# Relevant Research Papers

**Find papers can be used to support the technical direction I would like to take with this project.**

* **Title: Trajectory-Based Air-Writing Recognition Using Deep Neural Network and Depth Sensor:** 
  + URL: <https://www.mdpi.com/1424-8220/20/2/376>
  + Summary:

This research paper focuses on developing an air-writing recognition system that allows users to write characters in free space using 3D trajectories tracked by a depth camera. Unlike traditional writing systems that require contact with a surface, this trajectory-based system is beneficial in scenarios like augmented and virtual reality, where pen-up and pen-down methods are impractical. However, air-writing presents challenges due to the non-uniformity of characters and varying writing styles.

The authors developed a system that uses a depth-sensing camera to track fingertip movements in 3D space. To handle variability in writing styles and trajectory patterns, they employed normalization techniques such as nearest neighbor and root point translation. The air-writing system utilizes two deep learning models: Long Short-Term Memory (LSTM) and Convolutional Neural Networks (CNN) for recognizing the trajectories. The system was tested on a self-collected dataset as well as the publicly available 6D Motion Gesture (6DMG) dataset, achieving a 99.32% accuracy rate, the highest reported for this task to date.

Key contributions include:

1. The development of deep learning models (LSTM and CNN) for accurate air-writing digit recognition, which performed better when using normalized trajectories.
2. The creation of a new dataset with 21,000 trajectories, which is publicly available for further research.
3. Validation of the system’s accuracy using both the self-collected and 6DMG datasets, where the proposed model outperformed prior work.

The research shows that deep learning methods can effectively handle the challenges of air-writing, and the system is robust across different writing styles and conditions. The paper concludes with a discussion of future work, including further improvements and possible applications in human-computer interaction systems.

* **Title: Accuracy and feasibility of a novel fine hand motor skill assessment using computer vision object tracking:** 
  + URL: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9892571/>
  + Summary:

This paper introduces a computer vision-based 3D motion capture system using two action cameras to track an object manipulated by the hand, aimed at assessing fine hand motor skills. The system utilizes color-based object detection and tracking to estimate 3D object locations and kinematics, which represent goal-directed arm movements. Through three experiments, the study evaluates the system’s accuracy and feasibility in detecting motor skill improvements after practice in non-disabled young adults. The results demonstrate that the system can reliably estimate 3D positions and measure changes in motor skills, showing promise for future applications in rehabilitation research and patient care.

Key findings include:

1. The system provides accurate 3D tracking of objects manipulated by the hand.
2. It can detect changes in motor skills after practice, indicating its feasibility in tracking fine hand movements.
3. The research highlights the potential of this system for assessing motor functions in clinical settings, offering a cost-effective, markerless alternative to traditional motion capture systems.

* **Title: A Review on Image & Video Processing:** 
  + URL: <https://www.researchgate.net/publication/228612963_A_Review_on_Image_Video_Processing>
  + Summary:

The paper discusses the key concepts and technologies in image and video processing, fields that have significant research and development activity. Image processing involves processing signals where the input is an image, such as photos or video frames, and the output is either a modified image or information extracted from the image. Techniques typically treat images as two-dimensional signals and apply signal-processing methods. Video processing extends these techniques to handle video streams or files. The paper outlines elements of both digital image and video processing and highlights their applications in devices like televisions, video players, and codecs. It also reviews current technologies and advancements in these fields, emphasizing their widespread use in multimedia systems.

Key topics:

* Image processing: Digital image handling techniques.
* Video processing: Methods applied to video streams and files.
* Technologies: Applications in multimedia and everyday devices such as TVs and DVDs.

The paper aims to present foundational knowledge and current trends in both areas.

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