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PO-052 - (23739) - MUZZLE PATTERNS AS ANATOMICAL BIOMARKERS: AI-POWERED NON-INVASIVE IDENTIFICATION OF PHILIPPINE WATER BUFFALO

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The authors declare no conflicts of interest.

Accurate Philippine water buffalo (Carabao) identification is essential for health monitoring and farm management, but traditional methods (e.g., ear tagging, RFID bolus) are invasive, costly, and impractical for smallholder farmers. This study validates the Carabao muzzle pattern as a natural, stable anatomical marker for individual identification. Using computer vision and AI, we developed a biometric model that enhances livestock record-keeping while providing a non-invasive and scalable solution applicable for both large-scale and smallholder farming systems.
Muzzle images were collected using iPhone 11, iPhone 11 Pro, and Samsung S23. YOLOv8 detected and extracted muzzle regions, while ResNet50 with transfer learning analyzed ridge and groove patterns for biometric identification. Data augmentation (rotation, shifting, shear, zoom, flipping) improved model robustness. The model, trained on images from three carabaos, was tested on a separate dataset, achieving 97% accuracy. Data collection and testing were conducted with the Philippine Carabao Center.
Carabao muzzle patterns proved highly unique and stable, confirming their viability as a biometric identifier. The AI model

correctly matched 35 out of 36 test images, achieving 97% accuracy in individual identification with one misidentification. This study establishes the carabao muzzle pattern as a reliable, non-invasive, and cost-effective alternative to traditional methods. However, image quality remains a key limitation, as blurring from animal movement and muzzle obstructions (e.g., feed material) can reduce accuracy. Further improvements in image capture protocols, dataset expansion, and model refinement are needed for broader adoption, in farming systems.

Palavras-chave : Carabao, Muzzle Pattern, Artificial Intelligence