

Automatic position correction using center estimation for cereal images

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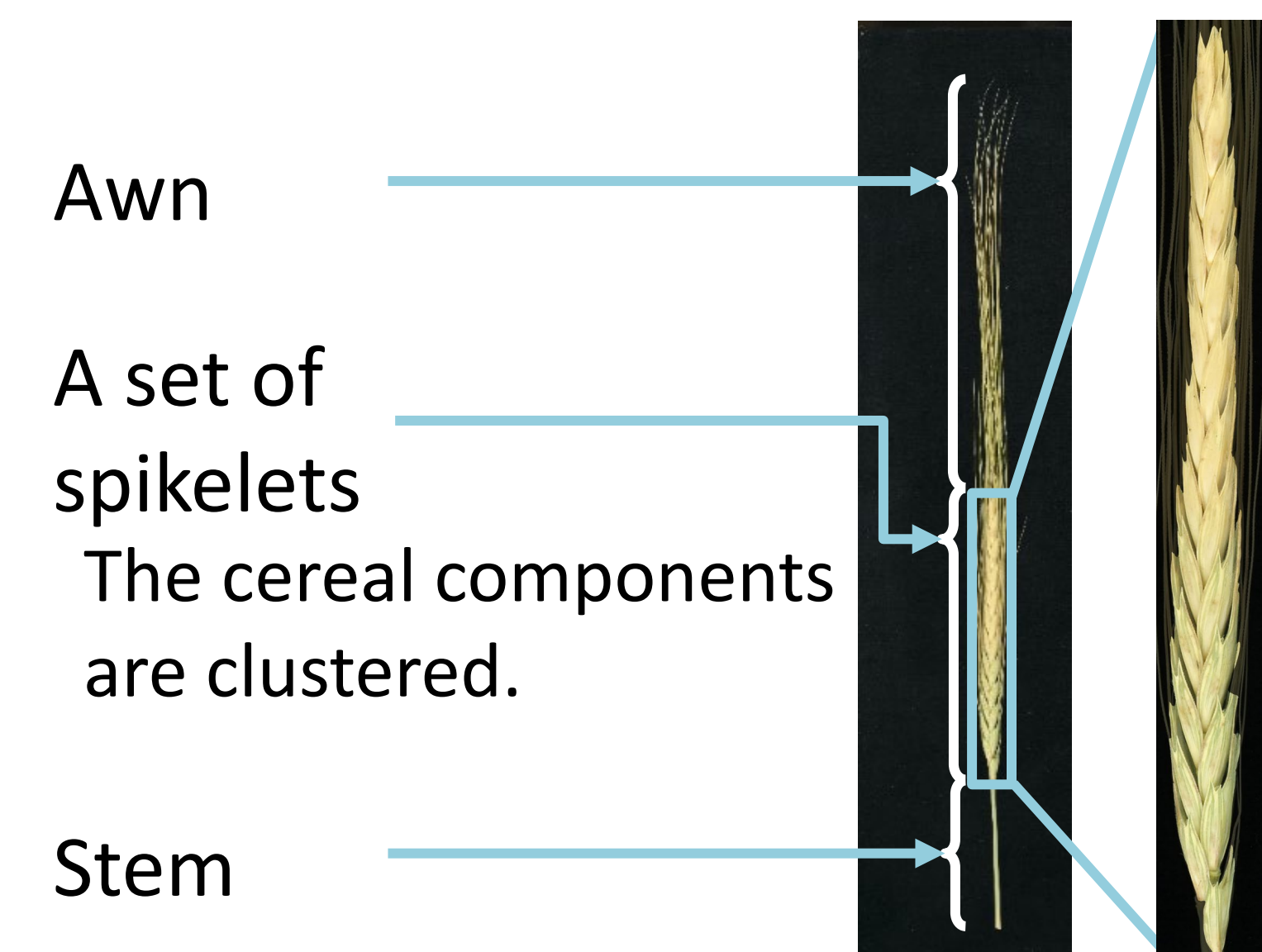


Introduction

We propose a method to automatically correct the misalignment by estimating the center position of a set of spikelets from a cereal image using a class activation map (CAM).

