Active object tracking with deep reinforcement learning

Can we train a **visuomotor** policy, purely with **machine learning**, to do **target tracking** "in-sim" .... and then use it to control a real vehicle like an ROV from camera input alone?

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Read me for context ..

Cetaceans (whales, dolphins & porpoise) are considered sentinel species of marine biodiversity and ecosystem health. **Monitoring and conservation** is therefore of key importance.

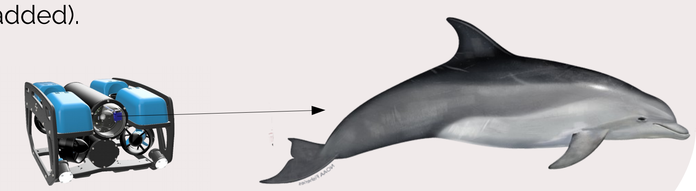
To study the **effects of anthropogenic activity on behaviour and distributions**, Newcastle's Marine Megafauna lab conduct surveys out in the North Sea (along the **Northumberland coast, North East England**) collecting photographs, audio recordings and video footage from a research vessel.

For behavioural study in particular, there is value in **filming at depth** and **away from the vessel**. An **underwater camera-fitted vehicle is perfect!**

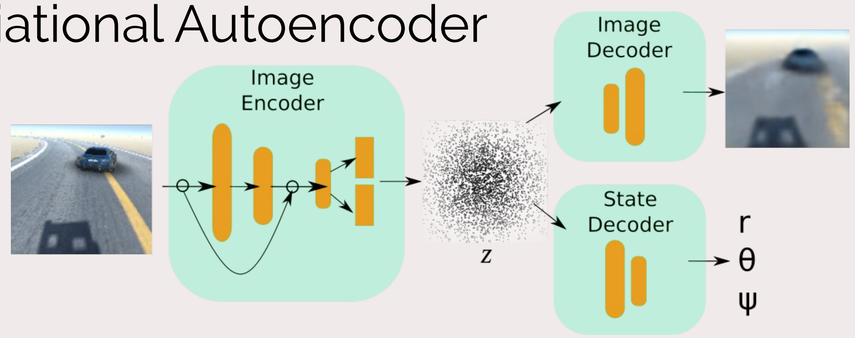
My research looks at **autonomous driving** algorithms in the context of **following something that is moving**.

This could be applied to filming free-swimming animals ... but it **could also be applied to lots of other areas**, like subsea cable inspection to name one.

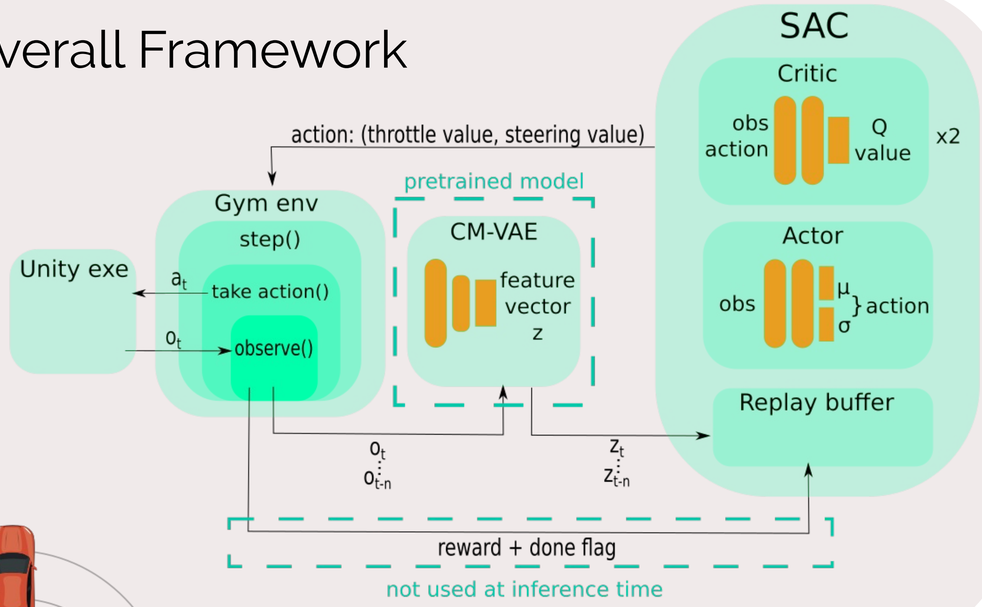
My research is just the **first building block** toward this goal. It is so far entirely **"in-sim"** (real-world transfer is to come), it is **"single object tracking"** (multiple objects would be the next challenge), and in **2 dimensions** (the vertical 3rd dimension will then be added).

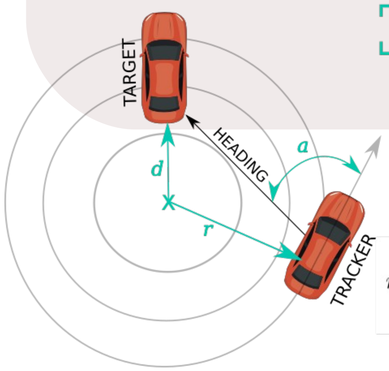


Variational Autoencoder



Overall Framework



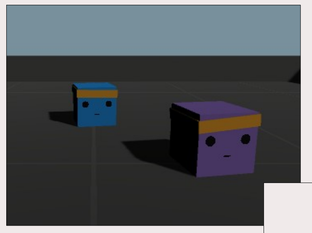


$$r = A - \left(\frac{\sqrt{x^2 + (y-d)^2}}{c} + \lambda |a| \right)$$

Reward per timestep: value in range [-1, 1] scaled by formula to left

Termination of episode: collision / > max distance / > max timesteps

Sim-to-real approach



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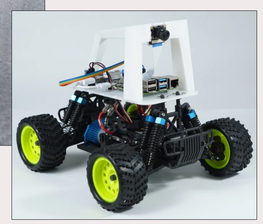

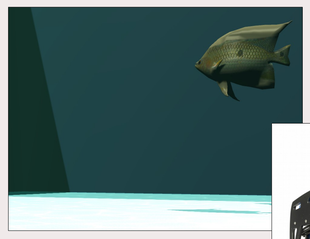

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Scan for videos of my agents and for talks on the same work