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Body Posture Accuracy Prediction for Swimming and Karate Using Machine Learning

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ABSTRACT: The realm of human pose classification presents ongoing challenges in contemporary research, crucial for comprehending human motion and sequential behaviors. A plethora of standardized human pose datasets has emerged, driving extensive inquiry in the domain. Our primary aim is to devise a system capable of accurately predicting individual poses within a Multiview dataset, encompassing novel actions distinct form conventional poses. Specifically, our focus lies on actions from Karate, a martial art, and swimming. Employing Deep Convolutional Neural Networks (CNNs), we propose a methodology that circumvents explicit feature extraction, streamlining the classification process.

By integrating Multiview data capturing dynamic actions from Karate and swimming, our approach transcends conventional pose classification frameworks, accommodating the diversity and complexity inherent in these activities. Leveraging CNNs enables the extraction of the intricate spatial and temporal features directly from raw input data, facilitating robust pose classification across multiple views.

Through extensive experimentation and validations, our proposed framework demonstrates promising results in accurately classifying poses within the context of Karate and swimming. We evaluate our model on a comprehensive dataset, showcasing its efficacy in handling the intricacies of dynamic actions intrinsic to these disciplines. Our contributions not only advance the state-of-the-art in pose classification but also opens avenues for applications in sports analytics, rehabilitation, and human-computer interaction.

KEYWORDS: Human pose classification, Multiview dataset, Deep Convolutional Neural Networks, Karate, Swimming, Dynamic actions, Sports analytics.

I.INTRODUCTION

In the era of rapid technological advancement, Machine Learning, particularly through Convolutional Neural Networks (CNNS), has emerged as a transformative force with far-reaching implications. One of its key applications lies in the analysis and prediction of human poses, a critical aspect with implications across various domains such as assisted living, human-computer interaction, surveillance, and industrial processes [1]. By leveraging Multiview datasets featuring activities such as Karate and Swimming, researchers have embarked on the journey of understanding and classifying human actions with unprecedented accuracy and efficiency.

Artificial Neural Networks (ANNs) are computational processing system of which are heavily inspired by way biological nervous systems (such as the human brain) operate. ANNs are mainly comprised of a high number of interconnected computational nodes (referred to as neurons), of which work entwine in a distributed fashion to collectively learn from the input in order to optimize its final output [2].

Karate, an unarmed martial arts discipline characterized by defensive and counter-attacking movements, presents a rich source of data for pose recognition. Similarly, Swimming, with its diverse aquatic manoeuvres encompassing entering, resurfacing, and navigating through water, offers a unique set of challenges for classification algorithms [3]. These activities underscore the complexity and diversity of human movement, necessitating sophisticated Machine Learning techniques for accurate analysis and prediction [4].

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The use of CNNs for deep learning has gained prominence due to their ability to directly extract future from input data. By employing pre-trained networks as base models and building upon them for specific recognition tasks, researchers can harness the power of transfer learning for efficient and effective results [5]. This paper delves into the methodology of utilizing CNNs for pose classification, highlighting the significance of Convolution Layers, Pooling Layers and Fully Connected Layers in exciting complex features and mapping them to specific actions. Through this research endeavor, we aim to contribute to the advancement of human centric analytics, paving the way for intelligent systems capable of understanding and interacting with human behavior in diverse real-world scenarios.

II.LITERATURE REVIEW

A Survey on Yogic Posture Recognition
Arun Kumar Rajendran and Sibi Chakkaravarthy Sethuraman. [VIT-AP Computer Science & Engineering]

This includes the aspects of identifying human posture using vision-based data collection and preprocessing the data and using different algorithms to check for the accuracy of the posture. The dataset included yoga posture.

Gymnastic Posture Detection Based on Deep Learning
Wu Wen, Yong Yang, Jingyi Du, Lixiang Liu and Jiahao Wang [School of Electrical and Control Engineering, Xi'an University of Science and Technology]

Attitude detection can help the gymnast's posture movements correct. The paper proposes a deep learning real-time attitude detection method to detect the posture of gymnasts. Input an image, extract features through the convolutional network, correctly link the detected key points of the human body in the picture, and finally merge them into one's overall skeleton to detect the posture of the gymnast. The method has good real-time performance and accuracy high.

III.METHODOLOGY OF PROPOSED SURVEY

A. Dataset Collection and Preprocessing:

1) Dataset Collection:
- Identify the scope of the research and the specific types of images required.
- Locate existing datasets from reputable sources or consider collecting our own data through various means such as web scraping, crowdsourcing, or utilizing APIs.
- Ensure that the dataset is diverse and representative of the target population to avoid bias in our analysis.
- Check for any copyright issues or usage restrictions associated with the dataset.

