Tabla 2. Síntesis de las características metodológicas y de desempeño de los estudios analizados. mAP (mean Average Precision).

Año	Autor	Título	Técnica IA - Algoritmo	Métricas de evaluación (%)
2018	Liu L et al.	Detección de puntos clave de peces para monitoreo ecológico basado en inteligencia visual submarina.	Deep learning + Sensores acústicos	Precisión: 97 %
2018	Allkent et al.	Fish species identification using a convolutional neural network trained on synthetic data	CNN AlexNet	Exactitud: 50,8 %–71,1 % (imágenes reales); máximo de 94,1 %
2018	Jiménez et al.	Sistema automático de clasificación de peces.	Deep learning - CNN	Precisión: 98,64 %
2018	Qiu et al.	Improving transfer learning and squeeze-and-excitation networks for small-scale fine-grained fish image classification	B-CNN framework	Exactitud: 71,8 %
2018	Zhao et al.	Semi-Supervised Learning-Based Live Fish Identification in Aquaculture Using Modified Deep Convolutional Generative Adversarial Networks	Redes generacionales de profunda evolución modificada (DCGAN)	Exactitud: 80 – 83 %
2018	Tamou et al.	Transfer learning with deep convolutional neural network for underwater live fish recognition	AlexNet	Exactitud: 99 %
2019	Salman et al.	Real-time fish detection in complex backgrounds using probabilistic background modelling	Gaussiano GMM. Deep Learning	F-measure: 84,28 %
2019	Lu y Kuo	Identifying species of common sea fish harvested by longliner using deep convolutional neural networks	CNN (VGG16, ResNet-50, DenseNet-201, MobileNet V2)	Exactitud: 95,82 %
2019	Mejia y Rosales	Sistema de detección y clasificación de peces utilizando visión computacional.	CNN Machine learning	Precisión: 90 %
2019	Jiang	Parameter estimation for PMSM based on a backpropagation neural network optimized by chaotic artificial fish swarm algorithm	BPNN + Chaotic Artificial Fish Swarm Algorithm	Exactitud: 80 %
2020	Suo et al.	Fish Keypoints detection for ecology monitoring based on underwater visual intelligence.	Deep learning (CNN) + visión estereoscópica	mAP = 90,5 % (detección de peces); OKS = 0,667 (puntos clave); error promedio = 5,58 %
2020	Jalal et al.	Fish detection and species classification in underwater environments using deep learning with temporal information	Deep Learning. Algoritmo CNN y YOLO. Gaussianos GMM	Exactitud: 91,64 %

Año	Autor	Título	Técnica IA - Algoritmo	Métricas de evaluación (%)
2020	Brautaset et al.	Acoustic classification in multifrequency echosounder data using deep convolutional neural networks	CNN profundas – RED CAN and present - N	Precisión: 85 % - 93 %
2020	Rico-Diaz et al.	An application of fish detection based on eye search with artificial vision and artificial neural networks	Deep Learning. RNA + Feed Forward. Algoritmo Hough	Precisión: 74% - 95%
2020	Wenjuan y Feng	An Application of Fish Detection Based on Eye Search with Artificial Vision and Artificial Neural Networks	Deep Learning. Mask R-CNN. Algoritmo R-CNN	Recall: 95,43 % Exactitud: 98,02 % mAP: 95,90 %
2020	Li et al.	Measurement of dynamic fish dimension based on stereoscopic vision.	Red Neuronal + Convolución	Exactitud (88 %)
2020	Salman et al.	Automatic fish detection in underwater videos by a deep neural network-based hybrid motion learning system	Red convolucional + Machine Learning	F-Score promedio: 87, 44 %
2020	Allken et al.	A real-world dataset and data simulation algorithm for automated fish species identification.	CNN (MobileNet)	Exactitud: 67 % - 94 %
2020	Jisha y Sathish	Genus and species-level classification of wrasse fishes using multidomain features and extreme learning machine classifier.	ELM (Wavelet/Polynomial kernel)	Exactitud: 92,42 % - 96,65 %
2020	Banan et al.	Deep learning-based appearance features extraction for automated carp species identification.	CNN (VGG16)	Exactitud: 100 %
2020	Tseng y Kuo	Detecting and counting harvested fish and identifying fish types in electronic monitoring system videos using deep convolutional neural networks	CNN (Mask R-CNN)	Exactitud: 98,06 % Precisión: 77,31 %
2021	Sánchez et al.	Reconocimiento de peces mediante el uso de redes neuronales convolucionales.	CNN (4 capas convolucionales)	Precisión 97,55 %
2021	Abinaya	Naive Bayesian fusion based deep learning networks for multisegmented classification of fishes in aquaculture industries.	AlexNet + Naive Bayesian Fusion	Exactitud: 98,64 % - 98,94 %
2021	Wageeh et al.	YOLO fish detection with Euclidean tracking in fish farms.	Algoritmo YOLO	No reportadas
2021	Petrellis	Measurement of fish morphological features through image processing and deep learning techniques.	Deep Learning (Mask R-CNN + VGG16)	Tasa de éxito: >91 %
2021	Ryazanov et al.	Deep learning for deep waters: An expert-in-the-loop machine learning framework for marine sciences	Deep Learning (ResNet18) + Expert-in-the-Loop	Exactitud: 93, 4 %