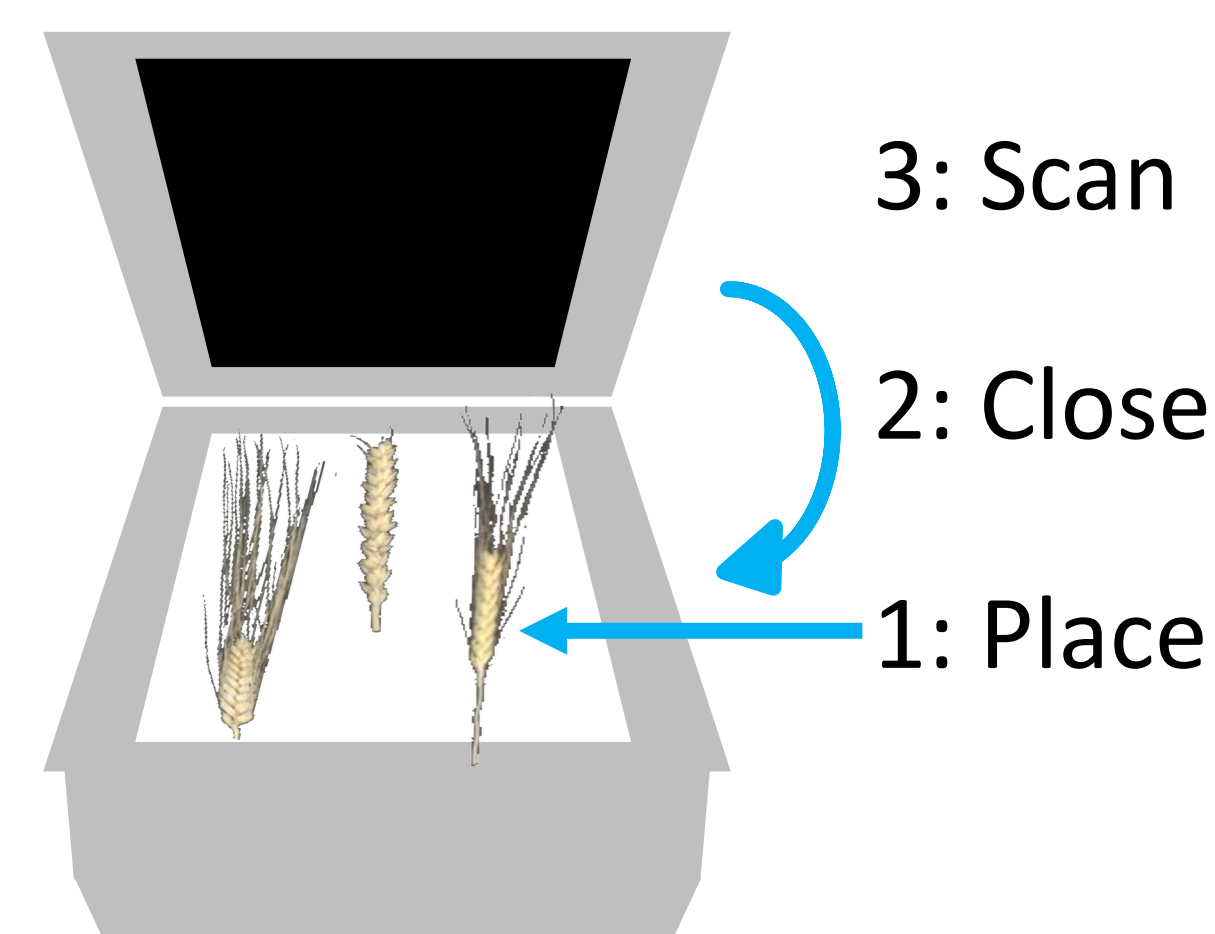
Cereal image

There is a significant demand for cereals such as barley and wheat.



Cereal image acquisition

Non-experts place the individual cereal spike on the scanner stand, close the scanner cover, and scan it.



Issue

Each acquired image is misaligned depending on how the individual cereal spike is placed and how the scanner cover is closed.



Goal

The center position of the set of spikelets should be constant without shifting.



