

PARTICLE POLLUTION DETECTION USING ARTIFICIAL INTELLIGENCE

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“Towards accurate, real-time, low-cost sensing”

1 Motivation

Air
Every year in the UK, exposure to polluting particles causes:

- 16,500 strokes.
- 4,200 lung cancers.
- Alzheimer's disease.



Water
Impact on marine life due to plastic particles absorbing toxins & entering food chain.

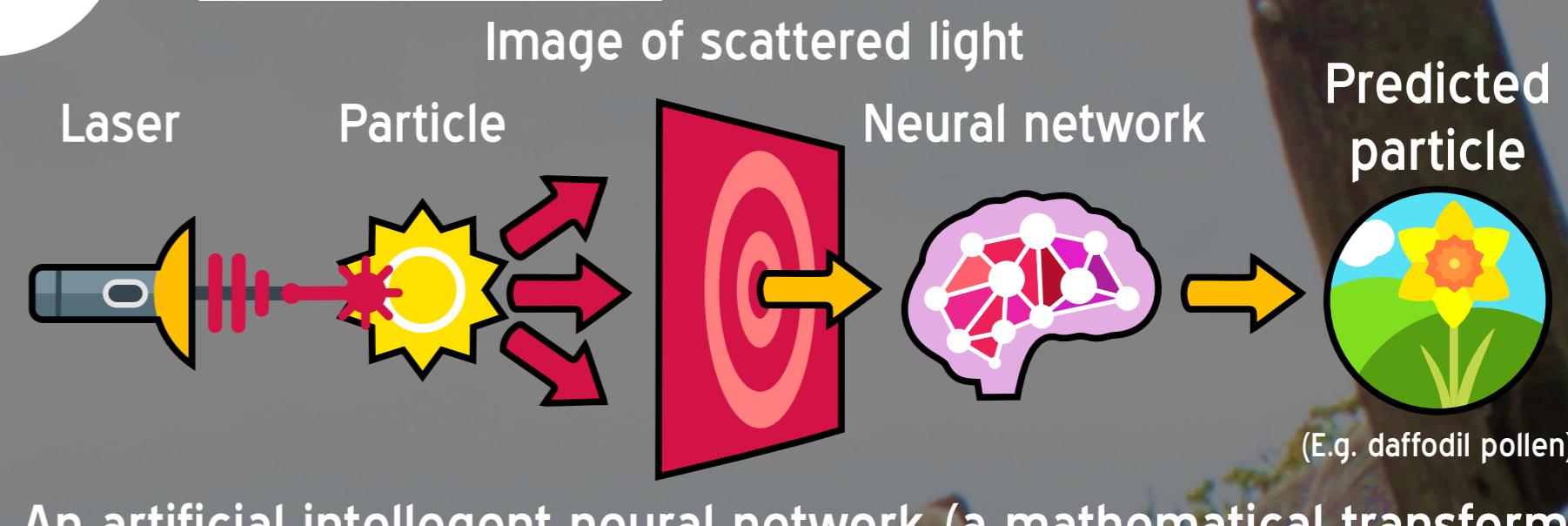
- Microplastics in drinking water.



40,000 deaths per year¹ **Trillions of microbeads enter the sea per year** **£20 billion per year**

Monitoring of pollution is vital to understand its origins and reduce it. Current sensors can lack accuracy and be expensive.

