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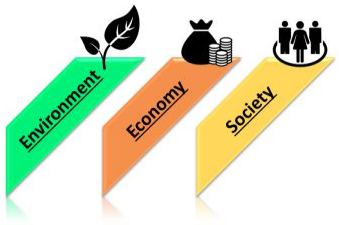

Satellite prediction of illegal wildlife trafficking routes

Illegal wildlife trafficking is one of the most profitable criminal activities and one of the major threat for biodiversity and peace. The aim of this idea is to develop an algorithm to predict the routes of vessels and to look for strange behaviours in order to interfere the criminal activity before its completion. The algorithm will use the Automated Identification Systems on-board the vessels together with a network of satellites and ground based receivers.

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Satellite prediction of illegal wildlife trafficking routes

By Eric Herrero

THE PROBLEM: A well-managed trade of animals and plants has the potential to deliver significant benefits in poor communities. It is estimated that the value of legal wildlife trade was around USD300 billion in 2005 [1]. Illegal trade however, is considered as one of the major threats for the biodiversity and one of the most profitable criminal activities. On February 2016 the European Commission and the United Nations recognized the role that wildlife trafficking has in financing militia and terrorist groups [2].

Table 1: Shows some prices of wildlife in the black market. Source: www.havocscope.com

ANIMAL	REFERENCE PRICE IN THE BLACK MARKET
Gorilla	USD 400.000
Rhino horns	USD 65.000 per Kilogram
Tiger (Alive)	USD 50.000
Butterfly (Queen Alexandra)	USD 8.195
Totoaba Fish Bladder	USD 200.000

Illegal wildlife is frequently transported with legal cargo and following an apparent legal path. Documentation can be easily falsified, authorities are bribed and physical inspections on all the containers are impossible due the huge quantity of containers that enters and exits the ports [3] [4].

The International Convention for the Safety of Life at Sea requires **Automatic Identification Systems** to be fitted aboard ships with gross tonnage of 300 or more. Such systems are a reliable source of data that could be used to discover illicit activities.

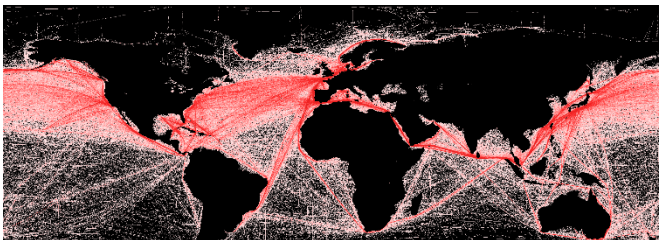

Image 1: This map of shipping routes illustrates the relative density of commercial shipping in the world's oceans. Source: Wikipedia.

DESCRIPTION OF THE IDEA: Satellite Automatic Identification System (S-AIS) is augmenting the capabilities of ground receiver stations. Since 2005, several agencies like ESA have been experimenting using satellite-based receivers [5].
Satellites enable the complete monitoring of vessels far from the coastline by receiving near-real time data containing information like the characteristics of the vessel, the position, speed or the destination.

The idea is to program a tool to visualize and analyze the S-AIS data. The tool should be able to create models of normal behavior using the raw data coming from all the global fleet. Thus, given one specific vessel we will be able to compare it with the model and quickly determine if there are unusual parameters.

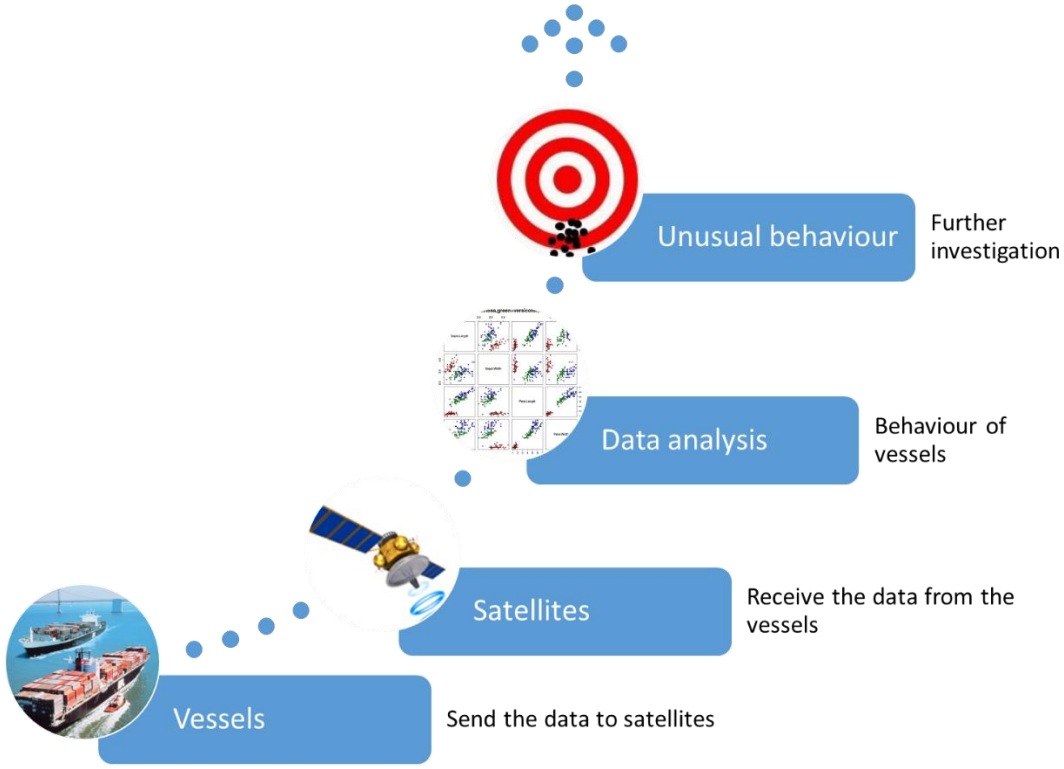

Image 2: Schematic of the global process.

