

Cloud computing system for automatic individual animal phenotyping: body condition score and animal identification case study

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Background

- Computer vision is a growing field in precision livestock
- Deep neural networks (DNN) are complex algorithms that allow computers to perform impressive cognitive tasks such as understanding and detecting objects in an image
- DNNs are very useful in precision livestock applications
- A fully automated computer vision system is essential for large-scale operations (from image acquisition to processing and data visualization)

Camera System



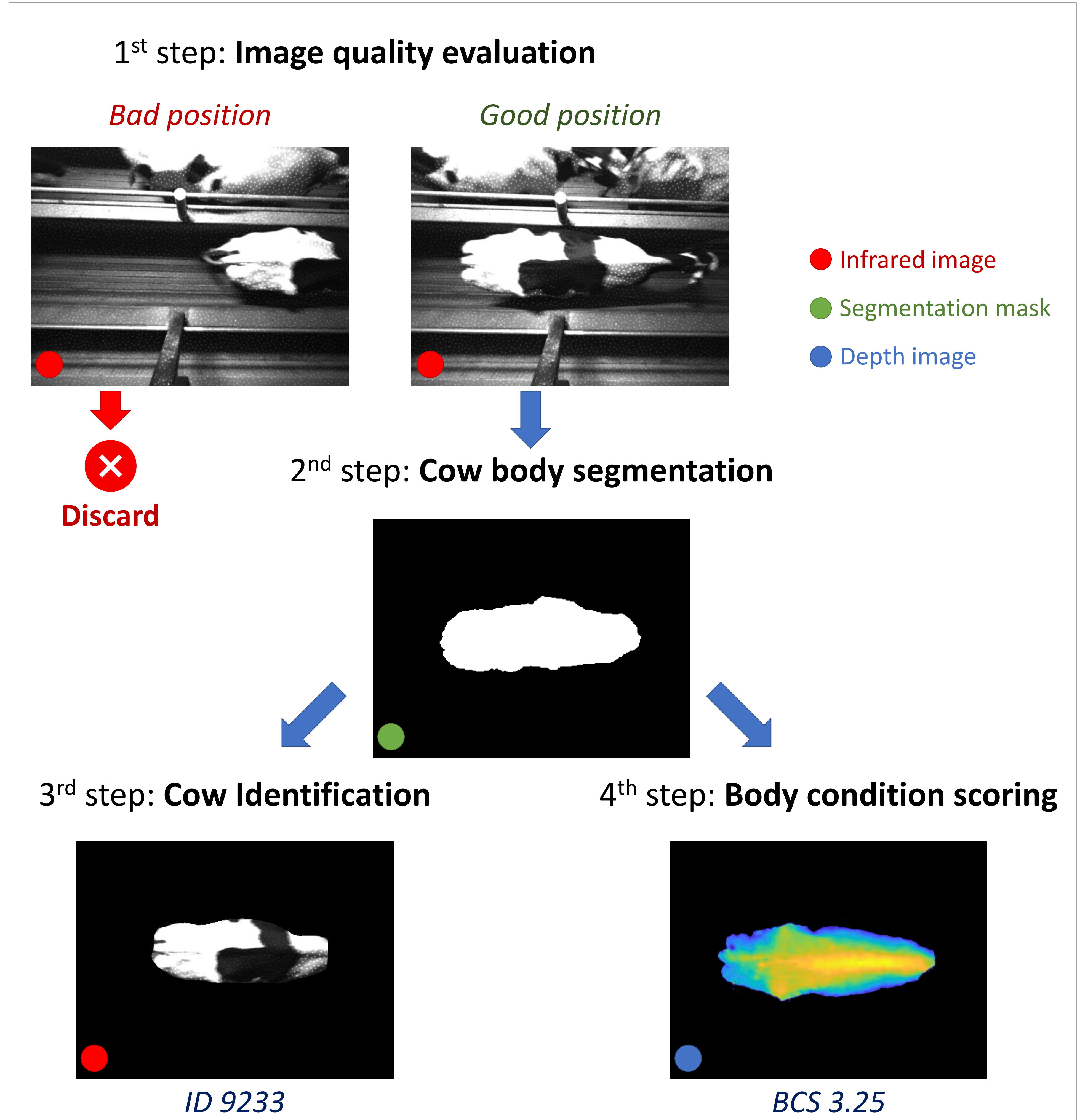
Objective

- Develop a modularized cloud computing-based framework that integrates images captured at the farm with real-time individual animal phenotyping
- Animal identification and body condition score case study

Material and Methods

- Four BCS were evaluated from 59 lactating Holstein cows in two-week intervals
- The images were captured using an automated system installed at the milking parlor exit lanes
- The whole pipeline is performed on the cloud and consists of four different steps:
 1. **Image quality evaluation:** an image classifier (Xception architecture) detects whether the cow is poorly positioned in the image so it can be filtered out of the dataset;
 2. **Cow body segmentation:** an image segmentation algorithm (U-Net architecture) removes background and keeps just pixels containing the cow's body;
 3. **Cow identification:** an image classifier (Xception architecture) identifies which cow is in the image based on her coat color pattern;
 4. **Body condition scoring:** an image classifier (Xception architecture) scores the cow's body condition using segmented depth images.

Proposed Framework



Results

- From a total of 52,247 snapshots, 32,655 were discarded in step 1, and only the remaining 19,592 were evaluated, saving processing time and storage usage
- The cow identifier network identified cows in an independent test set with an accuracy of 94%
- The body condition scoring network scored the correct BCS from an independent test set with an accuracy of 71%, and 0.20 MAE

Final Considerations

- Fully automate the pipeline for image analysis (capturing, storing and analyzing the data)
- Remote improvement and deployment (cloud platform)
- Independent modules and APIs (facilitates the development of new tools and data integration)