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FOREST WILDFIRE DETECTION IN A MACHINE VISION COURSE EXPERIMENT USING VGG19 AND DEEP LEARNING

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ABSTRACT: *AI and digital picture processing techniques are combined in the interdisciplinary field of machine vision. In this work, we design a large-scale experiment to detect wildfires in forests using a method that naturally combines deep learning, machine learning, with virtual image processing. Many of the studies in wildfire detection research are not student-friendly, despite notable advancements in the field. Moreover, attaining very accurate detection remains a significant challenge. This article addresses two components of the forest detection challenge: the classification of wildfire photos and the localization of wildfire regions. We provide two methods: one is an optimized convolutional neural network (CNN) that takes into account both geographical and temporal data for area identification, and the other is a unique technique to wildfire photo categorization using Reduce-VGGnet. According to the experimental findings, the best CNN model, which takes into account both temporal and spatial data, attains an accuracy of 97.35%; however, the suggested Reduce-VGGNet model may obtain 91.20%. We provide a new framework for the integration of education and research. It may accomplish outstanding detection performance, foster the development of machine vision ability, and act as a comprehensive experiment for the computer science course, among other things.*

INTRODUCTION:

AI & digital image processing are used by machine vision systems, that are becoming more and more common in various industries. Owing to the quick advancement of computer technology or the broad accessibility of cameras, these devices can currently perform a variety of functions, such as measuring things, identifying faces, and spotting surface imperfections. AI and computer vision are the two main topics of the multidisciplinary course

Machines Vision. Computer vision has the potential to replace human labor for certain automated procedures or measures with intelligent software as artificial intelligence advances. A camera and a picture processor are essential components of any good machine vision system. Associate writer Senthil Kumar examined and approved this work before it could be published. The target identification result cannot be sent to the terminal by the picture machine until the camera has taken pictures. The computer's picture recognition algorithm will then be used with the item's description applied. For individuals that handle visual data, such as those in manufacturing, computer science, or technology, among other fields, machine vision training is presently deemed necessary. In recent times, there has been a notable surge in demand for skilled experts in the domain of artificial intelligence, namely in the areas of natural language processing and digital image processing. Updates in the Machine Vision syllabus have been the focus of recent global expert discussions. For instance, Min and Lu concentrated on the manufacturing procedure. Chapter 11 of Year 2023 Absent Derivatives Non-Commercial Attribution The legal framework under which this project is hosted is the 4.0 Licence. Kindly see https://creativecommons.org/licenses/by-nc-nd/4.0/32671 for further details. The Forest Wildfire Detection in a Machine Vision Courses Using Deep Learning Through the Help of Multimedia Courses and Guided Collaborative Instruction by L. Wang et al. is very noteworthy. They went on to suggest that research had to be relevant to classroom instruction and in step with practical demands, in addition to piqueing students' curiosity. Wang et al. aimed to include machine vision principles and applications within graduate-level courses via study, in-class instruction, and hands-on practice. Students may make the connection between the production of actual goods and their project study in this manner. Shao et al. developed cocoon sorting as a machine vision technique to develop talent for intelligent manufacturing. It is predicated on evolving fields of engineering. To address issues with a dearth of useful data, imprecise experimental design, & a paucity of such trials, Han and Liu developed a framework for machine vision studies using the Tensorflow is and OpenCV libraries. Reforms to Machine Vision courses throughout the world seek to improve students' understanding of fundamental technology and increase their social awareness. Regarding Sigut et al., machine vision education is centered on the use of cutting edge technologies. Our study produced an Android app that may provide users instant access to Opengl image processing capabilities in order to aid students' comprehension. The curriculum's objective is to provide students a greater comprehension of image processing-

