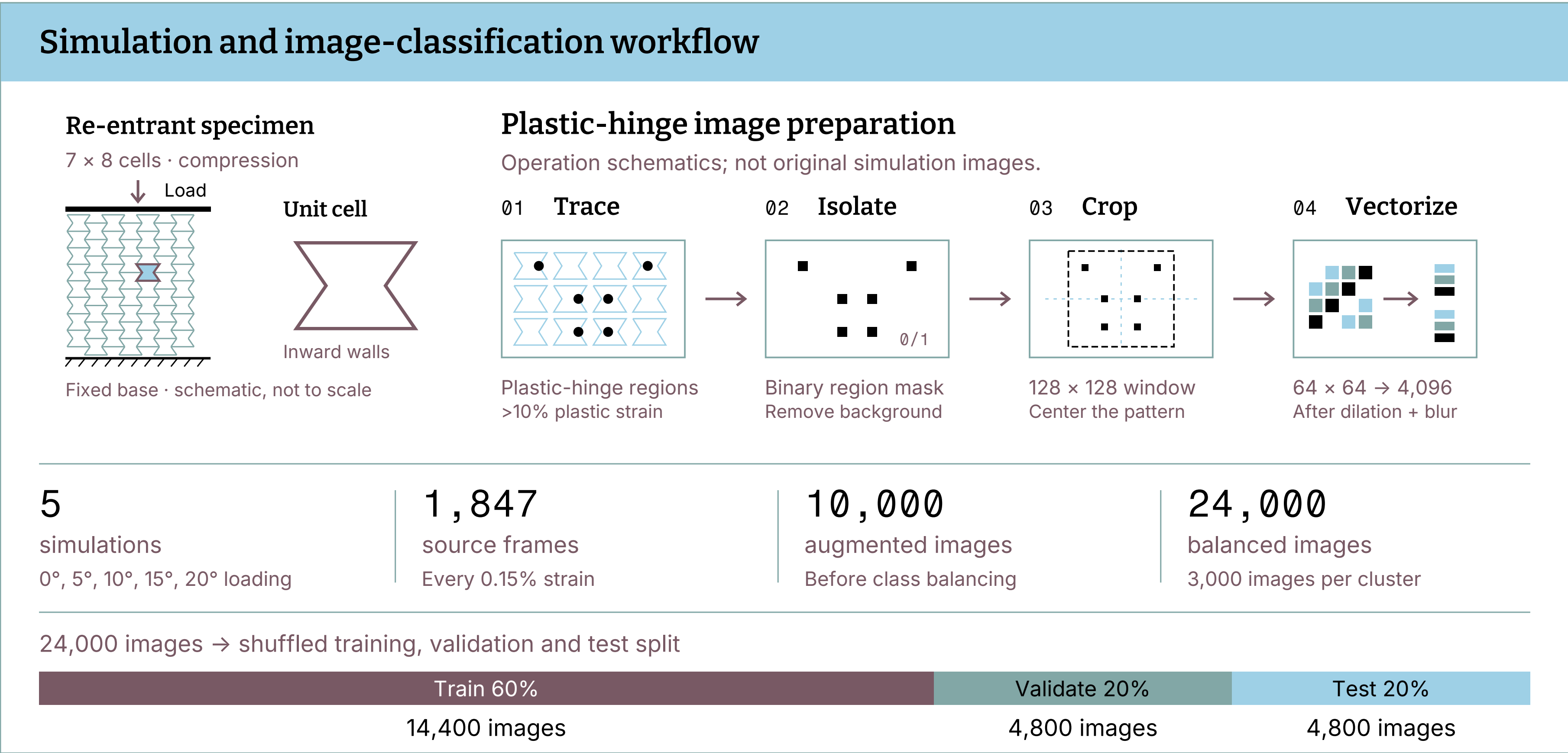


Classifying auxetic deformation

The study groups plastic-hinge images from five simulations into eight clusters. A classifier predicts those image labels; mechanical interpretation relates the clusters to deformation modes.



Simulation conditions

A 7 × 8-cell steel honeycomb is compressed at 0°, 5°, 10°, 15° and 20°. These runs contribute 293, 366, 347, 386 and 455 frames. Regions above 10% equivalent plastic strain guide hinge tracing. More images do not mean more independent runs: augmentation changes the examples, not their physical origin.

Image preparation and classification

The strip explains tracing, isolation, cropping and vectorization; the diagrams are illustrative. The paper uses dilation and Gaussian blur before flattening 64 × 64 images. Elbow analysis selects eight K-means groups. A logistic classifier learns these labels with cross-entropy and SGD: batch size 64, 100 epochs, learning rate 0.001.

Evaluation and limitations

Test agreement is 88.08% with image cluster labels. Separately, four of six reference mechanisms are recovered; y and horizontal V are absent. Neither result establishes generalization to unseen simulations. Proposed next test: hold out entire simulations before augmentation, then ask independent experts to assess the mechanical interpretations. This evaluation was not reported.

