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Artificial Intelligence Applications in Fish Classification and Taxonomy: Advancing Our Understanding of Aquatic Biodiversity

Shane Wasik[1]*, Robert Pattinson[2]

[1] *School of Biological Sciences, The University of Auckland, Auckland, New Zealand.*

[2] *CSIRO National Research Collections Australia-Australian National Fish Collection, Hobart, Australia.*

Abstract

The purpose of this research study is determining that artificial intelligence applications related to the fish classification also that taxonomy. Research describes that aquatic biodiversity between them. The research measure that advancing aquatic biodiversity related to the fish classification and taxonomy. Artificial intelligence (AI) systems surpass traditional human-centered methods in the rapid and accurate identification of fine-grained morphological features by analyzing massive datasets. The descriptive statistic, smart PLS Algorithm model related to them. As a result, this gives conservationists useful knowledge to take on new tasks and protect endangered species. It is emphasized that this technological breakthrough depends on ethical concerns and the appropriate use of AI. The paper also examines citizen science initiatives and public participation in the democratization of AI-assisted fish identification. The educational component is examined, demonstrating how AI-driven technologies provide immersive learning environments that encourage a deeper understanding and appreciation of aquatic biodiversity. In conclusion, the ingenious partnership of artificial intelligence and fish taxonomy not only clarifies the secrets of the deep blue but also paves the road for a future in which environmental preservation and technological growth coexist together. The result founded that direct and significant link between fish classification and taxonomy related to the artificial intelligence. Result also founded that aquatic biodiversity between them. The various achievements of AI are highlighted in this research, along with the ways in which it might further our knowledge of and efforts to protect the great diversity of species found under the ocean's surface.

Keywords: Artificial intelligence (AI), Taxonomy (TT), Fish Taxonomy (FT), Biodiversity (BD),

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Introduction

The word "Artificial Intelligence" is a broad term that can be explained in these words "the development and use of computer-based systems which can perform such tasks which need human intelligence for the accomplishment of task such as perception of visual stimuli, the best recognition of speech, the ability of decision power, the translation of different languages and many others. ". There are many benefits of artificial intelligence in this scientific era of life, such as in industry, medical healthcare, communication employment, entertainment, and many others(Muller-Karger et al., 2018). This study overviews the benefit of artificial intelligence for the discovery, classification, and Taxonomy of fishes which can be used to study aquatic Biodiversity. This aspect of artificial intelligence has become increasingly recognized and used in research of Aquatic life along with its production as well. The aspect of magnetic imaging by using artificial intelligence has become of extreme use because this imaging helps to identify different structures of fish bodies which are related to a variety of characteristics that are important to studying aquatic life. In today’s world, the classification of fish is a time-consuming process and there are also chances for possible errors and mistakes as

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well(Khan, Li, Temple, & Elhoseiny, 2023).

Now machine Learning techniques are used to study the Morphology of fish because it is less time-consuming with fewer chances for error. This machine learning approach aids in the research of fish traits as well as the study of fish evolution throughout time. Determining the relationships between various fish species is another benefit of studying morphology. The fact that some fish make particular noises that can be captured on camera with different kinds of microphone recorders is another significant feature of studying fish. Fish taxonomy may be categorized using voice recognition(Kavousi & Hicks, 2023). It has been concluded that there are almost 800 species of fish that can produce signals of sound waves. Usually, these sounds are emitted at a frequency of below 1000 Hz. These waves are emitted for only a short duration so these waves are not easily accessible. We can use acoustic sensors which can receive these signals of sound waves from fish. Some species of fishes can also be identified by sonar images which can be drawn by using computer vision technologies. The other technique that can be used for identifying and classifying fish is autonomous hydro phones which can measure the direction and intensity of sound waves(Shivaprakash et al., 2022).