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related subjects. Cote and Albu proposed including an awareness of society element in the Machine Vision curriculum to provide students with an understanding of the technological and societal implications of various technologies. In an effort to render machine vision more approachable towards audiences outside of undergraduate and doctoral programs, Spurlock and Duvall shifted their focus from obtaining mathematical formulae to creating realistic situations in the field of applications. This was done in order to make undergraduate courses more comfortable. As per the reform studies mentioned earlier, most classroom strategies instruct students in merging theory with practice by creating experiments that have real-world implications and captivating topics. Machine Vision is one course that excels at fusing theory and practice together. However, most institutions' current comprehensive undergraduate and postgraduate programs suffer from issues such as impracticality, outmoded design, and reliance on classical machine learning. Although wildfire detection research has advanced significantly, obtaining really trustworthy data remains difficult. In this research, we provide an autonomous system for forest wildfire detection to address these issues. It might be used during a Computer Vision lesson as a thorough experiment. This system automatically detects and annotates areas damaged by forest wildfires using the processing of images, machine learning, and advanced learning. It's a novel approach to combining research with education. None of the aforementioned challenges have been thoroughly investigated in any prior study that we are aware of. The key ideas discussed in this study are summarized as follows: By using our unique lower-VGGnet technique, we were able to decrease the training parameters of VGGnet and still achieve 91.20% classification accuracy for wildfire photos. (2) We propose a new approach to detect wildfire-prone locations by using the combined spatial and temporal properties of an optimized convolutional neural network (CNN). We can see that our method works by looking at the outcomes of the trials carried out on the FLAME dataset. We integrate the modules for categorizing photos captured during wildfires and identifying locations impacted by them as an extensive study in our machine learning course. Using a creative approach to teaching science, this technique involves instructors doing independent research inside the classroom.

RELATED WORK:

Approaches to Face Recognition: A Review

Intelligent systems capable of automatically comprehend and analyze data are desperately required, since video and picture databases are growing at an exponential pace. When communicating with others, the face provides a powerful medium for expressing uniqueness and emotion. Machines are much more adept at distinguishing between various face types than humans are. Automated face detection techniques find use in face recognition, head-pose calculation, facial expression proof of identity, and human-computer interaction applications, among others. "Face detection" is a computer application that recognises and measures the faces of people in digital images. Face recognition has received a great deal of attention in computer vision research. This article reviews all currently available techniques for digital picture face identification. This study also demonstrates the wide range of applications and difficulties in face detection. A variety of face detection typical datasets are also included in the conclusion, along with details on each one. Additionally, we provide special workshops that focus on the practical elements of creating a reliable face recognition structure, and we offer some intriguing avenues for further investigation.

Utilising transfer learning on upgraded datasets for the purpose of wildfire detection

Since wildfires may quickly worsen if ignition sites are not found quickly enough, this application has an elevated temporal criticality. Expert systems researchers' attention has been drawn to the development of reliable early-warning applications by the recent advances in deep learning for difficult visual interpretation tasks. These developments have created intriguing new avenues for study. Study of the method's drawbacks and difficulties is still woefully insufficient, despite the literature's demonstration of the method's improved performance. This book presents three fresh perspectives on the issue. We start by reviewing the literature to try to identify the most prevalent flaws, faults, and problems with these methods as well as to evaluate database quality concerns. Furthermore, to overcome data constraints, a tenfold cross-validation procedure is used to evaluate the proposed transfer learning approach and data augmentation techniques. The suggested framework allows for the utilization of a free data set including pictures from over 35 real fire occurrences, as opposed to techniques that depend on video. This dataset allows for increased variability between samples and allows the method to be evaluated in a large collection of real-world occurrences. The paper delves further into the constraints in its last part, offering a thorough examination of the trends that lead to inaccurate classifications. The findings of this study may guide further research on the use using expert systems for safety and firefighting decision-support systems.

The use of a novel group detection approach to the discovery of related Chinese medications

Over the past few decades, a large number of computer scientists have researched Traditional Chinese Medicine (TCM). However, no one has yet mined mountains of online TCM data and historical TCM prescriptions to determine which plants are compatible and which are not. To tackle this difficulty, we examine the characteristics of herbal network and offer a unique method for community identification that takes into account both graph structural aspects and herbal properties. This will enable us to identify groups of herbs that are relevant for drug exploitation. We analyze the degree of resemblance between the attributes of all pairs of plants as a first step towards building the herbal network. To accelerate the process of finding herbal communities, we offer RWLT (an arbitrary Walk & Label Transfer), a new method for community discovery. We have extensively studied RWLT's performance in comparison with representative approaches using networks which were either created at random or derived from real-world and herbal data. Our technology is able to distinguish between communities of Chinese herbs that are incompatible with one another and groups of herbs that have strong connections, according according to a traditional Chinese medicine (TCM) specialist.