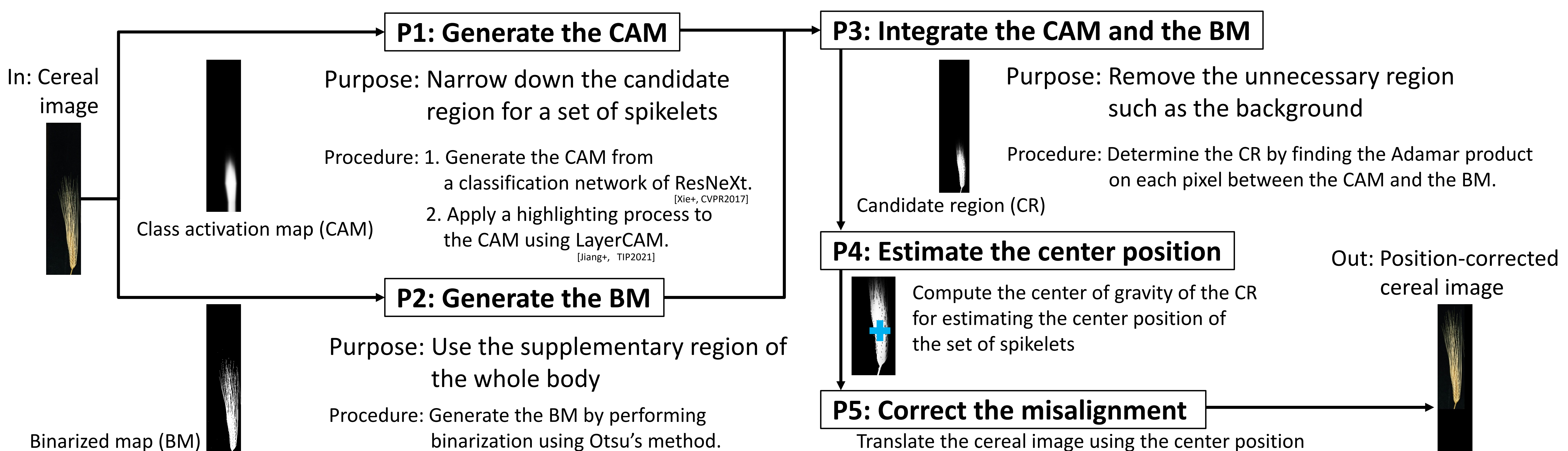
Cereal images after position correction

When expert agronomists analyze the appearance characteristics of cereal species, they focus on a set of spikelets in a cereal spike.

Our method

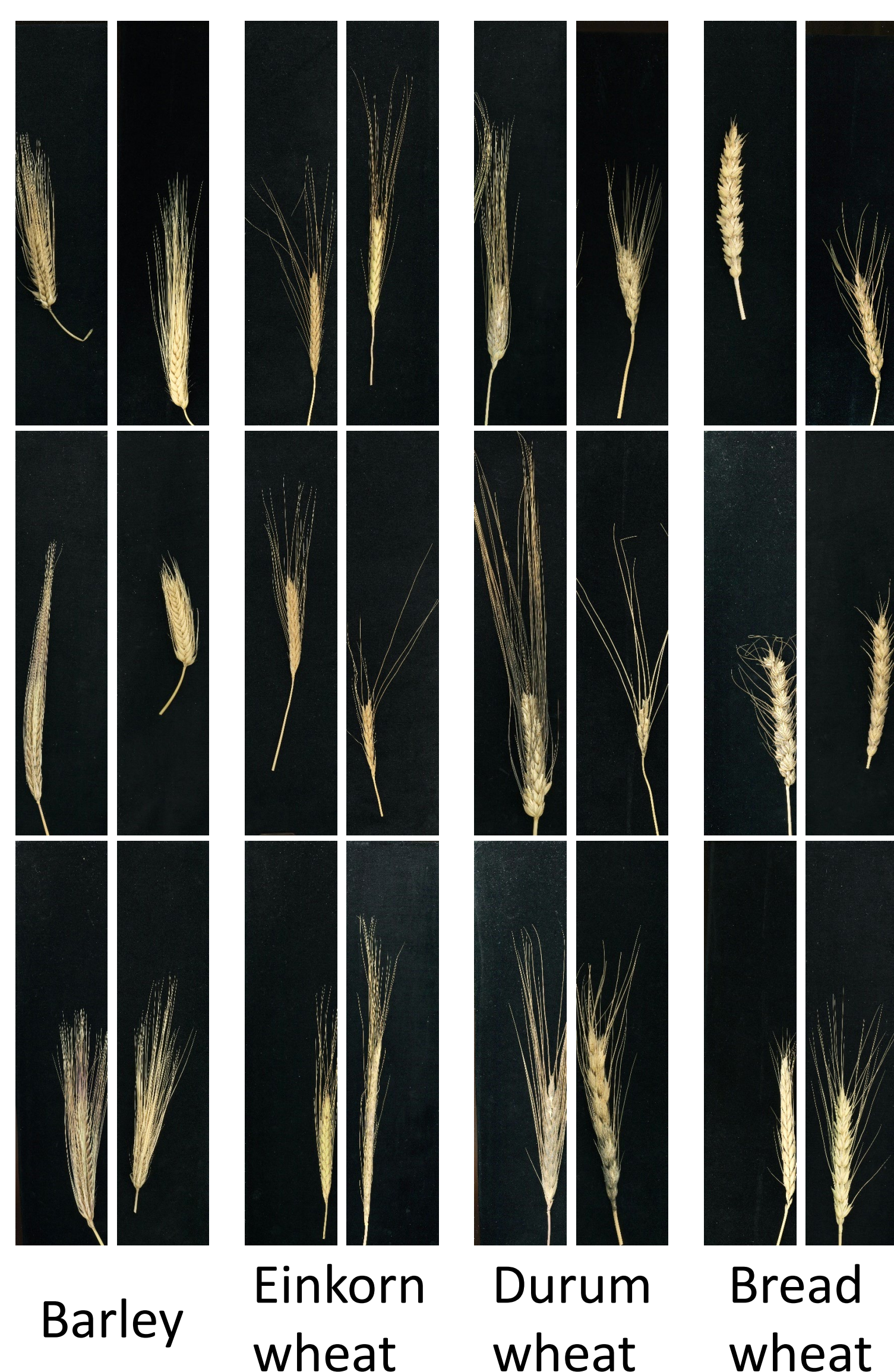
Key idea: Center estimation and position correction using the CAM of cereal species classification