The criteria drawn for the classification of fishes by using artificial intelligence is shown as, acoustic data, then pre-processing of this data, then syllable segmentation, then extraction of features, then classification, and last is output. The acoustic data can be collected by using two internet sound collections in which sound waves emitted by fishes are analyzed, there is a database abbreviated as DOSITS which is the discovery of sound in the sea, which is a main project for collecting information by collecting sound waves. The second step is pre-processing in which the frequency of sound emitted by fishes is evaluated(Canonico et al., 2019). Sometimes this frequency may exceed 8 kHz and more. The third phase is segmentation, in which audio signals are split into syllables for identification of sounds. Then in the next step, these features are used for the classification of fishes. The other aspect of artificial intelligence that can be used for the classification of fishes is electronic data mining, in which all the data related to the classification and Taxonomy of fishes can be stored in electronic singles. In this way, there are very minute chances for data loss(Fazzini et al., 2023). In this regard, all the data can be accessed by a single click. Artificial Intelligence uses automated microcaps cameras which can also be used in aquatic environments to get images of different fishes. Not only images but also videos related to body movement, body features, and others can also be accessed by using these micro cameras(Borazon, Heino, & Glaser, 2023). Computer vision, a cutting-edge technology that gives robots the ability to see and understand visual information, is the cornerstone of AI's entry into the fish categorization market. This results into an unparalleled ability in ichthyology to analyze large amounts of fish footage, identify minute patterns, and quickly classify species with an accuracy that is higher than human. It laboriously sorts through enormous datasets, producing an unprecedentedly fast comprehensive census of fish species. This acceleration is vital for expanding our knowledge of aquatic biodiversity, not only for practical reasons.

Then these images and videos are evaluated by using AI algorithms which help to study and classify fishes based on characters in them. The other aspect of artificial intelligence is machine learning which effectively helps to study gene structure, functions, and activation. This technique can be effectively used to study about evolution of fishes. This technology also explains that the fishes cannot be classified merely based on external features but their genetic makeup also should be studied for their proper classification and Taxonomy of fishes. As explained by scientists studying genes is mandatory for the classification of living things because genes more information as compared to external features of living things. By studying the classification and Taxonomy of fishes by using artificial intelligence we can get many benefits such as improving feed efficiency, the estimation of biomass, the tracking of growth and development of fishes, the swift and early identification of diseases., the monitoring and controlling of environment, the reduction of cost of labor and many others. When these fishes are classified based on different criteria, we can get an idea about the uses and misuse of this aquatic life for the

welfare of human beings.

This aspect also helps to understand the commercial and industrial importance of different species of fish. Although artificial intelligence can be effectively used for the classification and Taxonomy of fishes there are some lagging points in this regard(da Silva et al., 2023). AI's uses in taxonomy and categorization of fish will probably grow as the technology develops, providing new chances to improve conservation efforts and broaden our knowledge of aquatic ecosystems. Artificial intelligence and science can work together to discover the mysteries of the undersea world and create a sustainable environment for coexisting with the variety of species below the surface. First of all, using artificial intelligence-based computer systems seems to be very costly that cannot be afforded at micro business levels. Secondly, there is a dire need for experts to use these artificial intelligence-based programs to operate for the study of fish(Isabelle & Westerlund, 2022). Thirdly, artificial intelligence has replaced human intelligence so most of the jobs are being replaced by using artificial intelligence so the rate and level of unemployment have been tremendously unceasing and increasing day by day. If all these drawbacks are considered properly, then artificial intelligence can be used for the identification, classification, and Taxonomy of fishes which would be an effective step towards the welfare of human beings(Rivot, 2023; Zhang, Zou, Xiao, & Hou, 2023).

Research objective:

The main objective of this study is to understand the relationship of artificial intelligence with the classification and Taxonomy of fish. This study concluded that artificial intelligence can be used for the classification and Taxonomy of fish if few negative aspects are considered properly. This study also throws light on the importance of artificial intelligence for the welfare of humanity as well.