Surface imperfection detection using machine vision: a critical evaluation

The usage of machine vision for surface flaw identification of steel products has increased over the last 20 years due to the steel's extensive application in several industries. Through a review of more than 170 publications, this study seeks to give a cutting-edge assessment of vision-based surface flaw detection techniques for steel products. This analysis addresses typical challenges, hardware requirements, and potential future developments in automated vision-based surface flaw assessment in steel products. We can quickly review the many surface faults that may be found in steel items by using our optical inspection procedure, which includes an image capture equipment. The study explores many image processing techniques to identify surface defects in steel products. Pre-processing involves pre-identifying regions of interest (ROI), segmenting ROI images, extracting and choosing features, classifying faults, and other processes. We primarily address issues related to tiny sample sizes & real-time fault identification on steel surfaces. Finally, we discuss some future directions and possible obstacles in detecting surface defects in steel.

Modern vehicle assembly lines' use of machine vision: a literature survey

As machine vision technology continues to progress, computer vision's intelligence, speed, and accuracy are being used more and more in industrial detection. Measurement, guiding, and inspection are common uses for machine vision. Visual measuring technology verifies that the factory's products are approved by assessing the product's essential dimensions, surface quality, or assembly effect. The use of visual guidance technology may improve body assembly quality and production efficiency via a number of means, such as automated handling, perfect matching assembly, and accurate drilling. Applying visual inspection technology to the exterior manufacturing process may simultaneously save production costs, guarantee the integrity and traceability of the product, and monitor the process's stability. With critical hardware like processors, lenses, and cameras continuing to improve in performance as well as software advancements like profound learning and image processing, machine vision technology is expected to expand significantly and become more crucial in the future.

METHODOLOGY:

In order to carry out this project, we have developed the following modules and used the same dataset that was provided in your requirement file.

1. picture dataset upload: this module will be used to upload picture datasets..

2. Preprocessing the dataset will include using this module to split and clean the data.

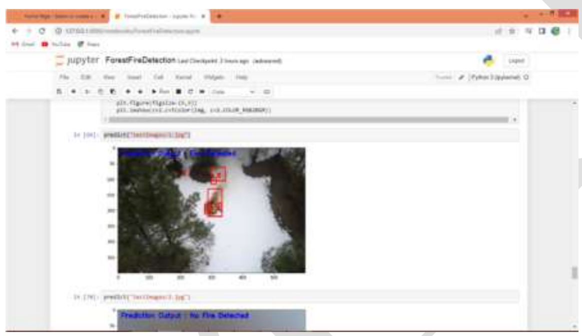
3. Execute SVM Algorithm: The SVM algorithm is run using this module.

4. Applying this module to carry out the VGG-REDUCENET algorithm is the fourth stage.

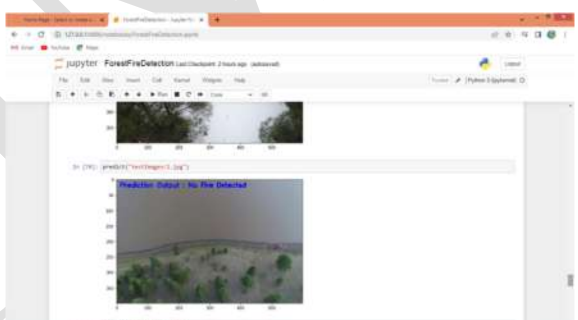
5. The fifth step is to execute the VGG19 algorithm by means of this module.
6. Algorithm comparison: this module is used to compare all algorithms.

7. Use this module to upload test photos.

RESULTS AND DISCUSSION:



Here we are making predictions based on a test picture; the first output says "image contains fire," while the second one adds a red bounding box to the image.