2) Data Cleaning and Preprocessing:
- Resizing Images: Standardize the dimensions of all images to a common size to ensure consistency across the dataset. This step is crucial for compatibility with machine learning algorithms.
- Colour Space Conversion: Convert images from BGR to RGB format, which is more widely accepted in image processing and analysis tasks.
- Noise Removal: Apply techniques such as Gaussian blur, median filtering, or denoising algorithms to reduce unwanted artifacts or distortions in the images.
- Image Enhancements: Employ methods like histogram equalization, contrast adjustment, or sharpening filters to improve the overall quality and clarify of the images.
- Normalization: Scale pixel values to a standard range (0 to 1) to facilitate better convergence during training of machine learning models.
- Data Augmentation: Generate additional training samples by applying transformations Such as rotation flipping or cropping to combat overfitting and improve model generalization.
- Data Labelling: If working with supervisor learning tasks, annotate or label the images with relevant classes or categories for training purposes.

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B. Splitting dataset into train & test data:

- Splitting dataset into train (75%) and test (25%) data.

C. Applying CNN for train & test dataset to create prediction model:

Primarily used for image classification tasks, the typical architecture comprises five essential layers:

- Convolution layer: Spreads the image to extract relevant features using techniques like RELU extraction.
- Max-Pooling layer: Introduces non-linearity while reducing spatial dimensions, enhancing computational efficiency.
- Flatten layer: Refines extracted features into a format suitable for subsequent processing.
- Dense layer: Groups enhanced features into cohesive patterns, facilitating classification.

This layered approach orchestrates the intricate process of image classification, transforming raw visual data into actionable insights with remarkable accuracy and efficiency.

D. Prediction model:

- Using CNN, we create a prediction model which helps us to classify the image and give the accuracy of the posture.

E. Suggestion and Feedback:

- The proposed output also provides the skeletal image for the given input image and predicts the accuracy.

F. ARCHITECTURE DIAGRAM OF PROPOSED WORK

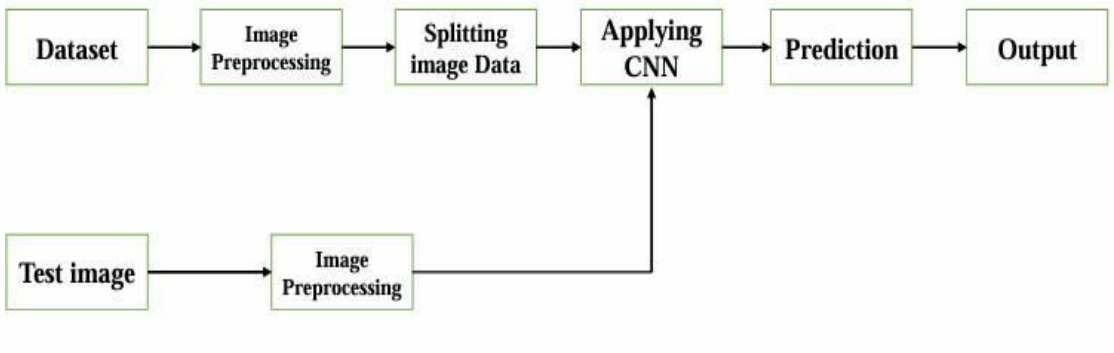

Fig 1. Architecture Diagram of proposed work

IV. CONCLUSION

Harnessing the power of deep learning a cutting-edge system emerges to revolutionizes the way we perceive and optimize body posture across various domains including Healthcare, Sports and ergonomics. By leveraging intricate neural network architectures and vast datasets, this groundbreaking technology seamlessly evaluates body posture, unlocking invaluable insights to evaluate physical health and performance. Imagine a world where sophisticated algorithms meticulously analyze every nuance of our body's alignment, offering instantaneous feedback and personalized recommendations, as this innovation matures and seamlessly integrates into our daily lives, it holds the promise to redefine how we monitor and enhance our posture. Picture athletes fine-tuning their movements with unprecedented precision, healthcare professionals gaining deeper insights into patient rehabilitation, and office workers maintaining optimal economic positions effortlessly. The implications are profound transcending mere convenience to fundamentally enhance our well-being and productivity. With each stride forward in technology, this deep learning

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driven posture accuracy detection system becomes an indispensable tool, guiding us towards a future were vitality and efficiency coverage seamlessly.

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