The presentation is entitled Addressing Perception and Interaction Challenges in Underwater Robotics for Preserving Life Underwater. More specifically, “how underwater robotics can help with the exploration and preservation of life.” (presenter’s quote) This problem is motivated by a consortium for the global good and one of their stated goals is the preservation of life underwater.

From what I gathered in the presentation these robots are Field Robots. That is, they are not controllable, function in outdoor environments, and said environment is natural and not engineered. An example of what these field robots would collaborate with humans on, would be the monitoring of invasive species, maintenance work, and even search and rescue. At the same time, there are many challenges underwater ranging from varying lighting conditions, wide range of termperatures, and extreme pressure, to name a few.

Now, these robots or AUVs (Autonomous Underwater Vehicle) must have some way to interact with humans so that they can assist with tasks. Simple programming languages have been developed and improved upon over the years so that now we can communicate with these robots using hand signals and gestures. Another way to communicate is with tags that signal the robot in certain ways. This method of communication seems a bit more cumbersome since the person communicating with the robot must carry a set of tags and show the robot the correct tag in under 40ft of water. A simple method of communication which is widely used underwater is pointing. This gives the diver a way to give cues related to location to an AUV. Even this simple method of communication has a fairly complicated flowchart to interpret the gesture.

Of course, many times divers go into the water in a team to accomplish some type of objective and it is not unreasonable to think that each diver may want to bring along their own AUV. This makes communication even more complicated. Not only does the AUV need to interpret one set of gestures but it should also be able to understand and communicate with all of the members on the team. To take things one step further, the robots should be able to communicate and signal each other. To facilitate this, there is research where robots are interpreting video clips that can capture gestures. This allows the AUV to distinguish between different types of similar gestures. “Most of these gesture interactions happen at a distance of 5 to 10 feet.” (presenter’s quote) Not only should the AUVs be able to communicate with a human but a human should also be able to understand what the AUV is trying to communicate and research continues in this area.

As an aside, while observing the robots in the water, I wonder if there is research being done around a robot being able to fix on and monitor a point in the water. For example, there are currents constantly trying to move the robot out of position as well as visibility and temperature fluctuations. I would think that this is a difficult problem to solve.

One application of these AUVs is trash cleanup. This necessitates that the AUV needs to detect what is trash and what is not trash. Deep learning models are being used in this area to observe the object shape, object volume, and object variety. However, there is not a lot of data in this area so new datasets are being developed such as a dataset TrashCan (only 8000 images). Another way to come up with a trash dataset is to use AI to help develop “fake trash” images.