Literature review:

Researchers claim that changes in the marine ecosystem are induced due to certain stressors. anthropic stressors are among the main stressors responsible for disturbing the life of aquatic organisms. Different fish species produce various sounds.by assessing the frequency of sound produced by various fish species it becomes easy to understand the location of particular fish species. The technology used for assessing fish sounds is machine learning. The machine learning approach provides all data related to the frequency of the sound produced by the marine organism(Barroso, Xavier, & Ferreira, 2023). Scholars explain that classifying fish species is a critical task. ecologists face a lot of problems in the fish classification process. traditional classification methods used by ecologists to classify fish species are replaced by the modern classification approach Feature fusion is an emerging strategy used in neural model development for classifying the different types of fish species(Bhanumathi & Arthi, 2023). Studies reveal that each fish species poses some morphological characteristics that determine its taxonomic value.to understand the morphological features posed by fish species the use of virtual reality technique is common(Borazon et al., 2023).studies suggest that collecting fish data only based on images is problematic. To solve this problem digitalization of image image-based fish tracking system is made. digitalization of an image-based tracking system helps in getting the fish data generated through the AI-based technique. The data thus obtained from AI technique is error-free (Campos et al., 2023).scholars show that accurate data regarding the fish species is important for classifying each species based on its unique morphological behavior Machine learning-based tools are employed for obtaining the data regarding the fish taxonomy to achieve high precision data. The near-infrared spectroscopy technique is combined with the machine learning approach to improve the precision of data obtained from the fish monitoring systems(Carvalho, Novais, Soares-Silva, Flores, & da Silva Magalhães, 2023).

Studies claim that for determining the biodiversity of the marine environment, the modern technique of

eDNA is used by ecologists. Despite the use of eDNA for fish classification, this technique has certain limitations. These limitations are overcome by advancing this technique with modern AI-based technology(Codex, 2023). Studies reveal that in South Africa the computer vision system has been employed in marine ecosystems for obtaining information related to marine species. This technology uses AI AI-based system for interpretation of the data obtained through images and video (da Silva et al., 2023).studies elaborate that one of the major environmental challenges is to evaluate aquatic life This environmental challenge is solved by using the eDNA technique This technique provides information about marine-related phylogenetic diversity(Gu et al., 2023). Studies highlight that explaining the behavior of marine species using various technologies like acoustic and eDNA-based techniques These techniques provide information regarding aquatic life at a high precision scale. The main advantage of using modern technology-based aquatic spice classification and identification tools is that they provide novel community data(Hartig et al., 2024).

Studies predicted that the Image-net technique sometimes provides misleading information regarding aquatic life. The bugs in aquatic data due to the inaccuracy of the Image-net technique misrepresent the aquatic biodiversity(Luccioni & Rolnick, 2023).studies scholars suggest that fish are natural food sources thereby their protection is necessary. maintaining suitable harvesting fish levels is essential to overcome the fish declination phenomenon. for assessing the information regarding the fish resource, the technology-based systems are used. the online fish stock information portals provide detail data regarding all the fish resources(Mini et al., 2023). Scholars predicts that fish related taxonomic data is digitized suing the modern technology-based approaches. The digitalization of aquatic taxonomic data makes the fish related information more accessible to the public. The traditional approaches used for classifying fish species are now been replaced with digitalized fish identification techniques(Rivot, 2023) Also, each species of fish belonging to a specific taxonomic group possesses its patterns.