Año	Autor	Título	Técnica IA - Algoritmo	Métricas de evaluación (%)
2021	Rum y Nawawi	FishDeTec: A fish identification application using image recognition approach	CNN (VGG16)	Exactitud: 87 %
2021	Pudaroth et al.	SuperFish: A mobile application for fish species recognition using image processing techniques and deep learning.	kNN + Deep Learning (TensorFlow)	Exactitud: 96 % - 98 %
2021	Ismail et al.	Convolutional neural network architectures performance evaluation for fish species classification.	CNN (AlexNet, GoogLeNet, ResNet-50)	Exactitud AlexNet: 99,85 % Exactitud GoogLeNet: 96,39 % Exactitud ResNet-50: 99, 51 %
2021	Iqbal et al.	Automatic Fish Species Classification Using Deep Convolutional Neural Networks	AlexNet and VGGNet..	Exactitud: 90,48 %
2022	Gúelac et al.	Conteo automático de peces utilizando visión computacional basado en Redes Neuronales.	Deep Learning MaskRCNN (SVA)	Precisión: 92,65 %
2022	Rico- Diaz	Metodología de desarrollo de sistemas de detección y seguimiento de peces mediante tecnología láser y visión artificial con inteligencia artificial.	Deep Learning + técnica de Hough + visión artificial	Exactitud: 74 %
2022	Al Muksit et al.	YOLO-Fish: A robust fish detection model to detect fish in realistic underwater environment	Deep Learning - YOLOv3 + SPP (YOLO-Fish)	Precisión promedio: 76,5 %
2022	Li et al.	Fish image recognition method based on multi-layer feature fusion convolutional network.	Deep Learning - CNN + Inception + ASPP	Exactitud: Top-4 89,54 % Top-5: 92,73 %
2022	Ben Tamou et al. (a)	Live fish species classification in underwater images by using convolutional neural networks based on incremental learning with knowledge distillation loss	Deep Learning - CNN + Aprendizaje Incremental	Exactitud: 81,83 %
2022	Fernández - García et al.	AcousticIA, a deep neural network for multi-species fish detection using multiple models of acoustic cameras.	CNN - YOLOv3	Recall: >95% / 80%
2022	Huang et al.	Recognizing fish behavior in aquaculture with graph convolutional network	NN - GCN	Exactitud: 97,3 %
2022	Chen et al.	Underwater abnormal classification system based on deep learning: A case study on aquaculture fish farm in Taiwan	CNN - InceptionV3 (Transfer Learning)	Exactitud: 98,94 %
2022	Ben Tamou et al. (b)	Targeted Data Augmentation and Hierarchical Classification with Deep Learning for Fish Species Identification in	CNN + Transfer Learning Jerárquico	Exactitud: 99,86 %

