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## Article

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# Biometric identification of Black Bengal goat: Unique iris pattern matching system vs. deep learning approach

Menalsh Laishram<sup>1</sup> , Satyendra Nath Mandal<sup>2</sup> , Avijit Halder<sup>3,\*</sup> , Shubhajyoti Das<sup>2</sup> , Santanu Bera<sup>1</sup> , Rajarshi Samanta<sup>1</sup> 

<sup>1</sup>Department of Livestock Production Management, West Bengal University of Animal and Fishery Sciences, Kolkata- 700037, West Bengal, India

<sup>2</sup>Department of Information Technology, Kalyani Government Engineering College, Kalyani, Nadia- 741235, West Bengal, India

<sup>3</sup>ICAR-Agricultural Technology Application Research Institute Kolkata, Indian Council of Agricultural Research, Kolkata, West Bengal, India

Correspondence: Avijit Halder, Tel: +91-8017325546, Fax: +91-33-23352355, Email: [vetavijit@gmail.com](mailto:vetavijit@gmail.com)

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## Abstract

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### Objective

Iris pattern recognition system is well developed and practiced in human, however, there is a scarcity of information on application of iris recognition system in animals at the field conditions where the major challenge is to capture a high quality iris image from a constantly moving non-cooperative animal even when restrained properly. The aim of the study was to validate and identify Black Bengal goat biometrically to improve animal management in its traceability system.

### Methods

Forty nine healthy, disease free, 3 months  $\pm$  6 days old female Black Bengal goats were randomly selected at the farmer's field. Eye images were captured from the left eye of an individual goat at 3, 6, 9 and 12 months of age using a specialized camera made for human iris

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scanner. iGoat software was used for matching the same individual goats at 3, 6, 9 and 12 months of ages. Resnet152V2 deep learning algorithm was further applied on same image sets to predict matching percentages using only captured eye images without extracting their iris features.

## **Results**

The matching threshold computed within and between goats was 55%. The accuracies of template matching of goats at 3, 6, 9 and 12 months of ages were recorded as 81.63%, 90.24%, 44.44% and 16.66%, respectively. As the accuracies of matching the goats at 9 and 12 months of ages were low and below the minimum threshold matching percentage, this process of iris pattern matching was not acceptable. The validation accuracies of resnet152V2 deep learning model were found 82.49%, 92.68%, 77.17% and 87.76% for identification of goat at 3, 6, 9 and 12 months of ages, respectively after training the model. Conclusion: This study strongly supported that deep learning method using eye images could be used as a signature for biometric identification of an individual goat.

**Keywords:** [Biometric Identification](#); [Black Bengal Goat](#); [Deep Learning](#); [Goat Identification](#); [Iris Image](#); [Iris Pattern Matching](#)