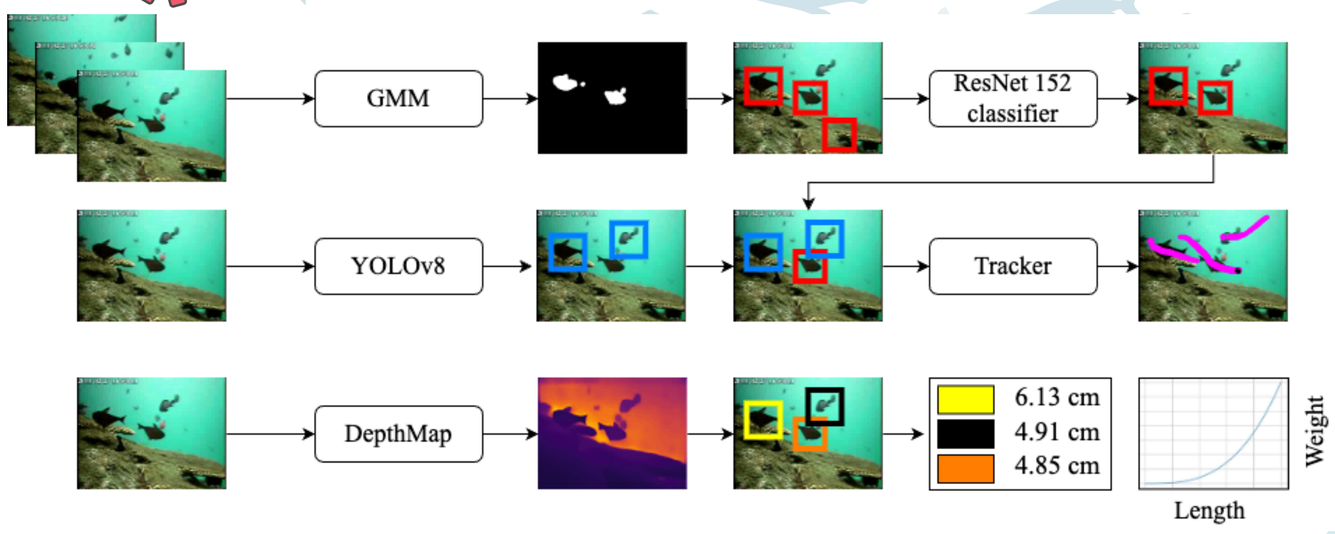
FISH BIOMASS ESTIMATION IN UNCONSTRAINED UNDERWATER IMAGERY

ABSTRACT

In our pursuit to determine the biomass of freely swimming fish by estimating their length and width, we will utilize underwater videos from a labeled dataset.

METHODOLOGY

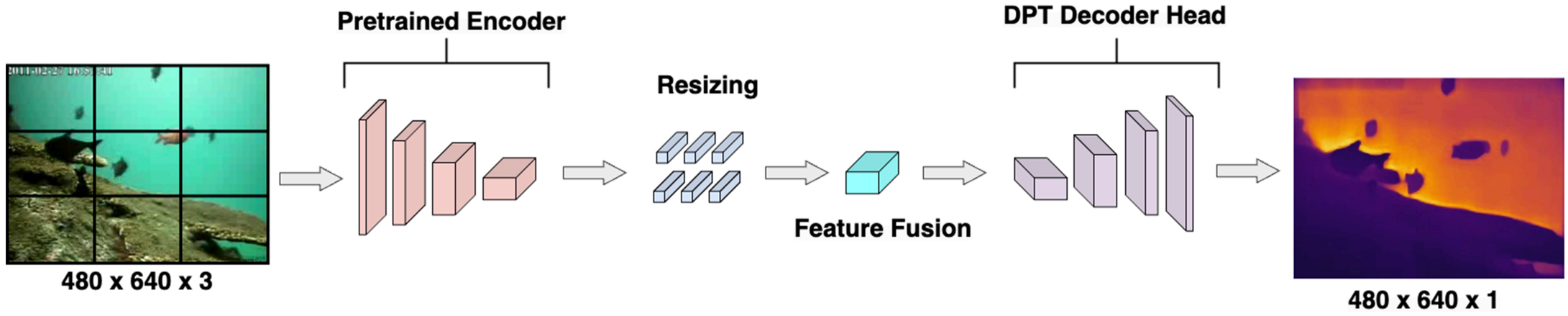


OBJECTIVES

- Develop robust method for accurate fish biomass estimation from underwater videos.
- Apply advanced techniques: CNN, GMM and computer vision approaches.
- Enhance methodologies for fish classification, tracking, and analysis in challenging underwater conditions.