The data of the patterns shown by the fish of any taxonomic group is achieved using machine learning-based algorithms. these algorithms use AI to determine the patterns posed by aquatic species. The data obtained through the AI-based machine learning algorithm is more elaborated using the bioinformatics tool. this tool provides large databases regarding the patterns of specific fish species (Rubbens et al., 2023) Moreover, the characterization of large complex aquatic data through machine learning algorithms holds great importance. The biological information related to marine life is explained in detail using machine learning-based algorithms ocean ecosystem possesses a large number of aquatic species saving diverse morphological and biological features. The information regarding the biological features of aquatic species is obtained using the ML-based technology(Sadaiappan et al., 2023) Studies of scholars explained that marine species are majorly used as a food source and this holds great importance. Conservation of aquatic species is critical for saving aquatic species that are used as a food source in numerous countries around the globe. They are monitored using modern monitoring techniques to conserve aquatic organisms. the monitoring system uses a deep learning-based algorithm that provides high-resolution motoring of species living in ocean depths(Saleh, Sheaves, Jerry, & Azghadi, 2023) Also, the species inhabiting the freshwater ecosystem are tracked using acoustic technology devices. the imaging-based sonars are used for identifying the required species regarding which the ecologist needs data. The richness of species in aquatic environments is assessed using acoustics devices. the fish species present in the African reef areas are identified using the IS(Sibley et al., 2023). Furthermore, reveling data regarding the dissolved aquatic species found in the ocean beds is possible using the eDNA method .first the sample of a dissolved aquatic species is obtained , and then the bioinformatics tools are used for obtaining the detailed information regarding the species sample(Thompson & Thielen, 2023).

Scholars' studies comprehend that the classification of aquatic species is one of the main tasks that provides data regarding the biodiversity of ecosystems. This data related to biodiversity then helps in developing effective

conservation strategies. Deep learning algorithms is the latest AI tool used for specie classification to obtain relevant knowledge about the ecosystem biodiversity(Tiwari, Gautam, Trivedi, Jain, & Sharma, 2023) Studies of research scholars reveal that by combining citizen sciences and mobile apps, the fish taxonomic-based identification system has advanced. The knowledge of public reading about fish taxonomic and morphological behavior increases through the use of the technology-based citizen science approach. Furthermore, the eDNA approach has revolutionized the process of identification as well as classification of aquatic species(Zhang et al., 2023). This merger of science and technology provides a revolutionary prism through which we may examine the ocean's depths beyond the constraints of previous methodologies. The research concluded that there are direct and significant link between them related to the artificial intelligence and fish classification also taxonomy. With AI as our digital diving companion, we started on an excursion that promises to reveal the secrets of the deep blue and assure a sustainable future for the broad spectrum of organisms that reside under the surface. With its sophisticated computer vision and pattern recognition skills, artificial intelligence offers a freshly found perspective that helps us peek into the inner workings of aquatic ecosystems. Fish species identification was a labor-intensive process in the past, but in the digital era, computers regularly search enormous databases and are faster and more exact than people at picking up on minute traits. Artificial intelligence plays a vital role in speeding up the process of identifying species and in the continual monitoring and preservation of aquatic biodiversity.

Researchers claim that knowledge based on scientific facts is critical in providing ecosystem-based services. The knowledge gained by the researchers related to the deep sea is less understandable because of the lack of accuracy of information.to obtain precise and accurate information related to the deep-sea organisms, the use of AI-based technology is made. For accurate data Accusation related to the deep sea, the citizen science approach holds great value. The citizen science approach is used to identify the diversification of aquatic species. By identifying the diversification of marine species, the citizen science approach helps develop strategies to conserve marine species. Along with the citizen science approach, virtual reality technique-based tools are used in observing the various kinds of aquatic species found in the deep sea(Escobar-Briones & Álvarez-Sánchez, 2023).Studies reveal that marine ecosystem observations can be made using video-based monitoring systems. The video-based analysis of aquatic life provides real-time data related to the aquatic species. The data obtained through the video and images of marine species provides insight into their taxonomic behavior. images of marine species determine to which taxa a specific species belongs. A specific fish species is identified from the image data using eth AI.AI explains which species belong to which taxa by extracting real-time information from the aquatic images. also, the changes in the climatic conditions have resulted in the altered behavior of fish species. Monitoring the aquatic species' behavioral activities using knowledge about their abundance in the ecosystem can be obtained using 3D image data and combining it with environmental data, which provides valuable information about the fish species' ecological worth(Francescangeli et al., 2023).

