# Modelo para la Detección de Posturas de Yoga usando Redes Neuronales Convolucionales

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***Abstract*—The abstract goes here.**

***Index Terms*—yoga, pose, detection, CNN.**

## I. Introducción

ENTRE las distintas causas de lesiones al ejercitarse, podemos encontrar la incorrecta ejecución de las actividades [1]. Por otro lado, para la recuperación en algunas de estas lesiones es necesario realizar otro grupo de ejercicios cuya efectividad viene dada a partir de la adecuada ejecución de estos [2]. Sin embargo, no siempre es posible supervisar que las actividades se realicen apropiadamente, por lo que un sistema que sea capaz de realizar esta tarea permitiría aumentar la eficacia de las rutinas.

La Yoga es una filosofía que, además ideas espirituales y filosofías alimentarias, utiliza distintas posturas muy marcadas que requieren de su correcta ejecución para conseguir diversos efectos en el cuerpo de quien las lleva a cabo. Debido a los efectos que estas posturas pueden tener en el bienestar de quien las hace, es que la gente busca practicarlas sin embargo al no siempre es posible asistir con un maestro yogi que supervise el desarrollo de estos ejercicios. Es por ello que se propone un modelo que permita identificar estas posturas para posteriormente usarse en un sistema de enseñanza de yoga.

## II. Estado del Arte

[3] The fundamental goal of Yoga pose detection and correction is to provide standard and correct yoga postures using computer vision. If the yoga posture is not done properly, it can result in serious injuries and long-term issues. Analyzing human poses to detect and correct yoga poses can benefit humans living a healthier life in their homely environment. This project focuses on exploring the different approaches for yoga pose classification, so we are using PoseNet and KNN classifier. Using such deep learning algorithms, an individual can get the correct/ideal way/method to perform that specific yoga asana that he/she is trying to do. Using computer vision techniques and Open Pose (an open-source library), human pose estimation is used to estimate an individual's Yoga posture. The suggested system recognises the difference between the actual and target positions and corrects the user with high accuracy by offering real-time visual output and necessary instructions to correct the identified pose.

[4] Yoga is a 5000-year-old practice developed in ancient India by the Indus-Sarasvati civilization. The word yoga means deep association and union of mind with the body. It is used to keep both mind and body in equilibration in all flip-flops of life by means of asana, meditation, and several other techniques. Nowadays, yoga has gained worldwide attention due to increased stress levels in the modern lifestyle, and there are numerous methods or resources for learning yoga. Yoga can be practiced in yoga centers, through personal tutors, and can also be learned on one's own with the help of the Internet, books, recorded clips, etc. In fast-paced lifestyles, many people prefer self-learning because the above mentioned resources might not be available all the time. But in self-learning, one may not find an incorrect pose. Incorrect posture can be harmful to one's health, resulting in acute pain and long-term chronic concerns. In this paper, deep learning-based techniques are developed to detect incorrect yoga posture. With this method, the users can select the desired pose for practice and can upload recorded videos of their yoga practice pose. The user pose is sent to train models that output the abnormal angles detected between the actual pose and the user pose. With these outputs, the system advises the user to improve the pose by specifying where the yoga pose is going wrong. The proposed method was compared to several state-of-the-art methods, and it achieved outstanding accuracy of 0.9958 while requiring less computational complexity.

[5] Yoga is a traditional Indian exercise. It specifies various body postures called asanas, practicing them is beneficial for the physical, mental, and spiritual well-being. To support the yoga practitioners, there is a need of an expert yoga asanas recognition system that can automatically analyze practitioner's postures and could provide suitable posture correction instructions. This paper proposes YogNet, a multi-person yoga expert system for 20 asanas using a two-stream deep spatiotemporal neural network architecture. The first stream utilizes a keypoint detection approach to detect the practitioner's pose, followed by the formation of bounding boxes across the subject. The model then applies time distributed convolutional neural networks (CNNs) to extract frame-wise postural features, followed by regularized long short-term memory (LSTM) networks to give temporal predictions. The second stream utilizes 3D-CNNs for spatiotemporal feature extraction from RGB videos. Finally, the scores of two streams are fused using multiple fusion techniques. A yoga asana recognition database (YAR) containing 1206 videos is collected using a single 2D web camera for 367 min with the help of 16 participants and contains four view variations i.e. front, back, left, and right sides. The proposed system is novel as this is the earliest two-stream deep learning-based system that can perform multi-person yoga asanas recognition and correction in realtime. Simulation result reveals that YogNet system achieved 77.29%, 89.29%, and 96.31% accuracies using pose stream, RGB stream, and via fusion of both streams,

respectively. These results are impressive and sufficiently high for recommendation towards general adaption of the system.

## III. Diseño e implementación

### A. Conjunto de datos

Para el conjunto de datos se utilizó uno preexistente en la plataforma Kaggle conformada por más de 1500 imágenes distribuidas en cinco posturas de yoga: perro boca abajo (downdog), árbol (tree), tabla (plank), guerrero 2 (warrior2) y diosa (goddess) [6].

| Tipo de capa | Salida | # Parámetros |
|---|---|---|
| conv2D (capa de entrada) | (None, 146, 96, 32) | 832 |
| MaxPooling2D | (None, 73, 48, 32) | 0 |
| Conv2D | (None, 69, 44, 64) | 51264 |
| MaxPooling2D | (None, 34, 22, 64) | 0 |
| Conv2D | (None, 30, 18, 128) | 204928 |
| MaxPooling2D | (None, 15, 9, 128) | 0 |
| Flatten | (None, 17280) | 0 |
| Dense | (None, 1000) | 17281000 |
| Dense | (None, 5) | 5005 |
| Parámetros totales: 17,543,029 | | |
| Parámetros entrenables: 17,543,029 | | |
| Parámetros no entrenables: 0 | | |

TABLE I
Arquitectura de la red neuronal.

## IV. Resultados

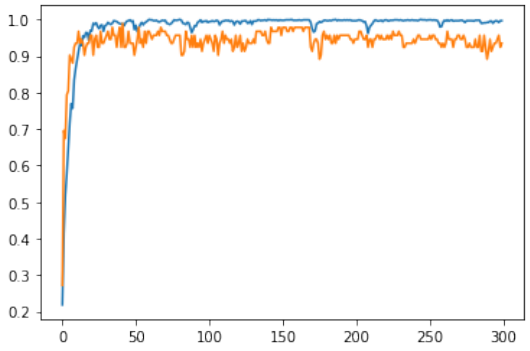


Fig. 1. Precisión del modelo, conjunto de entrenamiento (azul) vs conjunto de prueba (naranja).

## V. Conclusión y trabajo futuro

The conclusion goes here.

## Appendix A

Todo el código relacionado a este trabajo se encuentra en https://github.com/rakso-dev/TIA_proyecto.

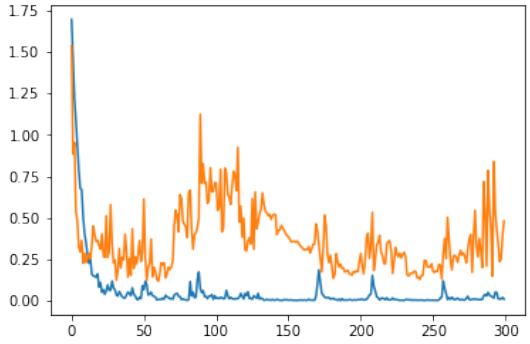


Fig. 2. Función de pérdida, conjunto de entrenamiento (azul) vs conjunto de prueba (naranja).

## References

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