2 Concept



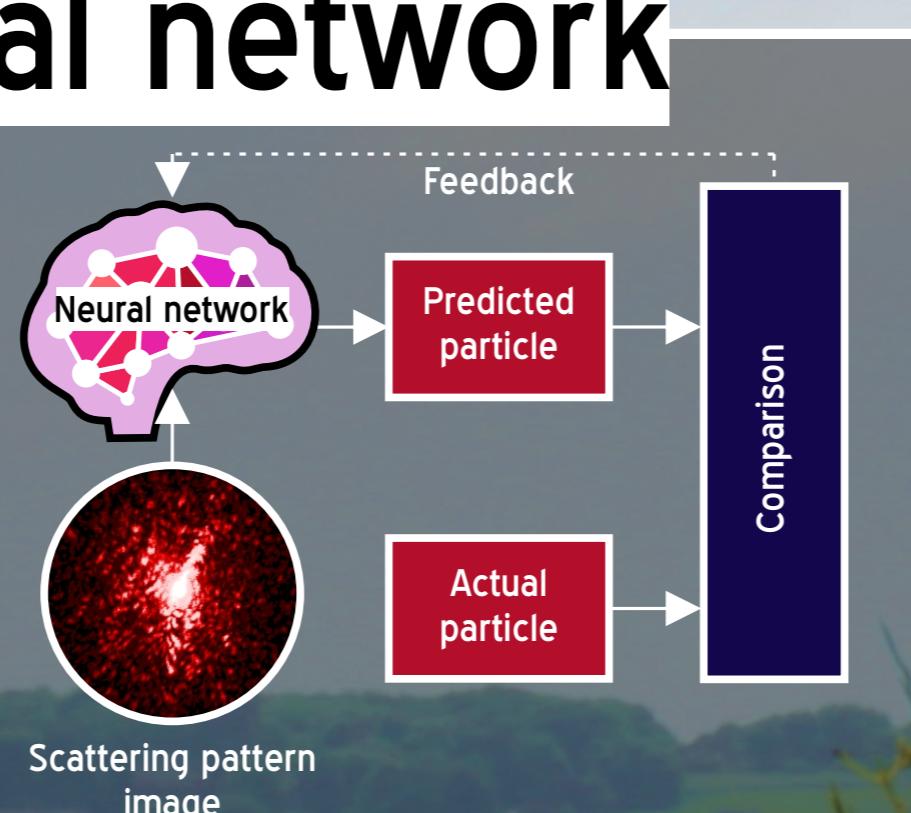
An artificial intelligent neural network (a mathematical transform that mimics the brain's visual cortex) classifies a particle directly from the light scattered by the particle.

3 Experimental setup

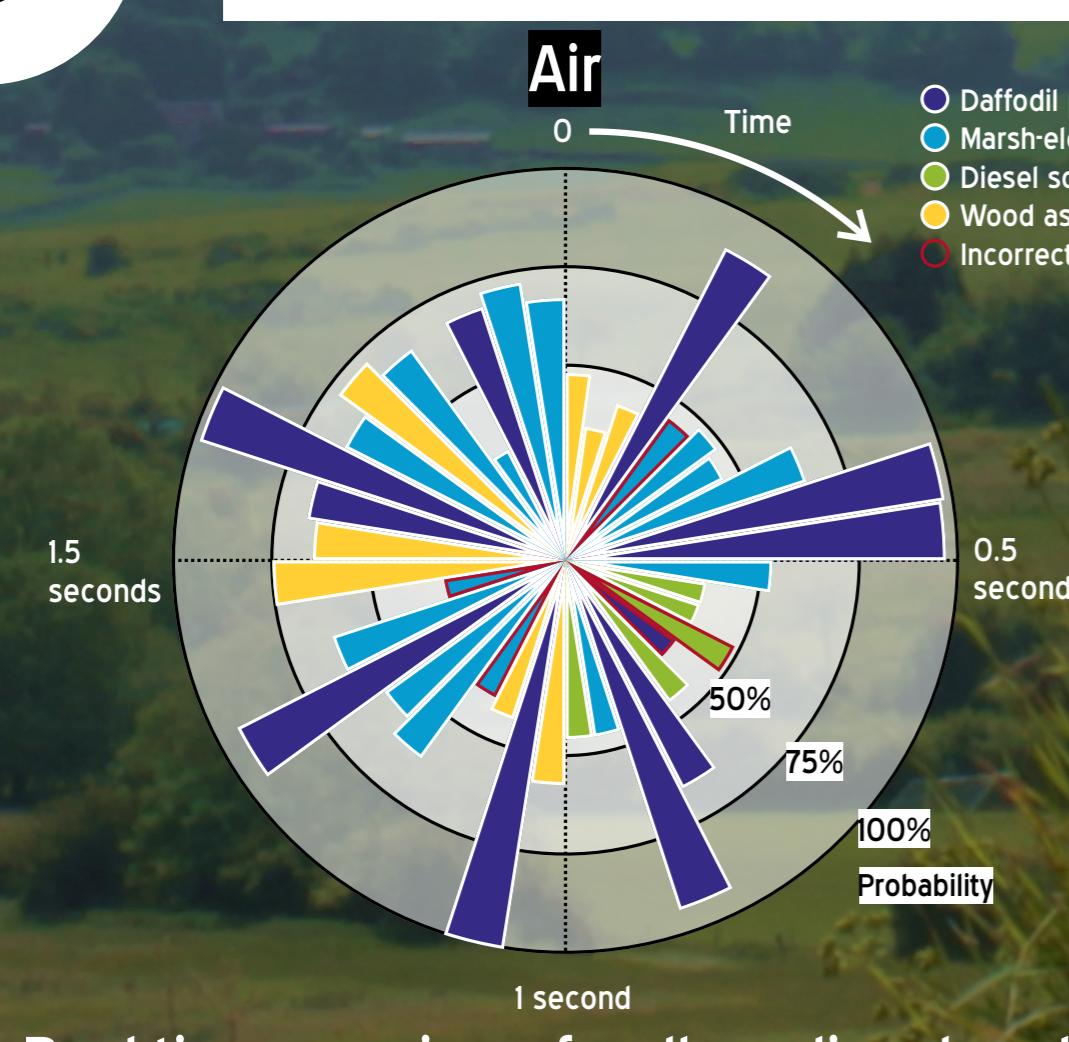
- A red laser beam was directed onto diesel, wood ash, pollen particles in air, and plastic particles in water, and the scattered light was imaged by a camera.
- The images were used for training the neural network.

