Patent Search

Invention Title	FINE-GRAINED FISH CLASSIFICATION ON UNDERWATER IMAGES USING DEEP LEARNING ARCHITECTURES
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Abstract:

Deep learning's arrival has benefited tremendous improvement in the area of FC research. Fine-grained fish classification is more complicated than conventional image classification because of low-quality and small-scale data. Convolutional neural networks (CNNs), well-known for their effectiveness, necessitate a significant volume of high-quality data over time. The proposed study addresses these two issues. First, the raw image quality was improved by an Underwater Image Enhanced Generative Adversarial Network (UIEGAN) trained on 6128 images from the ImageNet dataset by CycleGAN. Conventional data augmentation can help increase the dataset size by using traditional image transformations, but it cannot handle the imbalanced class problem. Synthetic images are generated for each species category using DCGAN to balance the dataset. Furthermore, two deep architectures, SmallerVGG and SmallerRESNET, were proposed as the best fit for the Croatian dataset. Again, the proposed method was tested against eight popular pre-trained transfer learning models trained on the ImageNet dataset. The experimental results show that the proposed techniques outperform well-known CNNs in terms of accuracy, demonstrating their potential applications in real-time underwater fish image classification.

Complete Specification

Claims:1.The methodology of using CycleGAN on the Underwater ImageNet dataset for increasing the quality of the images. The Underwater ImageNet database contains 6128 raw images and can be used for training underwater applications.
2.The methodology of using DCGAN on the Croatian dataset for increasing the scale of the dataset. Through this step, each category of the fish species is scaled up to 400 to 500 images.
3.The architectures proposed, i.e., SmallerVGG and SmallerRESNET. The two models are customized VGG16 and RESNET50 to improve the classification accuracy on the low-quality underwater image datasets.
4.The deep learning architectures follow the methodology of fine-grained classification using UIEGAN and DCGAN. The proposed three-step procedure gives better classification results compared without using these steps.
5.The transfer learning results of eight-popular architectures (INCEPTIONRESNETV2, RESNET50, VGG16, INCEPTIONV3, XCEPTION, DENSNET, MOBILENET, and NASENET) on the Croatian dataset.
, Description:Figure 2 depicts the overall framework of our strategy. First, there are 6128 underwater images from a subset of the ImageNet collection that have been collected. Second, with the help of the CycleGAN architecture, we have trained these images to construct a model (i.e., UIEGAN). This UIEGAN model improves the quality of the raw images (in our case Croatian dataset). Second, the dataset was balanced by instructing DCGAN to generate many synthetic images from the input (i.e., augmentation). Here, two GAN models were applied to the original dataset to obtain the Augmented Enhanced Image dataset. Then, using the Augmented Enhanced Image dataset, we trained two deep neural networks (SmallerRESNET and SmallerVGG) to produce classification results, which we then compared without using these pre-

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TITLE OF INVENTION	FINE-GRAINED FISH CLASSIFICATION ON UNDERWATER IMAGES USING DEEP LEARNING ARCHITECTURES
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Filed → Published → RQ Filed → Under Examination → Disposed

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FORM 1 THE PATENTS ACT, 1970 (39 of 1970) & THE PATENTS RULES, 2003 APPLICATION FOR GRANT OF PATENT [See sections 7,54 & 135 and rule 20(1)]	(FOR OFFICE USE ONLY) Application No.: ..... Filing Date: ..... Amount of Fee Paid: ..... CBR No.: ..... Signature: .....

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3. TITLE OF THE INVENTION: Fine-grained Fish Classification on Underwater Images using Deep Learning Architectures

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Sr.No.	Country	Application Number	Filing Date	Name of the Applicant	Tilte of the Invention

6. PARTICULARS FOR FILING PATENT COOPERATION TREATY (PCT) NATIONAL PHASE APPLICATION:

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9. DECLARATIONS:

(i) Declaration by the inventor(s)

I/We ,Prof. M. Sudhakara, REVA University, Bangalore.,Dr. M. Janaki Meena, VIT University, Chennai,Prof. Pole Anjaiah, Institute of Aeronautical Engineering, Hyderabad,Dr. N. Badrinath, Annamacharya

Institute of Technology and Sciences, Tirupati.,Prof. Korupalli V Rajesh Kumar, Woxsen University, Hyderabad, is/are the true & first inventor(s) for this invention and declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date: -----

(b) Signature(s) of the inventor(s): .....

(c) Name(s): Prof. M. Sudhakara, REVA University, Bangalore.,Dr. M. Janaki Meena, VIT University, Chennai,Prof. Pole Anjaiah, Institute of Aeronautical Engineering, Hyderabad,Dr. N. Badrinath, Annamacharya Institute of Technology and Sciences, Tirupati.,Prof. Korupalli V Rajesh Kumar, Woxsen University, Hyderabad

(ii) Declaration by the applicant(s) in the convention country

I/We, the applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date: -----

(b) Signature(s) : .....

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(iii) Declaration by the applicant(s)

- **I am/We are, in the possession of the above mentioned invention.**
- **There is no lawful ground of objection to the grant of the Patent to me/us.**

10. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION:

Sr.	Document Description	FileName

I/We hereby declare that to the best of my/our knowledge, information and belief the fact and matters stated hering are correct and I/We request that a patent may be granted to me/us for the said invention.

Dated this(Final Payment Date): ----------

Signature: .....

Name: Mallikarjun M Kodabagi

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The Patent office at CHENNAI

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