# A Hybrid Swarm Intelligence Convolution Neural Network for Object Detection and Tracking

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**Certification**

This is to certify that Afiss Emiola KAREEM with matriculation number LCU/PG/001703 carried out this research work titled "A Hybrid Swarm Intelligence Convolution Neural Network for Object Detection and Tracking" in the Department of Computer Science, Faculty of Natural and Applied Sciences, Lead City University, Ibadan, Oyo State, for the award of Doctoral Degree (PhD) in Computer Science and that this has not been previously submitted.

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Dr. Wumi Ajayi Date
(Supervisor)

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Dr. Wilson Sakpere Date
(Head of Department)

**Dedication**

This research work is dedicated to God Almighty.

**Acknowledgement**

I want to thank this prestigious institution, Lead City University for the Opportunity given to me to learn and complete my PhD program. I equally thank the University Library for the provision of adequate materials needed.

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I thank you all.

"Even though the above-mentioned institutions and persons have assisted in the process of this research work, I alone stand responsible for the errors, if any, found in the work".

**Abstract**

In recent years, analysis and interpretation of video sequences to detect and track objects of interest had become an active research field in computer vision and image processing. Despite significant efforts in object detection and tracking, an efficient method which provides high computational efficiency has not been developed. Hence, in this work a Hybrid Particle Swarm Optimization Convolution Neural Network (CNN-HPSO) technique was developed to improve computational efficiency in object detection and tracking. The video datasets (MP4 and AVi video formats) used in this work were obtained from a conventional online database and on a real-time basis from YouTube. Multiple frames sampled from the video clips were pre-processed and then segmented. An Enhanced Particle Swarm Optimization (HPSO) was formulated from standard PSO and was applied to Convolution Neural Network (CNN). CNN-HPSO technique was used for edge detection and extraction of the boundary of the image and the object tracking was finally carried out. The work was implemented using MatLab R2016 software. The average results of CNN-HPSO, CNN-PSO and CNN on the videos with MP4 format yielded processing time, accuracy, precision, FPR, sensitivity and specificity of 165.89s, 97.08%, 98.41%, 7.75%, 97.82%, and 92.25%; 179.52s, 94.25%, 96.99%, 10.37%, 95.23% and 89.62%; and 189.19s, 89.95%, 93.64%, 15.56%, 91.95.33% and 84.44% respectively. For the videos in AVi format, CNN-HPSO, CNN-PSO and CNN produced similar average results with processing time, accuracy, precision, FPR, sensitivity, and specificity of 185.09s, 96.62%, 98.23%, 7.80%, 97.34% and 92.19%; 198.24s, 94.83%, 97.62%, 8.56%, 95.46% and 91.43%; and 216.59s, 91.30%, 93.98%, 15.09%, 93.67% and 84.91% respectively. In this research, a CNN-HPSO with associated high computational efficiency was developed. The developed technique can be used for solving other related optimization problems.

**Keywords**: Deep Learning Algorithms, Computer Vision, Moving Objects, Video Frame, Object Segmentation

**Word Count:** 293

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