2023_41_ESE_Plancherel: Tracking Illegal Gold Mining Safely with Earth Observations and Machine Learning

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INTERPOL and UNEP estimate that illegal gold mining represents more than USD 48 billion a year in illegal gains. Globally, up to 80% of all small-scale artisanal mining is illegal. Recent events (e.g. Covid, Ukraine, politics), have led to further increases in gold prices, boosting demand. Given deteriorating socio-economic conditions, illegal gold mining is booming across the globe, causing severe, widespread, transnational, and chronic environmental damages. It is also linked to organized crime, human trafficking, and other human rights violations. In regions that are particularly affected by illegal mining, corruption of policymakers and law enforcement officials can further impair local action. Since illegal mining represents an attractive source of income and is often supported by organized crime syndicates, it can be very dangerous for civil servants in affected countries to investigate the social and environmental effects of illegal gold mining using traditional methods.

This project aims to leverage satellite observations, drone imagery, chemical, trade and socio-economic data and machine learning tools to develop the new field of "environmental forensics and criminology" and to quantify the environmental footprint associated with illegal gold mining.

By delivering new tools to openly and safely document, quantify and verify suspected illegal mining activities and their impacts, and by working with media outlets, (e.g. Citi FM, Ghana's largest radio station), and international institutions (INTERPOL, UNEP) to disseminate results, this project will aim to circumvent barriers to local action mainly due by corruption.

As part of this project, the PhD student will collaborate closely with SnooCode.com, an IT company based in Ghana. The student is expected to conduct fieldwork in Ghana to collect drone imagery and sample mining ponds, rivers and sediments, chemically characterise these samples, and integrate this information with satellite-derived products to quantify the mass of gold extracted illegally and the mercury emitted. Results from this project will help quantify the environmental footprint of illegal mining activities, including the degradation phase and the recovery phase after sites are abandoned; information that is critical to develop suitable management policies.

The ideal candidate for this project will have demonstrated expertise in computer programming, remote sensing or machine learning, be generally passionate about environmental or security issues and be willing to work in remote environments in Africa.

Interested candidates should send their questions, a CV and a 2-page personal statement to Dr. Yves Plancherel at y.plancherel@imperial.ac.uk as early as possible. Note, the ESE department requires full college applications to be submitted by the deadline (not only CV/statement).

Background information:

- https://www.interpol.int/News-and-Events/News/2022/The-devastating-impact-of-illegal-gold-mining-in-Latin-America

- https://www.unep.org/news-and-stories/story/environmental-crimes-are-rise-so-are-efforts-prevent-them