In above image 'fire is not detected'

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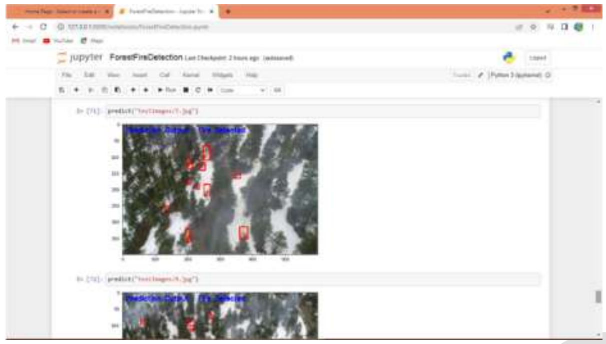

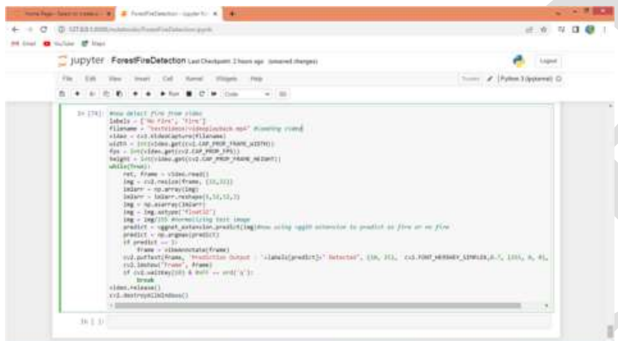

In above code we are predicting on video and below is the output video

The following are the output predictions from videos, as well as the results from detecting and annotating fire in the photos shown above.

We are identifying and labelling fires in the video as well, as shown in the screen capture above.

Just like that, you may execute code by following the code above.

Please keep in mind that this is a computer programmed and not a human being; as a result, it may mistakenly label a fire that isn't really there as a fire.

CONCLUSION:

AI and digital image processing techniques are combined in the interdisciplinary field of machine vision. As part of our research, we build a thorough experiment to detect wildfires in forests using a method that naturally combines virtual image processing, deep learning, and machine learning. Artificial intelligence (AI) or digital image processing techniques underpin machine vision technologies that have revolutionized a number of sectors, including face identification, object measuring, surface flaw detection, or wildfire detection. The widespread use of cameras and the quick development of computer power are mostly to blame for this. Machine Vision is an interdisciplinary course that blends artificial intelligence with the processing of digital images. Artificial intelligence advancements mean that in certain automated processes and measures, machine vision may eventually be able to take the position of human workers. The camera and image processor are the two most crucial components of a machine vision system. Senthil Kumar, an assistant writer who had managed the revisions, gave the go-ahead for publication. An image processing system may take pictures, analyze them, and then send the results to a terminal so that an object may be identified using a computer and an image recognition algorithm. Machine vision is regarded as a crucial professional issue by several fields, including computer science, smart manufacturing, video among image processing, and others. Furthermore, the ability of doing so has become increasingly crucial for people who work in the sector. The current explosion in machine learning research has resulted in a serious lack of skilled personnel with experience in natural language processing and digital image processing.

REFERENCES:

1. Kumar A, Kaur A, Kumar M. Face detection techniques: a review[J]. Artificial Intelligence Review, 2019, 52(2): 927-948.

2. Sousa M J, Moutinho A, Almeida M. Wildfire detection using transfer learning on augmented datasets[J]. Expert Systems with Applications, 2020, 142: 112975.

3. Voulodimos A, Doulamis N, Doulamis A, et al. Deep learning for computer vision: A brief review[J]. Computational intelligence and neuroscience, 2018, 2018.

4. Tang B, Kong J Y, Wu S Q . Review of surface defect detection based on machine vision[J]. Journal of Image and Graphics, 2017, 22(12): 1640- 1663.

5. Yin S, Ren Y J, Liu T, et al. Review on application of machine vision in modern automobile manufacturing[J]. Acta Optica Sinica, 2018, 38(8): 0815001.

6. Min F, Lu T. Exploration and practice of machine vision course teaching for production practice[J]. Computer Education, 2017(10):41-43.

7. Wang Z, Xiao G, Liu H. Teaching Reform of the Course of Machine Vision Principles and Applications for Professional Degree Postgraduates[J]. Education Teaching Forum, 2021, 3(11): 37-40.

8. Shao T, Tang J, Liao Y. Comprehensive experiment system of cocoon sorting based on machine vision[J]. Experimental Technology and Management, 2020, v.37;No.289(09):125-127+132.

9. Han Z, Liu X. Design of machine vision experiment teaching platform based on Python[J]. Computer Measurement and Control, 2020, v.28;No.258(03):249-253+258.

