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Leverging CNN and Learning For Vision Based Activity Recognition

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***Abstract*-**Human activity recognition (HAR) through vision-based systems has gained significant attention due to its wide-ranging applications in various domains such as healthcare, security, and human-computerinteraction. Convolutional Neural Networks (CNN) have emerged as powerful tools for feature extraction and classification in visual data processing tasks. Additionally transfer learning models on large datasets, has shown promise in enhancing the performance of HAR systems, particularly when labeled data is limited.

This paper presents a comprehensive review and analysis of leveraging CNN architecture and transfer learning methods for vision-based HAR. We investigate the application of transfer learning in HAR, wherein features learned from large-scale datasets are transferred to HAR tasks with smaller, domain-specific datasets.

This paper aims to provide insights into the utilization of CNNs and transfer learning techniques for advancing the field of vision-based human activity recognition, ultimately contributing to the development of more efficient and reliable HAR systems.

1. INTRODUCTION

Human activity recognition has become a crucial research area with applications such as healthcare, security, smart environments and so on. Vision-based HAR which involves analyzing and interpreting human activities from video

or image sequences. However, the task of accurately recognizing human activities from visual data poses several challenges, including variability in human poses.

In recent years, deep learning techniques, particularly Convolutional Neural Networks (CNNs), has the field of computer vision by achieving state-of-the-art performance in various tasks such as image classification, object detection.

Hence this methodology is getting more consideration now a days ,consequently making HAR framework simple and easy to be deployed in many applications .

2. LITERATURE SURVEY

CNNs and Transfer Learning:

Researchers often start by introducing convolutional neural networks (CNNs) and transfer learning. They explain how CNNs are powerful tools for image recognition tasks and how transfer learning allows us to leverage pre-trained CNN models for new tasks like human activity recognition.

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Datasets and Pre-processing Techniques:

It would discuss the datasets commonly used for training and testing human activity recognition models, such as UCF101 or HMDB51.

Additionally, it might highlight pre-processing techniques applied to the data to enhance model performance.

Transfer Learning Approaches:

The survey would cover different transfer learning approaches employed in the literature, such as feature extraction, fine-tuning, or domain adaptation. It would explain how researchers adapt pre-trained CNN models to recognize human activities effectively.

Evaluation Metrics and Results:

Researchers typically evaluate the performance of their models using various metrics like accuracy, precision, recall, or F1-score. The survey would summarize the results obtained by different studies and highlight the strengths and weaknesses of each approach.

3. PROBLEM STATEMENT

Despite significant advancements in computer vision and deep learning techniques, vision-based HAR still faces several challenges inreal world scenarios. They include:

Variability in Human poses and actions: Human activities can exhibit considerable variability in terms of poses, gestures. Recognizing activities accurately requires robust models capable of capturing and understanding these variations.

Limited labelled data: In many cases, acquiring labelled data for all possible activities and scenarios may not be feasible, leading to insufficient training data for all possible activities may not be feasible.

To address these challenges, this research aims to leverage Convolutional Neural Networks and transfer learning techniques for vision-based HAR.

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4.PROPOSED METHODOLOGY

First, we'll take a pre-trained CNN that's already good at recognizing basic patterns in images.

Then, we'll adjust this CNN to learn the specific patterns related to human activities. This process is called fine-tuning.

Next, we'll feed the CNN images or video frames showing different human activities, like walking, running, or eating.

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The CNN will analyse these images, recognize patterns, and learn to associate each pattern with a specific activity.

Finally, we'll test the CNN on new images or videos to see if it canaccurately identify human activities.

In simple terms, we're using a smart tool (CNN) that already knows a lot about images, and we're teaching it to understand what humans are doing in those images.

VGG-16(also called Oxford Net):

1. VGG-16 is really good at recognizing objects and patterns in images. It's like a super-smart detective that can look at a picture and tell you what's in it, whether it's a cat, a car, or a tree.
2. VGG-16 is a powerful tool for understanding and recognizing what's in images. It's like having a highly trained detective that can quickly spot and identify objects.

HAR System:

1. HAR is like teaching a computer to understand what people are doing based on their movements or actions. For instance, whether someone is walking, running, or sitting.
2. HAR systems use sensors like accelerometers or cameras to collect data about how a person moves.
3. They analyse this data using algorithms to figure out what activity the person is doing.
4. HAR systems can be used in many ways, like in fitness trackers to count steps, in healthcare to monitor patients' movements, or in smart homes to automate tasks based on people's activities.
5. HAR system is like a smart observer that watches how people move and figures out what they're doing, which can be really useful for various applications.

Advantages of human activity recognition:

1. **Health:** Helps monitor and improve daily activities for better health.
2. **Safety:** Enhances security by identifying suspicious behaviour.
3. **Convenience:** Makes tasks easier by automating actions based on activities.
4. **Fitness:** Tracks exercises and progress to promote a healthier lifestyle.
5. **Interaction:** Allows natural control of devices through gestures or movements.
6. **Efficiency:** Optimizes workflows in industries for better productivity.
7. **Understanding:** Provides insights into human behaviour for research and analysis.

5. Transfer Learning:

Transfer learning is a technique in machine learning where a model that has already learned to solve one problem is reused as a startingpoint for solving a different but related problem. It's like taking knowledge gained from one situation and applying it to another similar situation to make learning faster and more efficient.

