

ABSTRACT

Underwater images face various quality degradation issues due to the complex underwater physical visualization environment. However, most existing underwater image clarification methods cannot enhance all degradation types of underwater images, which is significant for designing dedicated degradation classes of underwater image clarification methods. To solve the classification issue of underwater images driving the design of specialized underwater image clarification methods, we present a **Unified multi-color-model-learning-based Deep Support Vector Machine (UDSVM)** for underwater image classification. Specifically, we propose a multi-color model feature encode strategy, combining features from different color models into a unified feature model to enrich the diversity of feature representation capabilities. Then, we design a deep support vector machine, considering the deep network structure with better nonlinear modeling performance. Meanwhile, we embed the unified multi-color model into the deep support vector machine with gradient descent backward optimization, which solves issues of insufficient learning features and low classification accuracy of the single-color model. Besides, we built a large-scale underwater image classification dataset (UICD) including 6630 underwater images, which have the characteristics of different degradation classes and different degradation levels of the same degradation class. Our UDSVM is compared with ten leading methods, and our UDSVM achieves the highest classification accuracy for rough and fine classifications, respectively.