Studies explain that aquatic diseases are becoming prevalent because of changes in the marine ecosystem. Aquatic diseases change the biodiversity of aquatic species and are a major threat to them. Advanced technology is used to identify aquatic diseases and provide efficient treatment against these diseases. studies made on aquatic diseases explain that anthropogenic pathogens are the main cause of aquatic diseases. Effective AI-based technologies are implemented in the management of aquatic ecosystems for a healthier aquatic ecosystem. AI-based strategies to protect the marine environment play a very significant role in maintaining the biosafety factor associated with marine ecosystem(Hutson, Davidson, Bennett, Poulin, & Cahill, 2023).

Researchers can collect massive datasets more rapidly because to AI's ability to speed up the identification process, which helps them get a more accurate image of the intricate network of life under the seas. Scientists consider This kind of data a gold mine because it enables them to conduct in-depth biodiversity studies and

monitor changes in fish populations over time. Because AI-driven taxonomy provides real-time insights, marine scientists can respond swiftly to emerging threats, such as the extinction of rare species or the expansion of invasive species. In conservation, AI takes on the role of a marine watchdog. Artificial Intelligence (AI) has the potential to significantly impact conservation efforts, whether they include tracking the migratory patterns of critically endangered species or evaluating the effectiveness of breeding programs. studies claim that biodiversity conservation is essential for maintaining the integrity of living systems in the sea. Identifying the areas in marine ecosystems that require conservation is a critical task.

The use of an AI-based monitoring system is made to identify the mist conservation needed areas in the marine ecosystem. IPBES is an organization that claims that the number of species that require conservation from saving them from extinction has increased.in the past spec, it required conservation to save them, but in recent years, this number has increased because of the shift in various marine ecosystem-related factors.to conserve the fish species, it is essential to first obtain a large amount of data related to the taxonomy of fish species. For obtaining this data, monitoring sensors are used that gather large data about the aquatic species the species in a short time frame. the efficiency of remote monitoring systems improves by combining AI and ML techniques with the monitoring devices(Kerry et al., 2022). It can recognize changes in fish populations that may point to ecological imbalances or risks to marine ecosystems due to its never-ending curiosity. With AI-generated data at their disposal, conservationists may priorities protecting regions of biodiversity risk, ensuring a targeted and effective approach to preserving aquatic life. Think about the situation with endangered animals; artificial intelligence fills the void to protect these populations that are at risk.

Because of its quick identification and tracking of individual specimens, conservation efforts may be aimed with never-before-seen accuracy. studies suggest that river water and its health depend on certain chemicals as well as hydrological factors. Various advanced technological tools are used to assess these factors' impact on aquatic organisms. ANN is a technology-based system employed for assessing the impact of certain marine factors on the health of marine species. the ANN model uses the ML approach to make the obtained data more accurate and precise. Moreover, several human activities disturb the health of river water, polluting and making it more polluted and smelly.to save the aquatic ecosystem from pollutant-based contamination, efficient pollutant-managing strategies are used by marine ecosystem management organizations(Liu et al., 2023). Studies explain that the extremely diversified nature of nematodes is because of their unique taxonomic features. The large diversified nature of nematodes is one of the reasons that most of the nematode's tees are unidentified. the classical taxonomy approach is used to explain the diversified nature of nematodes. Also, due to the modernization of nematode identification techniques, gaining more knowledge about the nematodes has become easier. using PCR and biochemical approaches greatly helps in revealing the taxonomic background altered to each specific type of nematode.

