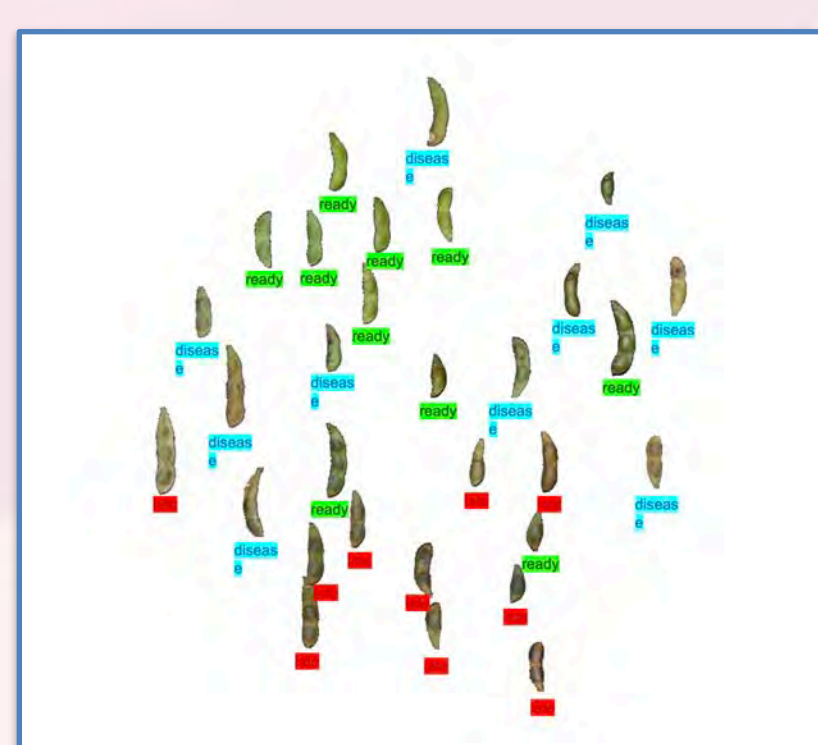# CIFellows 2020-2021

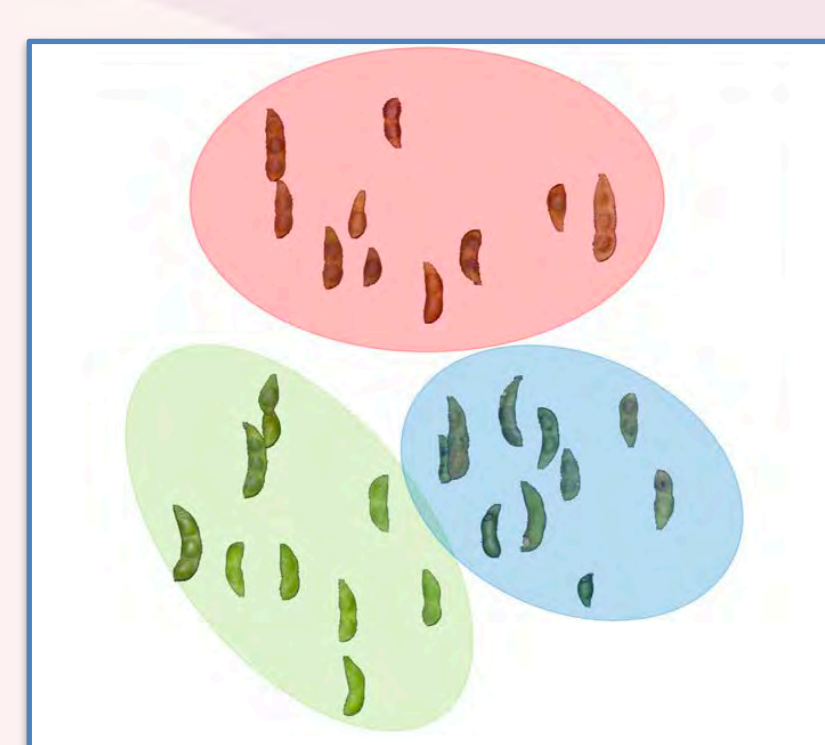## Rebecca Faust

Virginia Tech

Interactive Dimension Reduction with Explainable Deep Learning for Image Sorting

Problem

Dimension reductions (DR's) provide 2D organizations of images based on visual features. However, the DR layout may not match the given task.