REALISTIC IMPLEMENTATION: Automatic Identification Systems transmit to ground stations. The use of satellites has been a recent introduction. Satellites allow a global coverage of the vessels beyond the coastline, however there are several shortcomings due the large volume of data that the satellite would need to process [6]. Thus, satellites will complement ground receivers rather than substitute them.
In any case, the technology has proven to be minimally functional and there are several efforts ongoing [7][8].

The algorithms for modelling the global fleet and show unusual behavior already exists and has been proven its practical application [9].

To implement the algorithm, I have strong preference to use open source software like Python, which also has many cost free resources to work with large amount of data as well a global support community of developers.

RESULTS EXPECTED: Since the traffickers use legal routes to transport its illegal wildlife hidden in a container, one could expect that no algorithm could really determine which vessel we need to inspect. This is a partial truth. On one hand, it is true that we cannot be 100% sure about which vessel is trafficking with illegal wildlife. On the other hand, the perfect plan doesn't exist and always there are direct and/or indirect parameters that make us suspect that one vessel is performing suspicious activities.
Imagine for example that one ship reports to moving dried fish from Tanzania (Dar es-Salam port) to Guangdong. If the ship says the truth, its route should be: **Dar es-Salam**, **Shenzhen** and **Guangdong**. However, our ship follows the alternative route of: **Dar es-Salam**, **Haiphong**, **Mong Cai** and **Guangdong**.

In appearance there's nothing wrong in the second route but if we analyze the costs of shipping one container of dried fish for each route we will find that the former has a transport cost of USD1.683 while the second route via Vietnam has a transport cost of USD2.480. Since there is no economic reason for that, the behavior of this ship is suspicious. And in fact, further investigation reveals that there are clusters of criminal brokers around Mong Cai port [10].

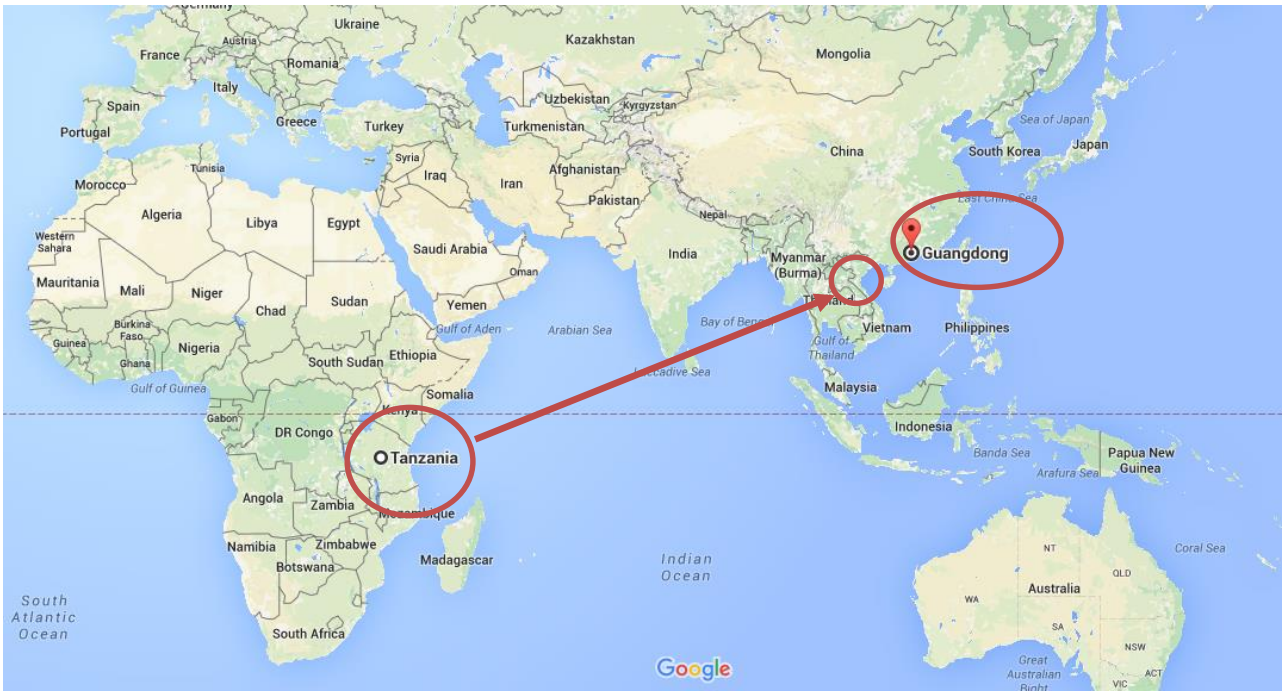

Image 3: Situation of the traffic areas on the map.

The costs, the time spent for upload and download cargo, which vessels enter and exit from a port, the costs of a route, etc. Many indirect parameters could be calculated using AIS data and reveal if the vessel is doing something different from the normal.

CONCLUSION: No algorithm will indicate exactly which container of which vessel we should look but the application of this technology will reduce the search space to few suspicious vessels and save months of international investigation giving a chance to act quickly and interfere the illegal activity before its completion.

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