Using the advanced sequencing technique is another way to identify the diverse characteristics of nematodes as the modern sequencing technique provides a large open database associated with nematodes(Nisa, Tantray, & Shah, 2022). Scholars predict that large data on specific marine areas is obtained using the citizen sciences approach. The citizen science approach makes the research on identifying the biodiversity of aquatic species easier. The data regarding small-scale fish species is as important as the data on large-scale fish species. For collecting data about small-scale species, ML-based monitoring systems are used by researchers. AI provides immense application in species identification and determining each fish species' size. This application of AI in marine ecosystems is of great help in developing strategies to manage and conserve aquatic ecosystem species. a large number of images of aquatic species captured by the monitoring system is stored using the great database storing capacity of AI Furthermore, using the region-specific models based on ML for region-based species identification holds great importance(Silva, Dainys, Simmons, Vienožinskis, & Audzijonyte, 2022). Studies

highlight that low-cost cameras are employed in obtaining images of marine species as images provide insight into marine diversity. The DL algorithms have advanced the working of marine monitoring and sensor systems. The chances of flaws in the data obtained using the DL algorithm are less.to carry out the automated monitoring of marine biodiversity, the DL algorithm is combined with the working principle of digital cameras. The combination helps in achieving the most updated data about the taxonomic of various aquatic organisms. Automated monitoring of marine ecosystems using DL is necessary for obtaining the marine species associated with a large database(Villon, Iovan, Mangeas, & Vigliola, 2022).

Descriptive statistic:

Table:1

Name	No.	Mean	Median	Scale min	Scale max	Standard deviation	Excess kurtosis	Skewness	Cramér-von Mises p value
AI1	0	1.694	2.000	1.000	4.000	0.734	0.556	0.887	0.000
AI2	1	1.510	1.000	1.000	3.000	0.576	-0.554	0.621	0.000
AI3	2	1.449	1.000	1.000	3.000	0.574	-0.181	0.876	0.000
AI4	3	1.551	2.000	1.000	3.000	0.537	-1.139	0.198	0.000
AI5	4	1.469	1.000	1.000	3.000	0.538	-0.915	0.530	0.000
FC1	5	1.612	2.000	1.000	3.000	0.600	-0.615	0.426	0.000
FC2	6	1.531	1.000	1.000	3.000	0.575	-0.634	0.541	0.000
FC3	7	1.367	1.000	1.000	2.000	0.482	-1.751	0.568	0.000
FC4	8	1.469	1.000	1.000	3.000	0.538	-0.915	0.530	0.000
FC5	9	1.551	1.000	1.000	3.000	0.608	-0.484	0.641	0.000
TT1	10	1.571	2.000	1.000	3.000	0.535	-1.147	0.118	0.000
TT2	11	1.694	2.000	1.000	3.000	0.579	-0.540	0.160	0.000
TT3	12	1.592	2.000	1.000	3.000	0.569	-0.756	0.312	0.000
TT4	13	1.776	2.000	1.000	3.000	0.581	-0.312	0.074	0.000
TT5	14	1.714	2.000	1.000	3.000	0.571	-0.474	0.097	0.000

The above result represents that descriptive statistical analysis result shows that mean values, median rates, the minimum values, also that maximum values, the result also present that skewness values and standard deviation of each indicators included dependent and independent. The mean value is 1.694 AI1, its standard deviation rate is 73%, the skewness value of AI is 88%, and the probability value is 0.000, showing that there is a 100% significant level between them. the AI2, AI3, AI4 these are all present that average value of mean rates is 1.510, 1.449 and 1.551 all of them are present positive average value of mean. Because AI can process massive amounts of visual data, researchers are able to monitor changes in fish populations over time. This real-time monitoring makes it feasible to identify areas that require conservation efforts, detect invasive species, and assess the health of ecosystems.

Another one is AI assists in the development of targeted conservation programs by identifying vulnerable or endangered species. Conservationists may create protective strategies and policies to decrease threats to aquatic biodiversity by using AI-generated data. By detecting changes in fish populations, AI contributes to the preservation of ecological balance. This is particularly important for identifying disruptions caused by overfishing, habitat degradation, and climate change. AI's rapid and efficient data processing and analysis allows for the production of large datasets for scientific research. The standard deviation rates are 57%, 53%, showing that positive deviate from mean values.