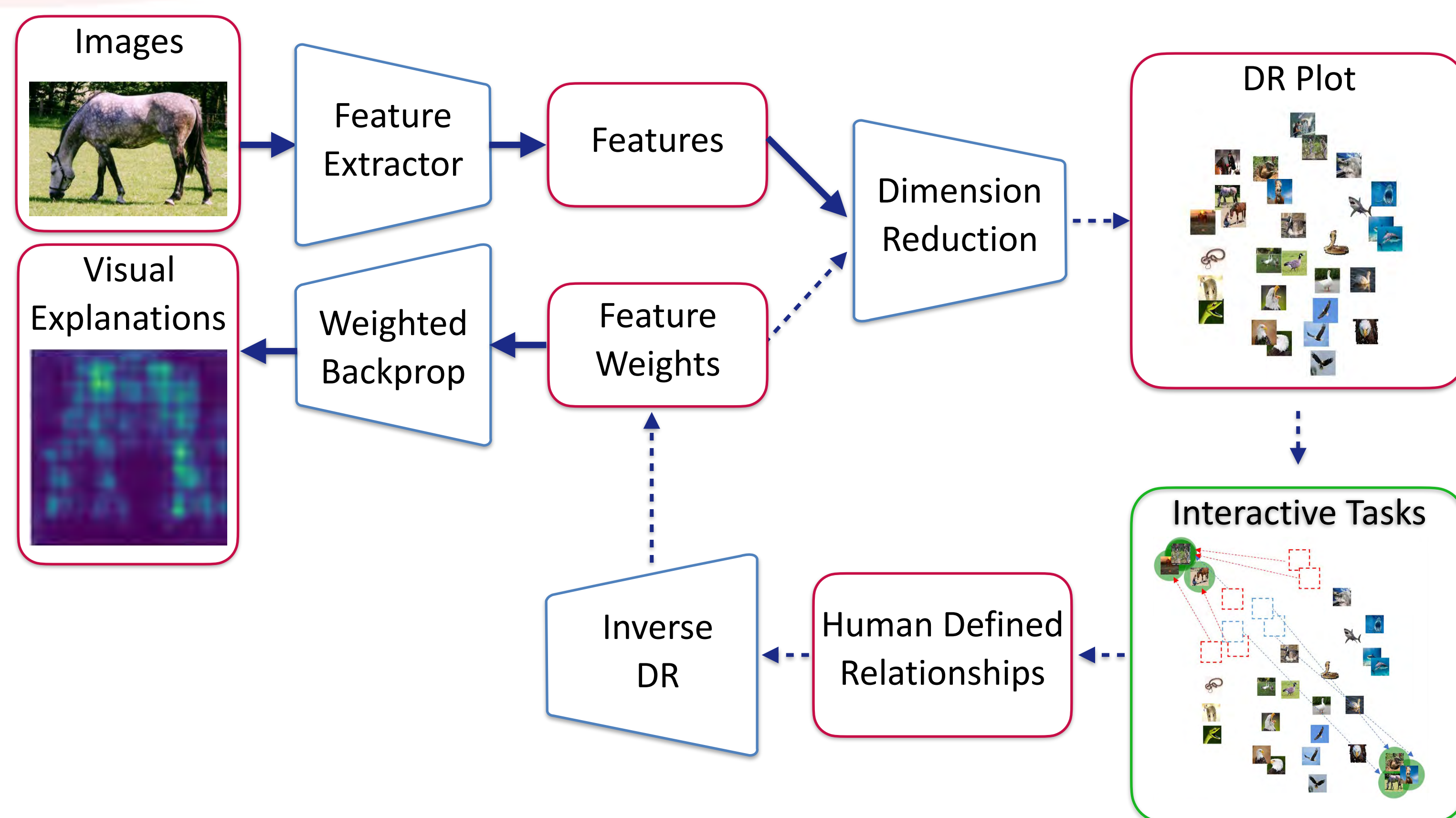


Initial Projection

Ideal Projection

Process Overview

We developed an interactive DR method for images using deep learning features that allows people to interactively steer projections based on prior knowledge and view visual explanations highlighting image features that are important to the current projection.