Observation: The CAM responds near a set of spikelets in classification deep neural networks.

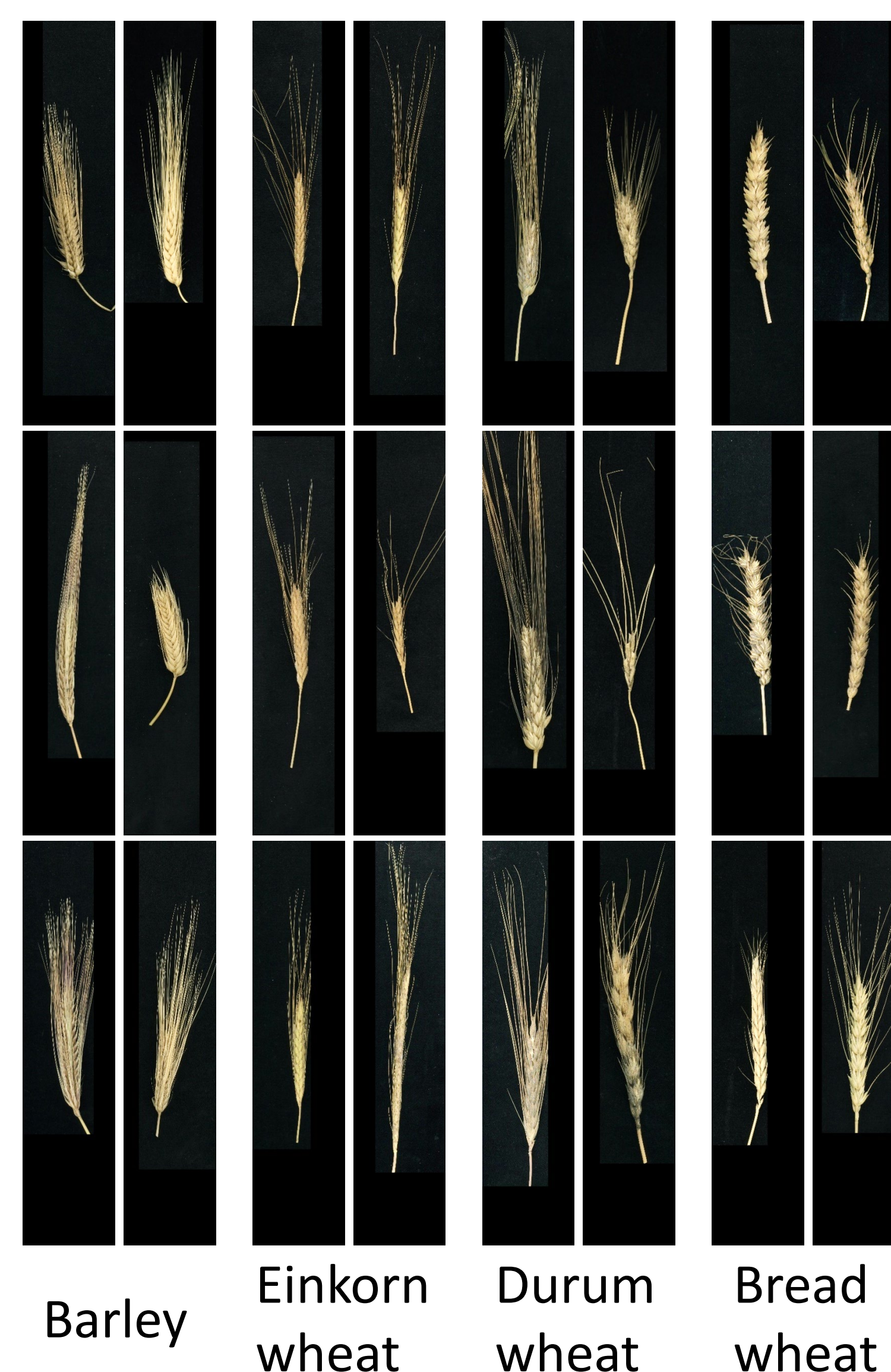


Experiments

Images acquired by non-experts

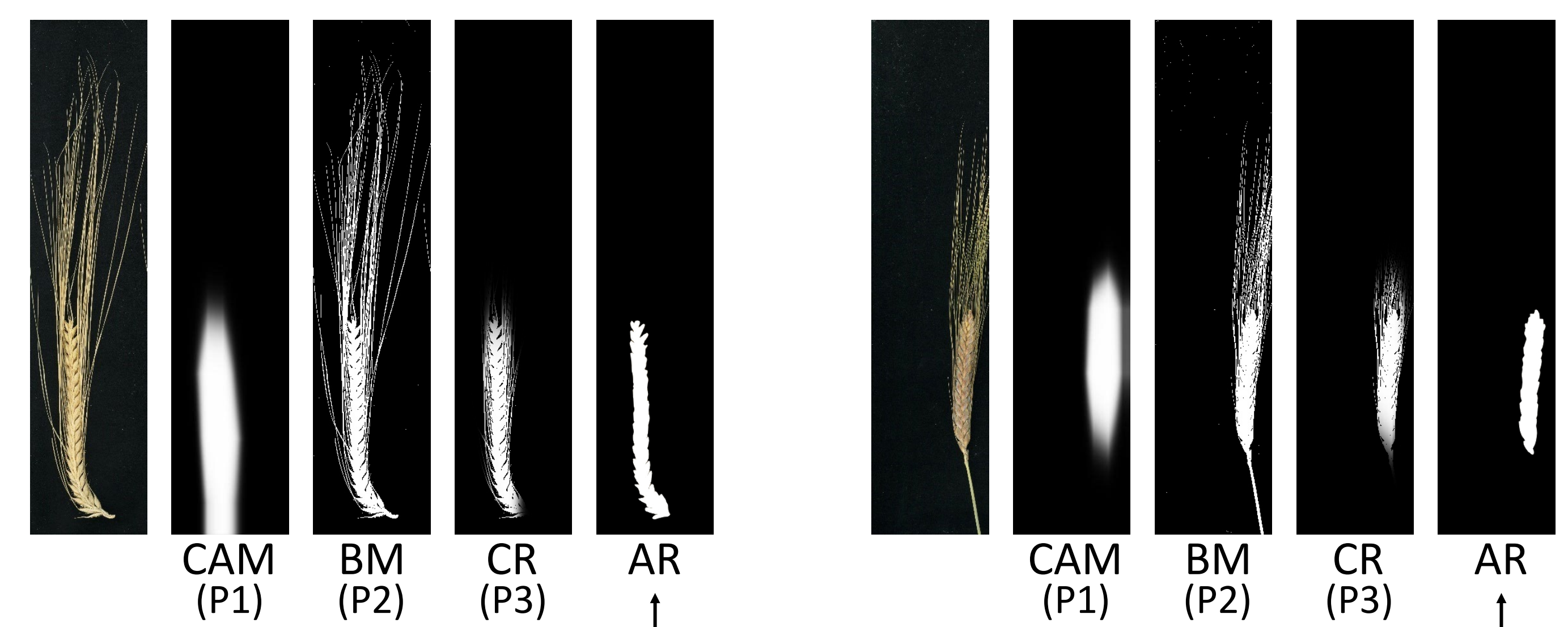


Images after position correction



Our method showed better alignment of the set of spikelets compared to that acquired by non-experts.

Effectiveness of the CAM and the BM



The CR generated by our method was similar to the manually annotated region.

Estimation error of the center position

The cereal image acquired by non-experts with no further processing

Method	Error [pixels]
Baseline	178±54
Our method	29±21

- Size: 800×182 [pixels]
- Number of test images: 153 [images]×4 [species] = 612
- Evaluation metrics: Root Mean Squared Error (RMSE)
- Correct value of the center position: The center of the gravity of the annotated region (AR)

Our method significantly reduces the estimation error.