CHALLENGES

- Underwater environment
- Water murkiness
- Poor visibility
- Dynamic light beams
- Dynamic background due to moving aquatic plants

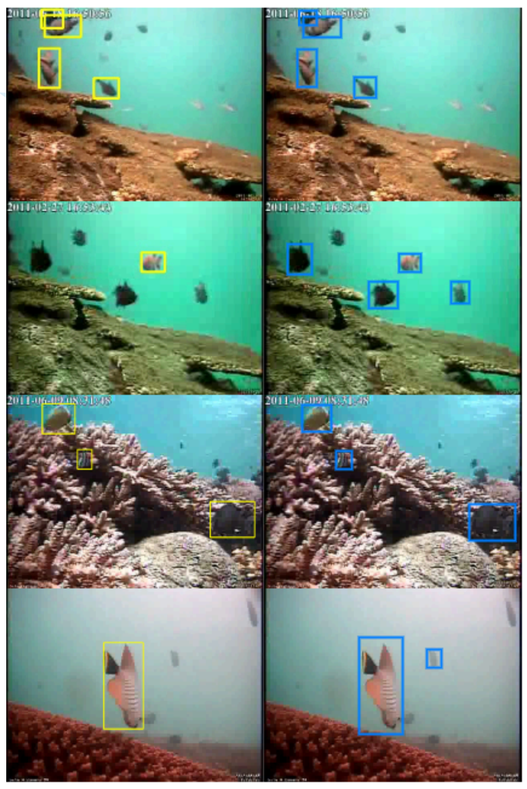


RESULTS

Fish Detection & Classification

Species	Precision	Recall	F1 Score	Accuracy
Abudefduf vaigiensis	0.949	0.833	0.914	0.877
Acanthurus nigrofuscus	0.967	0.983	0.994	0.975
Amphiprion clarkii	0.954	0.985	0.985	0.969
Chaetodon lunulatus	0.988	0.999	0.992	0.993
Chaetodon speculum	0.988	1.000	0.995	0.994
Chaetodon trifascialis	0.989	0.981	0.993	0.985
Chromis chrysura	0.964	0.906	0.946	0.934
Dascyllus aruanus	0.988	0.999	0.992	0.993
Dascyllus reticulatus	0.960	0.945	0.980	0.952
Myripristis kuntee	0.943	0.981	0.992	0.962
Neoglyphidodon nigroris	0.937	0.971	0.989	0.954
Pempheris vanicolensis	0.930	0.938	0.971	0.934
Plectroglyphidodon dickii	0.942	0.920	0.953	0.931
Zebrasoma scopas	0.985	1.000	0.995	0.992
Overall	**0.965**	**0.959**	**0.975**	**0.963**

Ground Truth Yolov8 Predictions



Fish Length, Weight & Biomass

Species	Avg. Length (cm)	Avg. Weight (g)	Biomass (g)	RMSE	SD
Abudefduf vaigiensis	6.994	13.107	2806.297	4.763	2.507
Acanthurus nigrofuscus	16.540	54.205	22166.045	14.050	12.125
Amphiprion clarkii	6.489	6.743	5677.834	4.500	0.0183
Chaetodon lunulatus	7.290	2.038	3781.290	11.702	7.990
Chaetodon speculum	5.350	403.588	55243.356	33.458	33.12
Chaetodon trifascialis	4.481	16.931	27699.947	7.751	5.462
Chromis chrysura	13.962	25.699	7416.312	4.311	2.833
Dascyllus aruanus	23.724	4.995	14215.755	3.730	1.640
Dascyllus reticulatus	5.917	10.766	74409.924	2.571	1.245
Myripristis kuntee	19.840	5.182	1758.798	5.501	3.776
Neoglyphidodon nigroris	6.223	13.107	8984.170	3.296	2.581
Pempheris vanicolensis	7.560	4.995	3185.570	6.429	5.110
Plectroglyphidodon dickii	4.942	2.960	2057.840	4.773	1.850
Zebrasoma scopas	5.969	6.757	1726.235	3.630	0.963

We are the first one to estimate **biomass** on an **Underwater Monocular Dataset.**

Overall F1 Score: 97.5%

Overall RMSE: 6.503

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