would further help us determine foraging performance in these natural habitats. A critical insight that can produce deductive insights from the analysis of movement recursions to detect reproductive events and breeding sites of various species and estimate their foraging behaviours. These movement recursions also provide insights to draw correlation between movement and resource dynamics, predator and prey interactions, population distribution and their survival rate. Using these data insights, we can build models and present Spatio-temporal visualisation to analyse and predict predator and prey behaviours in various habitats.

Submission : Independent Electricity System Operator.

Real-Time Energy Monitoring and Carbon Emission Tool for Green Energy Switch

Awase Khirni Syed, Saied Pirasteh, Jonathan Li

Abstract: Electricity generation and consumption accounts for nearly 40% of carbon emissions worldwide as the power plants rely on burning fossil fuels to generate it. The flow of electricity through the grids varies by location, season and time of day. Curbing carbon emissions in real-time by having precise data to untangle the complex flow of carbon is essential in devising an effective strategy. With the availability of many publicly available datasets, we can model health and climate impact of associated emissions in real-time to create carbon footprint metric (Carbon dioxide emissions coefficient) for each post-code on the temporal frame. In the recent years, focus has been on using location, IT load, electrical efficiency to correlate energy use to carbon emissions for various IT data centres. By using similar factors, we can generate carbon footprint for each post-code across Canada in real-time and devise strategies for switching to alternative green energy options using game-theory based simulation techniques. This project presents Spatio-temporal visualization to track real-time emissions and electricity consumptions to plot thematic maps that reflect consumption-based carbon intensity of electricity. This tool would help us visualize in real-time how much electricity is being consumed by post-code and how the emission-intensive that power is on a temporal scale.

Submission: Great lakes foundation

Multi-Scale Spatio-Temporal Analysis of Fish Mobility using Hyper-Spectral Imaging and Management of Coral Reef fisheries for Great Lakes

Awase Khirni Syed, Saied Pirasteh, Jonathan Li

Proposals Abstract

Spatio-temporal scale is an effective method for studying trends in various surface processes. A new methodological paradigm for integrating hyperspectral remote sensing data on different spatial and temporal scales to study the temporal variability/stability of key fish species in Great Lakes. This study would help us in rehabilitation projects and understanding the factors involved in degrading great lakes ecosystems at large Spatio-temporal scales. We investigate the current and historical states of the fish in Great Lakes regions and the factors affecting their growth or decline in numbers. We intend to use electrofishing and habitat mapping techniques clubbed with hyperspectral imaging data to understand fish mobility in Great Lakes Ecosystem. Furthermore, we intend to replicate these studies across various geographies to understand fish behaviour in the lake ecosystems and the large ocean bodies. The study also aims to provide a means to explore various techniques using hyper-spectral imaging to identify/survey different species on a Spatio-temporal scale and provide predictions of their population growth and decline due to various factors being human, rising climatic conditions etc. The study will also help present simulation of fish behaviours based on lake ecosystems and large marine ecosystems. This would help in predicting aquaculture harvesting for commercial fishing industries.