Año	Autor	Título	Técnica IA - Algoritmo	Métricas de evaluación (%)
		Underwater Images.		
2022	Saleh et al.	Computer vision and deep learning for fish classification in underwater habitats: A survey.	Deep Learning + Visión por Computadora	Exactitud: 95 %
2022	Malla et al.	A study on fish classification techniques using convolutional neural networks on highly challenged underwater images.	CNNs	Exactitud: 95 %
2022	Jini y Albin	Fish species classification using optimized deep learning model	CNN - AED-EGWO / AlexNet	Exactitud: 88,6 % / 86 %
2023	Yin et al.	Individual Fish Recognition Method with Coarse and Fine-Grained Feature Linkage Learning for Precision Aquacultur	Deep Convolutional Neural Networks (DCNN)	Exactitud: 96,7 %
2023	Fleuré et al.	Automated identification of invasive rabbitfishes in underwater images from the Mediterranean Sea.	Deep Learning - ResNet50 + GoPro HERO5	Recall: 98 %
2023	Rubbens et al.	Machine learning in marine ecology: an overview of techniques and applications.	Machine Learning	Exactitud: 90 – 9 5 %
2023	Deka et al.	Automated freshwater fish species classification using deep CNN	Deep CNN - AlexNet + ResNet-50	Exactitud: 100 %
2024	Lu et al.	FishFocusNet: An improved method based on YOLOv8 for underwater tropical fish identification.	Deep Learning - YOLOv8 (FishFocusNet + AKConv + AFPN + Shape-IoU)	mAP = 81,8 %
2024	Rahman et al.	A deep CNN-based salinity and freshwater fish identification and classification using deep learning and machine learning	CNN - 7 Arquitecturas (DL + ML)	Exactitud: 98,06 – 100 %
2024	Yin et al.	A novel fish individual recognition method for precision farming based on knowledge distillation strategy and the range of the receptive field.	CNN + Knowledge Distillation	Precisión: 93,19 %
2024	Mifsud et al.	AquaVision: AI-powered marine species identification.	YOLOv8 + ResNet18	Exactitud: 84 %
2024	Degirmuncoglu y Kokamaz	Determination of early breeder in goldfish (*Carassius auratus* Linn.) with learning vector quantization, probabilistic and pattern recognition neural networks	PRNN (Pattern Recognition Neural Network)	Exactitud: 77,4 – 84,6 %
2024	Zhang et al.	An improved YOLOv8n used for fish detection in natural water environments.	Deep Learning - YOLOv8n + SPD-Conv + BiFormer + STDL	mAP: 88,3 %
2024	Zhang y Wang	A new workflow for instance segmentation of fish with YOLO	Deep Learning - YOLOv5 + YOLOv8	Exactitud: 98 – 99 %

Año	Autor	Título	Técnica IA - Algoritmo	Métricas de evaluación (%)
2024	Sasithradevi et al.	DePondFi'23 challenge on real-time pond environment: Methods and results	YOLOv8n, YOLOv8s, YOLOv8m, YOLOv8+SAHI	mAP: 75 %
2024	Zhang et al.	An efficient detection model based on improved YOLOv5s for abnormal surface features of fish.	Deep Learning - YOLOv5s + DenseOne + MobileViTv2 + CBAM	Exactitud: 99,5%
2024	Siri eta al.	Enhanced deep learning models for automatic fish species identification in underwater imagery	R-FCN mejorado + ENGO-based ShuffleNetV2	Exactitud. 99,94% / 99,93%
2024	Zheng et al.	Underwater Fish Object Detection with Degraded Prior Knowledge.	Deep Learning - ResNet50 + ResNeXt101	mAP: 81 %
2024	Saleh et al.	Applications of deep learning in fish habitat monitoring: A tutorial and survey.	DEEP learning	Exactitud: 90 %
2024	Hasegawa et al.	Transferable deep learning model for the identification of fish species for various fishing grounds.	CNNs (Transfer Learning)	Exactitud: 72,9 %
2024	Liu et al.	YWnet: A convolutional block attention-based fusion deep learning method for complex underwater small target detection.	YOLOv5 + CBAM + SRC3 (YWnet)	mAP: 73,2 %
2024	Zhou H et al.	Real-time underwater object detection technology for complex underwater environments based on deep learning	CBAM-YOLO v8 - Network	mAP: 90 %
2024	Tejaswini et al.	Automatic estuarine fish species classification system based on deep learning techniques	ResNet50v2 + ViT	Exactitud: 99,04 %
2024	Quin et al.	YOLO8-FASG: A High-Accuracy Fish Identification Method for Underwater Robotic System.	YOLOv8 + AKConv + GAM + SimSPPF (YOLO8-FASG)	mAP: 94 %
2024	Gao et al.	Research on marine fish classification and recognition based on an optimized ResNet50 model	Deep Learning - SE-ResNext	Exactitud: 98,75 %
2024	Zhu et al.	FCFormer: Fish density estimation and counting in recirculating aquaculture system.	Deep Learning - FCFormer (Transformer + CNN)	Exactitud: 97,06 %
2025	Mainali y Li	A robotic fish processing line enhanced by machine learning.	Transfer Learning + CNN	Exactitud: 83,8 – 100 %
2025	Bürgi et al.	Towards a fully automated underwater Census for Fish Assemblages in the Mediterranean Sea.	Deep Learning - YOLOv7	Exactitud: 99 %
2025	Samarão et al.	Improving machine learning predictions to estimate fishing	ML - Random Forest + XGBoost	Exactitud: 99 %

Año	Autor	Título	Técnica IA - Algoritmo	Métricas de evaluación (%)
		effort using vessel's tracking data		
2025	Chieza et al.	Automated fish detection in underwater environments: Performance analysis of YOLOv8 and YOLO-NAS	YOLOv8 + YOLO-NAS	Exactitud: 95 %
2025	Zhang et al.	A method for detecting feeding fish in ponds based on FFishNet-YOLOv8	FFishNet-YOLOv8 + Joint-IoU	mAP: 95,59 %