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Smart algorithms for monitoring plastic litter

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Plastic Litter (PL) has become more ubiquitous in the last decades posing socio-economic as well as health problems for the blue and green economy. However, to date PL monitoring strategies have been based on field sampling by citizens and scientists during recreational, sporting, scientific and clean-up campaigns. To this end, remote sensing technologies combined with artificial intelligence (AI) have gained rising interest as a potential source of complementary scientific evidence-based information with the capabilities to (i) detect, (ii) track, (iii) characterise and (iv) quantify PL. Within the smart algorithms, convoluted and recurrent neural networks ingest vast multi to hyperspectral images from smartphones, unmanned aerial systems, fixed observatories, high-altitude pseudo-satellites and space stations. Detection would involve the application of object recognition algorithms to true colour Red-Green-Blue (RGB) composite images. Typical essential descriptors that are derived from RGB images include apparent colour, shape, type and dimensions of PL. In addition to object recognition algorithms supported by visual inspection, AI is also used to classify and estimate counts of PL in captured imagery. Quantification assisted by smart systems have the advantage of uncertainties associated with predictions, a cruial aspect in determing budgets of PL in the natural environment. Hyperspectral data is then utilized to further characterise the polymer composition of PL based on spectral reference libraries of known polymers. Fixed observatories and repeated image capture at regions-of-interest have prospective applications in tracking of PL. Here we present plausible applications of remote detection, tracking and quantification of PL assisted by smart AI algorithms. Smart remote sensing of PL will be integrated in future operational smart observing system with near real-time capabilities to generate user (citizens, stakeholders, policymakers) defined end-products relevant to plastic litter. These tailor-made descriptors will thus contribute towards scientific evidence-based knowledge important in assisting legislature in policy making, awareness campaigns as well as evaluating the efficacy of mitigation strategies for plastic litter. Essential descriptors proposed need to include geolocations, quantities, size distributions, shape/form, apparent colour and polymer composition of PL.