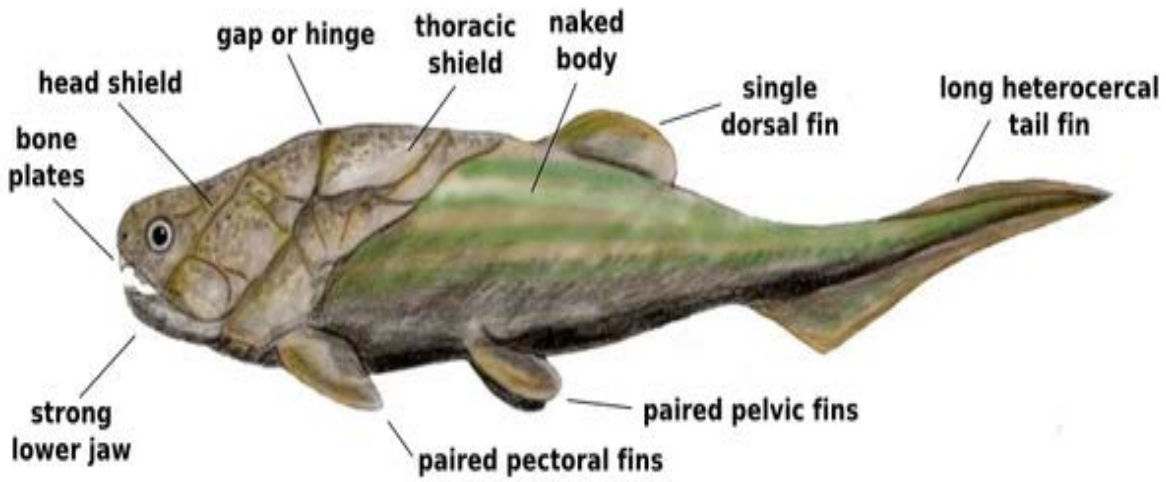


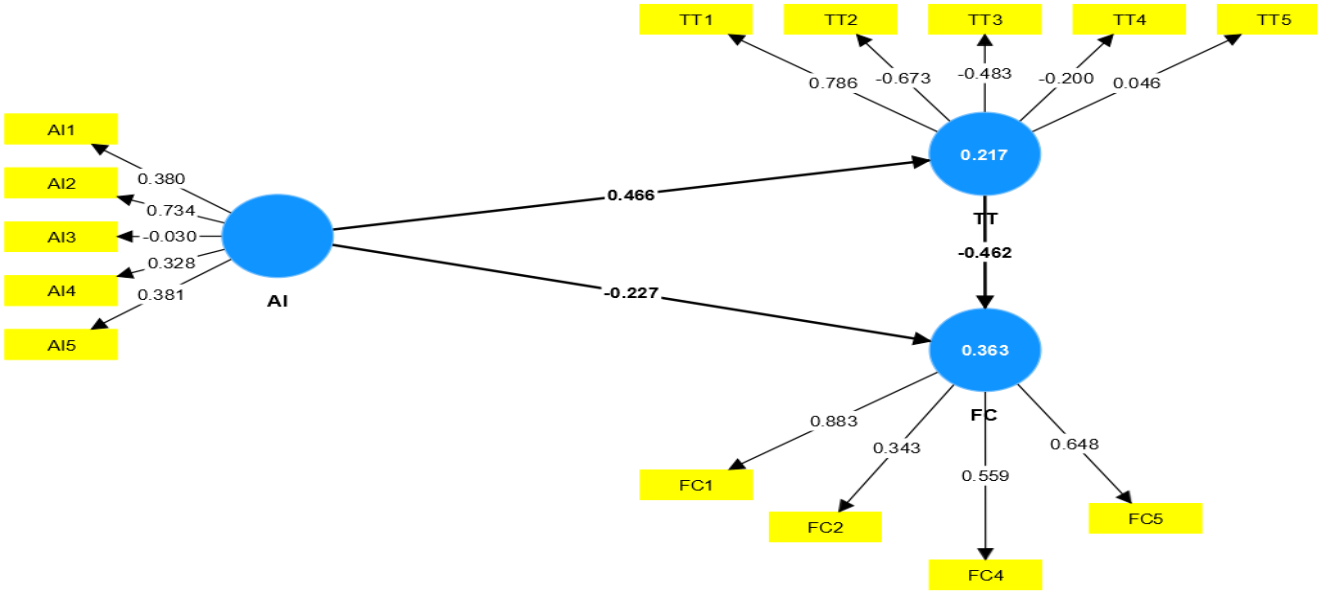
Figure:1 Fish classification and taxonomy