10. Sigut J, Castro M, Arnay R, et al. OpenCV basics: a mobile application to support the teaching of computer vision concepts[J]. IEEE Transactions on Education, 2020, 63(4): 328-335.

11. Cote M, Albu A B. Teaching Computer Vision and Its Societal Effects: A Look at Privacy and Security Issues From the Students' Perspective[C]//2017 IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW). IEEE, 2017: 1378-1386.

12. Spurlock S, Duvall S. Making computer vision accessible for undergraduates[J]. Journal of Computing Sciences in Colleges, 2017, 33(2): 215-221.

13. Jiang Y, Li B. Exploration on the teaching reform measure for machine learning course system of artificial intelligence specialty[J]. Scientific Programming, 2021, 2021.

14. Wang Y, Stanković M, Smith A, et al. Leader-Follower System in Convoys:: An Experimental Design Focusing on Computer Vision[C]//2021 IEEE Sensors Applications Symposium (SAS). IEEE, 2021: 1-6.

15. Shamsoshoara A, Afghah F, Razi A, et al. Aerial Imagery Pile burn detection using Deep Learning: the FLAME dataset[J]. Computer Networks, 2021, 193: 108001.

16. Bouguettaya A, Zarzour H, Taberkit A M, et al. A review on early wildfire detection from unmanned aerial vehicles using deep learning- based computer vision algorithms[J]. Signal Processing, 2022, 190: 108309.

17. Saldamli G, Deshpande S, Jawalekar K, et al. Wildfire detection using wireless mesh network[C]//2019 Fourth International Conference on Fog and Mobile Edge Computing (FMEC). IEEE, 2019: 229-234.

18. Toan N T, Cong P T, Hung N Q V, et al. A deep learning approach for early wildfire detection from hyperspectral satellite images[C]//2019 7th International Conference on Robot Intelligence Technology and Applications (RiTA). IEEE, 2019: 38-45.

19. Jia L, Jiong Y. Multi-information Fusion Flame Detection Based on OhtaColor Space[J]. Journal of East China University of Science and Technology (Natural Science Edition) , 2019, 45(6): 962-969.

20. Tan Y, Xie L, Feng H, et al. Flame detection algorithm based on image processing technology[J]. Laser & Optoelectronics Progress, 2019, 56(16): 161012.

21. Hossain F M A, Zhang Y, Yuan C, et al. Wildfire flame and smoke detection using static image features and artificial neural network[C]//2019 1st international conference on industrial artificial intelligence (IAI). IEEE, 2019: 1-6.

22. Schultze T, Kempka T, Willms L. Audio-video fire-detection of open fires[J]. Fire Safety Journal,2006,41(4);311-314.

23. Xie Y, Zhu J, Cao Y, et al. Efficient video fire detection exploiting motion-flicker-based dynamic features and deep static features[J]. IEEE Access, 2020, 8: 81904-81917.

24. Shahid M, Chien I, Sarapugdi W, et al. Deep spatial-temporal networks for flame detection[J]. Multimedia Tools and Applications, 2021, 80(28): 35297-35318.

25. Zhang D, Xiao H, Wen Jie, Xu Y. Real-Time Fire Detection Method with Multi-feature Fusion on YOLOv5. Pattern Recognition and Artificial Intelligence, 2022, 35(6): 548-561.

26. Yuan J, Wang L, Wu P, et al. Detection of wildfires along transmission lines using deep time and space features[J]. Pattern Recognition and Image Analysis, 2018, 28(4): 805-812.

27. Wang Z, Wei D, Hu X. Research on two stage flame detection algorithm based on fire feature and machine learning[C]//Proceedings of the 2019 International Conference on Robotics, Intelligent Control and Artificial Intelligence. 2019: 574-578.

28. Ryu J, Kwak D. Flame Detection Using Appearance-Based Pre- Processing and Convolutional Neural Network[J]. Applied Sciences, 2021, 11(11): 5138.

29. Barnich O, Van Droogenbroeck M. ViBe: A universal background subtraction algorithm for video sequences[J]. IEEE Transactions on Image processing, 2010, 20(6): 1709-1724.

30. Shamsoshoara A, Afghah F, Razi A, et al. Aerial imagery pile burn detection using deep learning: The FLAME dataset[J]. Computer Networks, 2021, 193: 108001.