Human Activity Recognition in Dark

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Problem

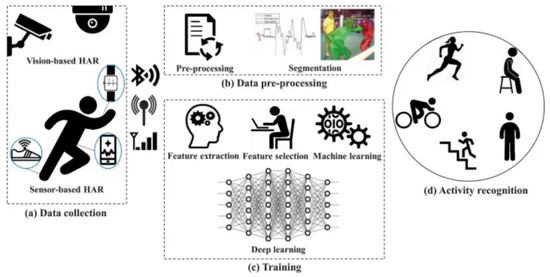
The task of action recognition in dark videos is useful in various scenarios. Though progress has been made in the action recognition task for videos in normal illumination, few have studied action recognition in the dark. This is especially useful in security and surveillance.

Contributions

The method is based on [**?**]. Our main contributions are

1. Hybrid approach using CNN and LSTM implemented.
2. LSTM units were replaced with GRU to compare performance.

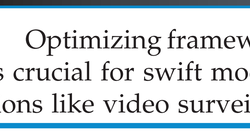
Method



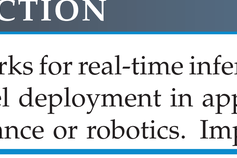
1. **Data Collection**: The ARiD - Action Recognition in Dark dataset has been used.
2. **Data Preprocessing**: The videos have a frame rate of 30 frames per second(fps). To discard the redundant frames and thus decrease the size of the input data we extract only a subset of frames sparsely and uniformly distributed throughout the video.
3. **Training**: The model has four convolutional layers coupled with max-pooling and dropout in between. Then the output is fed into a RNN unit -LSTM/GRU. Which is finally flattened and softmax is used to get predictions.
4. **Activity Recognition**: We will be using two types of evaluation metrics - accuracy and confusion matrix.

Background Model

RNN Unit and LSTM Unit



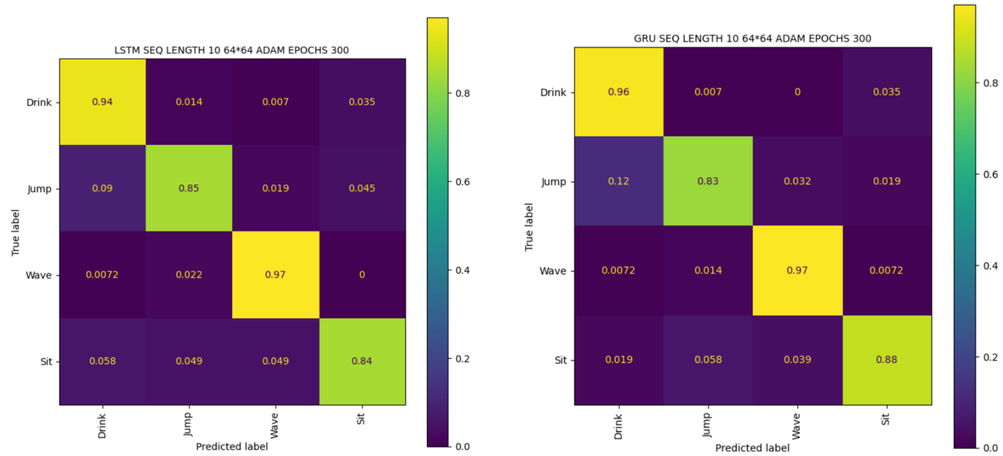
GRU Unit



1. **Recurrent Neural Network(RNN)**: It analyzes the input hidden sequential pattern by concatenating the previous information with current information from spatial and temporal dimensions and predicting the future sequence.
2. **Long Short-Term Memory(LSTM)**: It can remember the information for a long period. LSTM includes several gates. Esach gate processes the input from the previous gate and forwards it to the next one thereby controlling the flow of information toward the final output.
3. **Gated Recurrent Unit**: Unlike LSTM, it does not have a separate cell state (Ct). It only has a hidden state(Ht). Due to the simpler architecture, these are faster to train.

Results

The LSTM model gave an accuracy of 93.75% while the GRU model gave an accuracy of 92.68%. Below are some results and confusion matrices of LSTM and GRU respectively.



Applications

Human activity recognition in the dark has several applications in real life. Some of these are:

- **Security and Surveillance**: Identify and monitor suspicious activities in low-light conditions, enhancing the capabilities of security and surveillance systems.
- **Assistive Technologies for the Visually Impaired**: Develop systems that can recognize human activities in the dark to aid visually impaired individuals in navigating unfamiliar environments.
- **Smart Home Automation**: Integrate human activity recognition in low-light conditions to automate home systems based on occupants' behavior.

References

[1] Xu, Yuecong and Yang, Jianfei and Cao, Haozhi and Mao, Kezhi and Yin, Jianxiong and See, Simon ARID: A New Dataset for Recognizing Action in the Dark

A Future Direction

Optimizing frameworks for real-time inference is crucial for swift model deployment in applications like video surveillance or robotics. Improving efficiency and speed ensures timely recognition of human activities in critical scenarios.