Transfer learning is like borrowing knowledge from one task to help with another task. It's similar to how you might learn to play chess and then use some of the strategies you've learned to play another

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board game like checkers. Instead of starting from scratch every time, you build on what you already know to tackle new challenges more quickly and effectively.

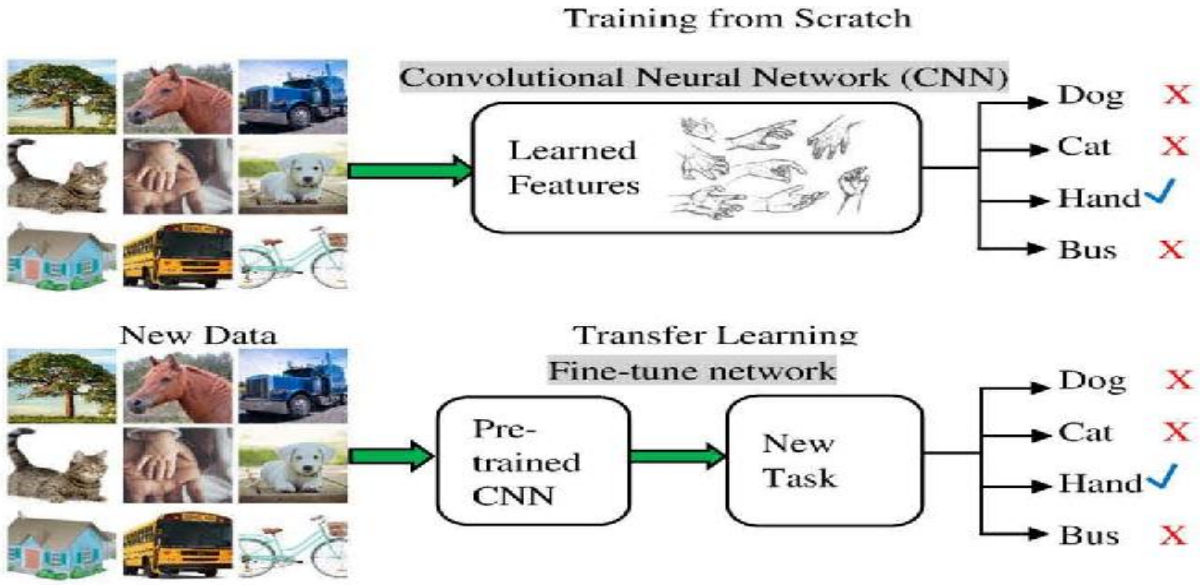

Fig 1.Schematic diagram to demonstrate transfer learning

The main approaches in transfer learning are: To preserve the original pre-trained neural model of large-scale dataset and update weights of the trained model on the target dataset, and use the pre-trained neural model for feature extraction and representation followed by a generic classifier such as Support Vector Machine or Logistic Regression

6 .IMPLEMENTATION

Implementing a system that leverages ConvolutionalNeural Networksforactivity recognition involves several important steps:

Data Collection: Gather a dataset of labeled images or videos representing different activities you want to recognize. For example, if you're recognizing activities like walking, running, or standing, you'd need images or videos of people performing these actions.

Data Preprocessing: Prepare the data by resizing images, normalizing pixel values, and splitting it into training and testing sets.

Model Architecture: Design the CNN architecture for your activity recognition task. This typically involves stacking convolutional layers to extract features from the input images, followed by pooling layers to reduce spatial dimensions, and finally, fully connected layers for classification.

Training: Train the CNN using the training dataset. During training, the network learns to recognize patterns in the input images that correspond to different activities. This is done by adjusting the weights of the network using an optimization algorithm like gradient descent.

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Validation: Validate the trained model using the validation dataset to ensure it's performing well and not overfitting the training data. Adjust the model hyperparameters if necessary.

Testing: Evaluate the model using the test dataset to measure its performance on unseen data. This gives you an idea of how well the model generalizes to new instances.

Deployment: Once the model performs satisfactorily, deploy it to the desired platform or integrate it into your application for real-world use.

By following these steps, you can implement a system that leverages CNNs for activity recognition, allowing you to automatically detect and classify different activities based on input images or videos.

7. CONCLUSION

In conclusion, using CNNs and transfer learning for vision-based human activity recognition is like having a smart assistant that learns from previous tasks to understand what people are doing in images or videos. By borrowing knowledge from pre-trained models and fine-tuning them to recognize specific activities, we can efficiently and accurately identify human actions, making tasks like monitoring health, analyzing sportsperformance, or securing

environments mucheasier. It's like having a trained observer that continuously learns and adapts, making our lives safer and more convenient.

8. FUTURE SCOPE

With further research and advancements, we can expect CNN-based models to become even better at recognizing human activities in images or videos. This means fewer mistakes and more precise identification of actions.

As technology progresses, we'll likely see these techniques being applied in various fields beyond just surveillance or healthcare. This could include areas like sports analysis, gaming, or even personalized virtual assistants that understand and respond to human gestures.CNN models may be able to process data faster, leading to real-time activity recognition. This could enable immediate responses or alerts in situations where quick action is needed.

Overall, the future of leveraging CNNs and transfer learning for vision-based human activity recognition holds the promise of more accurate, versatile, and integrated systems that can benefit various aspects of society and everyday life.

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