4 Training neural network

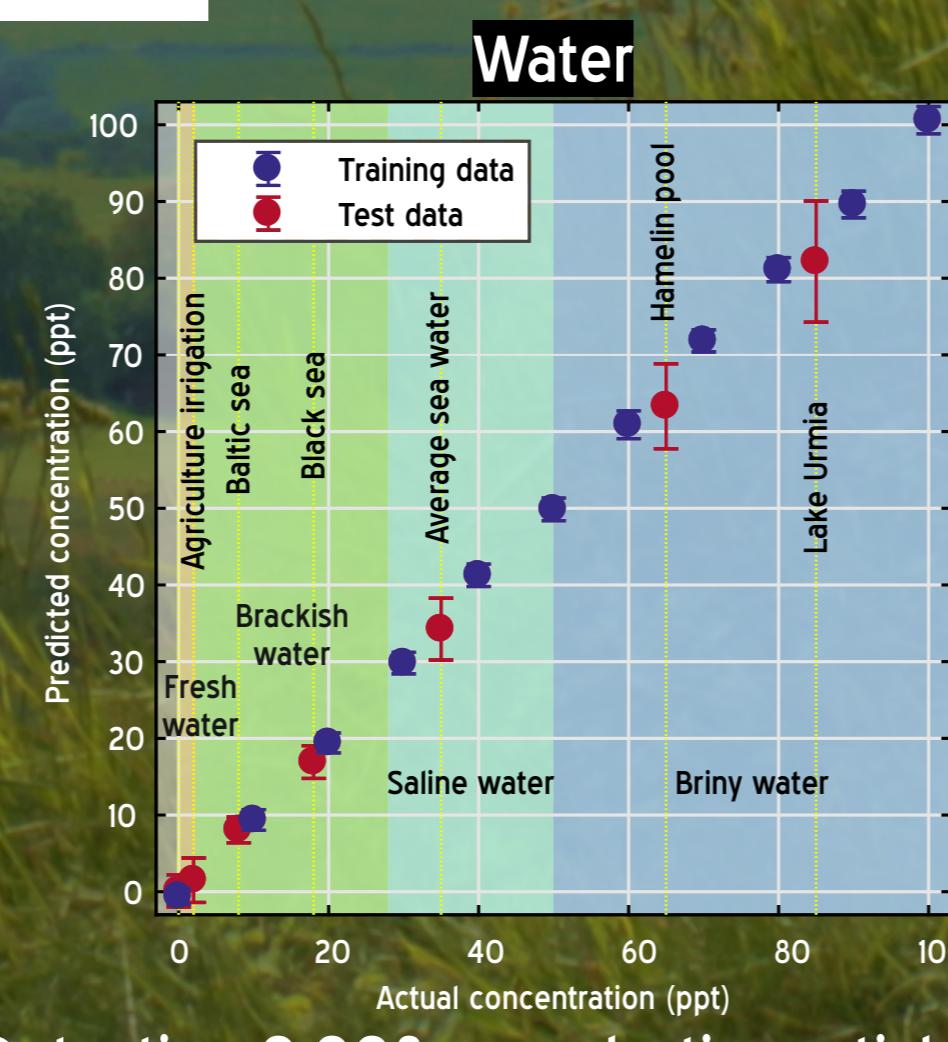
- Scattering patterns were used as an input for the neural network, which was trained to predict the material and number of particles.
- Once trained, the neural network was used in real-time for particle pollution classification.



5 Real-time detection



Real-time sensing of pollen, diesel and wood ash particles. Most likely particle type with its probability of prediction as a function of time.



Detecting 0.008 mm plastic particles in water, with the average prediction accuracy of water salinity presented.

6 Future work

Nationwide sensors:

Developing a network of sensors over the country, such as on lampposts and in marine areas, which send data to the cloud and allow a live map of particle pollution to be viewed online.



Wearable technology:

- Rings, watches, headphones.
- Air pollution monitor with alerts.
- Hay fever alerts.
- Personalised.