Applications:

Artificial intelligence has a wide range of applications in fish taxonomy and categorization, just as it aims to comprehend aquatic life. Artificial Intelligence assists taxonomists by automating laborious procedures linked to species identification. This accelerates taxonomic research and frees up experts to focus on more complex aspects of taxonomy. Another application is Fish identification initiatives may involve hobbyists and citizen scientists due to AI-powered mobile applications and platforms. AI systems may assist in species identification by allowing people to upload photos of fish, therefore expanding the reach of biodiversity monitoring initiatives.

- Outreach and Education: AI applications for fish categorization offer interesting resources for teaching. AI-powered web platforms, interactive applications, and virtual reality experiences may introduce the general public and students to the intriguing realm of aquatic biodiversity.
- Early Warning Systems: Artificial intelligence (AI) can serve as a precursor to environmental shifts that affect fish populations. Artificial intelligence (AI) helps with proactive conservation efforts by detecting pollutants, temperature changes in the water, and habitat deterioration.

Smart PLS Algorithm Model:



The above model represents the smart PLS Algorithm model related to the variables. The result describes that AI shows 38%, 73%, 3%, and 32% and also that 38% positive values rates of AI. The result describes that FC shows 88%, 34%, 55%, and 64% positive links between them. There are explore some major domains where artificial intelligence is making waves: first one is AI systems that have been trained on big datasets of fish pictures are able to accurately and swiftly distinguish between various fish species. These speeds up the process of cataloguing and classification, which has traditionally depended on the expertise of human taxonomists. Our understanding of fish behavior, migratory patterns, and ecological linkages is enhanced by this data-driven approach. Artificial Intelligence facilitates improved management of fish farms in the aquaculture industry. according to the model, the AI shows a negative link with FC. Its rate is -0.227, but the AI presents a positive and 46% significant link with TT its rate of 46%.

Conclusion:

In conclusion, the employment of Artificial Intelligence in fish categorization and taxonomy constitutes a revolution in our understanding of aquatic biodiversity. The marriage of contemporary technology with the difficult field of ichthyology holds considerable potential for expanding our knowledge of the broad assortment of species in our planet's rivers and oceans. Foe measuring the research used smart PLS software and generate informative results related to the fish classifications and taxonomy. The descriptive statistic, also that smart PLS Algorithm model present overall research. In conclusion, the application of AI to fish taxonomy and categorization is opening a new chapter in our awareness of and devotion to maintaining aquatic biodiversity. Using real-time data insights, scientists and conservationists can identify ecological imbalances, react swiftly to changes in fish populations, and carry out targeted preservation efforts. When paired, AI and human expertise may be a digital helper to safeguard the fragile balance of marine ecosystems and indicate hope for threatened or endangered species. According to the findings, we must deploy artificial intelligence ethically and responsibly as we traverse that new region. AI is being utilized in fields outside of research, like public outreach, citizen science projects, and education. Fish identification has grown more democratic and accessible owing to AI-powered technology, which has boosted accessibility and made more people feel more involved in preserving our seas and related to it. The combination of fish categorization and artificial intelligence indicates our potential to learn and adapt in this period of fast technological advancement.

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