Assignment # 1

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LIBS1095-23W-Sec4-Artificial Intelligence
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1. Which article did you choose?

University of Bristol. (2023, January 24). Fish sensory organ key to improving navigational skills of underwater robots. ScienceDaily. Retrieved February 16, 2023 from www.sciencedaily.com/releases/2023/01/230124192629.htm

2. Why did you choose this particular article?

The article is interesting for several reasons. Firstly, it discusses an innovative approach to improving the navigational skills of underwater robots by studying fish sensory organs. This is a unique and creative way of tackling a real-world problem, and the findings could have significant practical implications for areas such as ocean exploration and search and rescue missions. Secondly, the research described in the article is interdisciplinary, combining expertise from the fields of biology, engineering, and mathematics. This cross-disciplinary approach is an important trend in modern scientific research, as it enables researchers to tackle complex problems from multiple perspectives and develop more effective solutions. Overall, the article presents a fascinating and promising area of research that could have important implications for the future of underwater robotics.

3. What was the article about?

    a. Describe in detail the technology.

The technology/AI described in the article is a novel type of pressure sensor that could be used on underwater robots. The inspiration for the sensor comes from the lateral line sensing organ found in fish, which enables them to sense

and interpret water pressures around them with enough acuity to detect external influences such as neighboring fish, changes in water flow, predators and obstacles. They discovered that the lateral line system could be applied to larger scales than just the tiny scales found in fish, making it useful for underwater robots, particularly swarm robotics, where cost is a large factor.

b. Who designed it?

The technology is designed by scientists from the University of Bristol.

c. How was this AI developed?

The AI was developed based on studying the lateral line sensing organ in African cichlid fish, which allows fish to sense and interpret water pressures around them. The scientists aimed to understand the cues for collective behavior that could be employed on underwater robots. They examined the different areas of the lateral line, such as the head versus the body, and the different types of lateral line sensory units, such as those on the skin versus those under it, to determine how fish can sense their environment. They used hybrid fish to allow for natural variation and discovered that the lateral line system around the head has the most significant influence on how fish can swim in a shoal. They also found that the presence of more lateral line sensory units under the skin results in fish swimming closer together, while a greater presence of neuromasts on the skin tends to make fish swim further apart. The mechanisms behind the lateral line were simulated and found to be applicable at larger scales, inspiring a novel type of easily-manufactured pressure sensor for underwater robotics. The

researchers plan to integrate this sensor into a robotic platform to help robots navigate underwater and demonstrate its effectiveness.

d. What inspired the creation of this AI?

When conducting a search in dark or murky water, the conventional camera installed on the underwater robot will function much like a human eye and will encounter difficulty in navigating through the water (Deep Trikker, n.d.). The sensor system on the underwater robot will improve its navigation efficiency.

e. What is the purpose/application of this AI?

The purpose/application of this AI is to help underwater robots that can navigate in dark or murky environments. The researchers studied the lateral line sensing organ in fish to understand how it enables them to sense and interpret water pressures around them, and how this information can be used to inform shoaling behavior. By developing an inexpensive pressure sensor based on this mechanism, the researchers hope to improve the navigation abilities of underwater robots, particularly in swarm robotics, where cost is a significant factor. The team plans to further develop and integrate the sensor into a robotic platform to demonstrate its effectiveness.

4. Do you feel that this technology is truly “intelligent”? Why or why not?

We feel this technology is “intelligent” because it can allow greater automation of robotics in the future by automate submersible robots allows to reverse the oceans and other bodies of water to get a better understanding in the oceans and other bodies of the water on our planet and it can help to create a rover for aquatic planets. All of this it

can allows the robots to traverse the water greatly by keeping away from fish in the water and obstacles get in the away of the exploration in the water filled areas.

5. If you were a venture capitalist or investor, would you fund this project? Why or why not?

If we were investors, we would fund the project because to see the progression to advance the aquatic part of robots, to improve research under the water that can have the chance on making robotics and other field get better from having a better understanding on planet we live on and as mankind we know more about the galaxy than the very world we live on. Moreover, the study conducted by Data Bridge Market Research in 2022, states that the underwater robot market is expected to reach the growth of almost USD 8036.40 million by year 2029 (Globe News Wire, 2022, para. 2). In addition to, as per reports published by MarketInsightsReports group, the market will grow at 13.8% Compound Annual Growth Rate (CAGR) between year 2023 to 2029 (Digital Journal, 2023, para. 2). Because of numerous applications of automated underwater vehicles, governments across the globe are allocating more capital in the military budget to get more of such robots. Hence, based on the market trends and interest of governments in the technology, the money invested in funding the technology will result in high return.

6. Do you think this is a good/bad technology?

Underwater robots integrated with fish sensory organs like lateral line, contributes

to numerous advantages to the operation of underwater robots. It can improve the performance, navigation, accuracy and cheaper to implement as compared to LASER based systems.

The use of sensors equipped with lateral lines increases the performance of underwater robots significantly. Conventional robots use LASER or SONAR for navigation which does not work when robots are moving in a group. Light or sound waves emitted get blocked by closer robot which affects the movement. But with the use of such sensors this problem gets resolved. A sensor is deployed on each robot which continuously keeps sensing the surroundings for any changes and taking quick actions to alter the movement (Technical University of Munich, 2010, para. 9). This can support deployment of robots in swarms, and they will navigate intelligently and smoothly without any kind of intervention.

Moreover, artificial sensory organs used in robots do not use conventional indicators to measure changes in pressure and flow. Instead, it uses thermistors to sense the surroundings. Changes happening around are measured electronically with more speed and less space. Artificial sensors use only a small amount of energy as compared to other systems. They can capture fluctuations in pressure at the interval of one tenth of a second and less than one percent over an area of few square millimeters (Technical University of Munich, 2010, para. 8). This feature makes this technology more accurate and efficient as compared to light or sound-based sensors.

In addition, the implementation of artificial sensors is cheaper than laser scanners. Laser based scanners like LiDAR require high powered lasers which need more powerful

operating systems to run them. Implementing such sophisticated systems will be costly and it does not make robots energy and cost efficient. In comparison to such systems, artificial sensors are easy to use and cheaper to manufacture. Even though being cheaper than other systems they make the performance better.

References

Deep Trikker. (n.d.) *Murky Water Search & Rescue Using an Underwater Drone*. Retrieved on February 16, 2023, from

https://www.deeptrekker.com/resources/murky-water-search-rescue

Globe News Wire. (2022, July 20). *Underwater Robotics Market to Observe Impressive Growth of USD 8,036.40 Million By 2029 | Industry Trends, Global Demand, Future Scope and Top Player Analysis*. Retrieved on February 17, 2023, from

https://www.globenewswire.com/en/newsrelease/2022/07/20/2483085/0/en/Underwater-Robotics-Market-to-Observe-Impressive-Growth-of-USD-8-036-40-Million-By-2029-Industry-Trends-Global-Demand-Future-Scope-And-Top-Player-Analysis.html

Digital Journal. (2023, February 16). *Autonomous Underwater Robots Market Analysis, Developments in Manufacturing and Regional Growth Overview – Forum Energy Technologies, ECA Group, TMT.* Retrieved on February 18, 2023, from

https://www.digitaljournal.com/pr/news/autonomous-underwater-robots-market-analysis-developments-in-manufacturing-and-regional-growth-overview-forum-energy-technologies-eca-group-tmt

Technical University of Munich. (2010, March 29). *Clever as a blind fish: New senses for autonomous robots*. Retrieved on February 16, 2023, from

https://webarchiv.typo3.tum.de/TUM/robotics/en/in-the-media/press-singleview/indexe9fe.html