Feature Extraction & Weighted Visual Backpropagation

We use RESNET-18 to extract high dimensional features from images and adapt Bojarski et al.'s visual backpropagation method to create visual explanations of features of importance under the current DR.
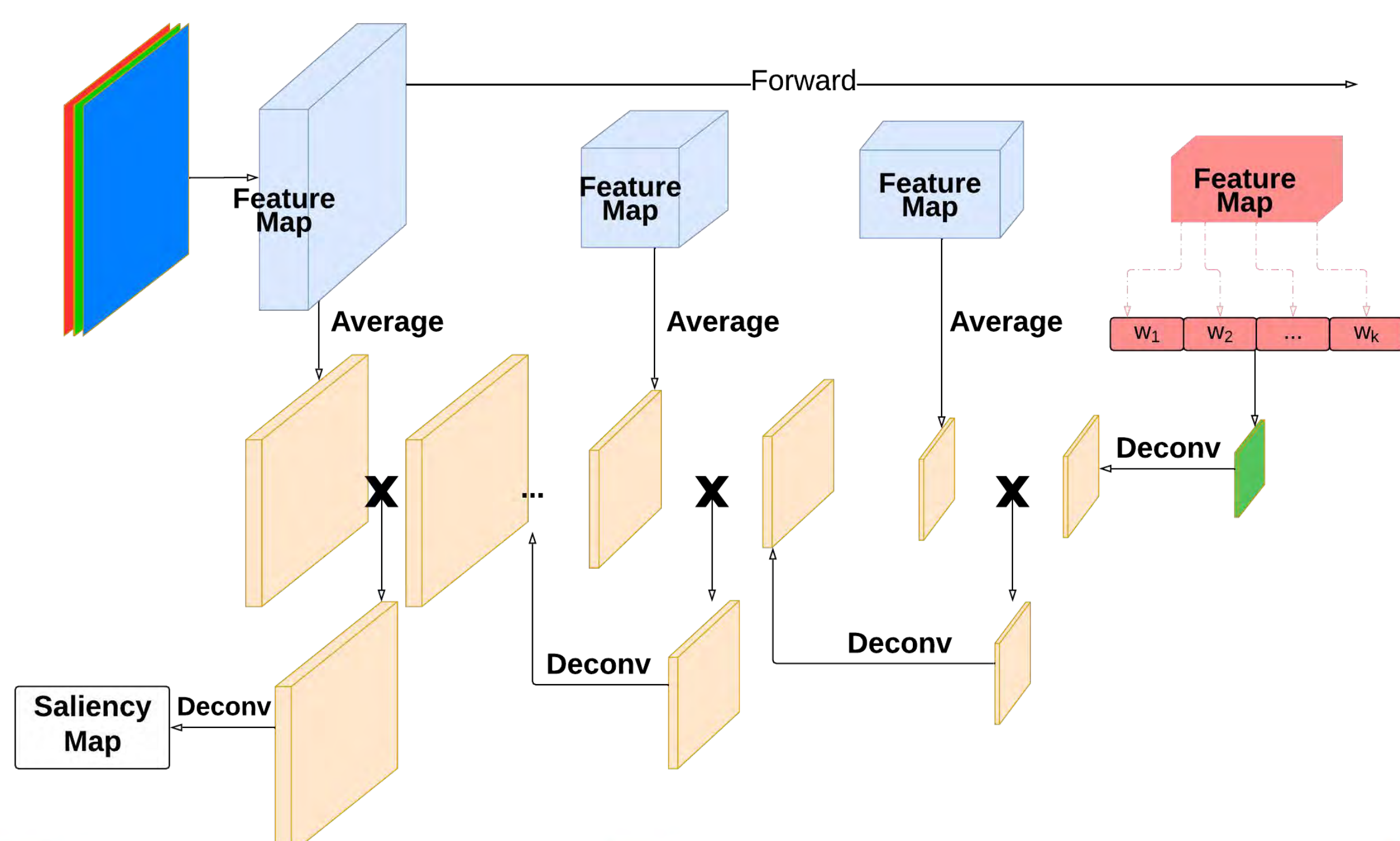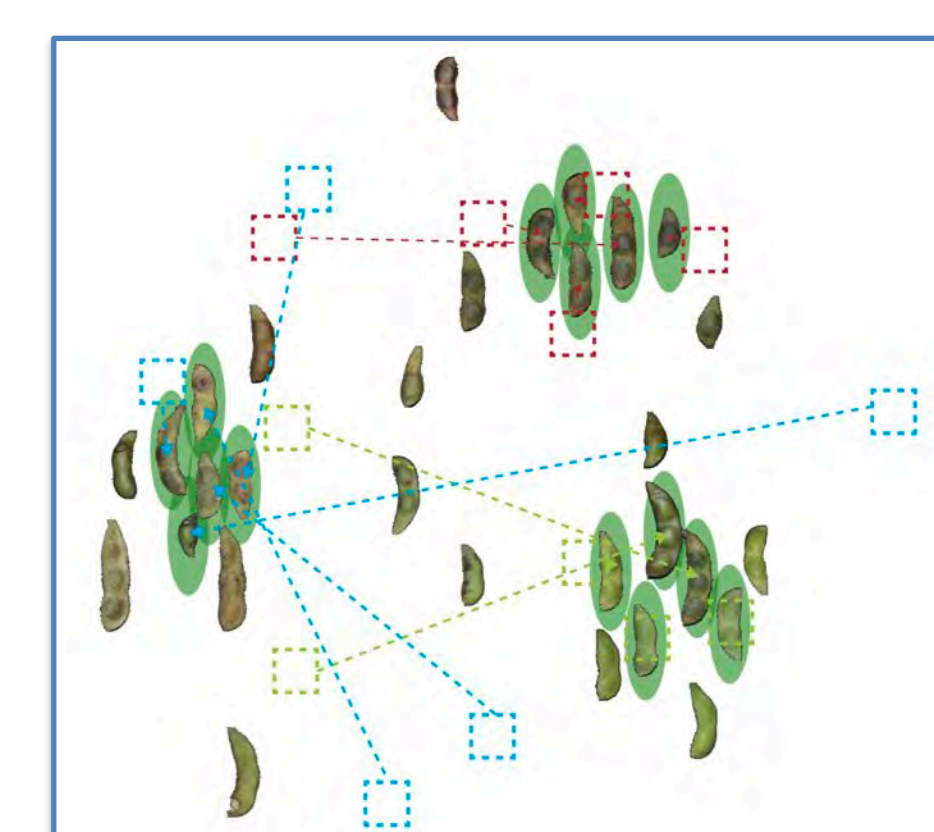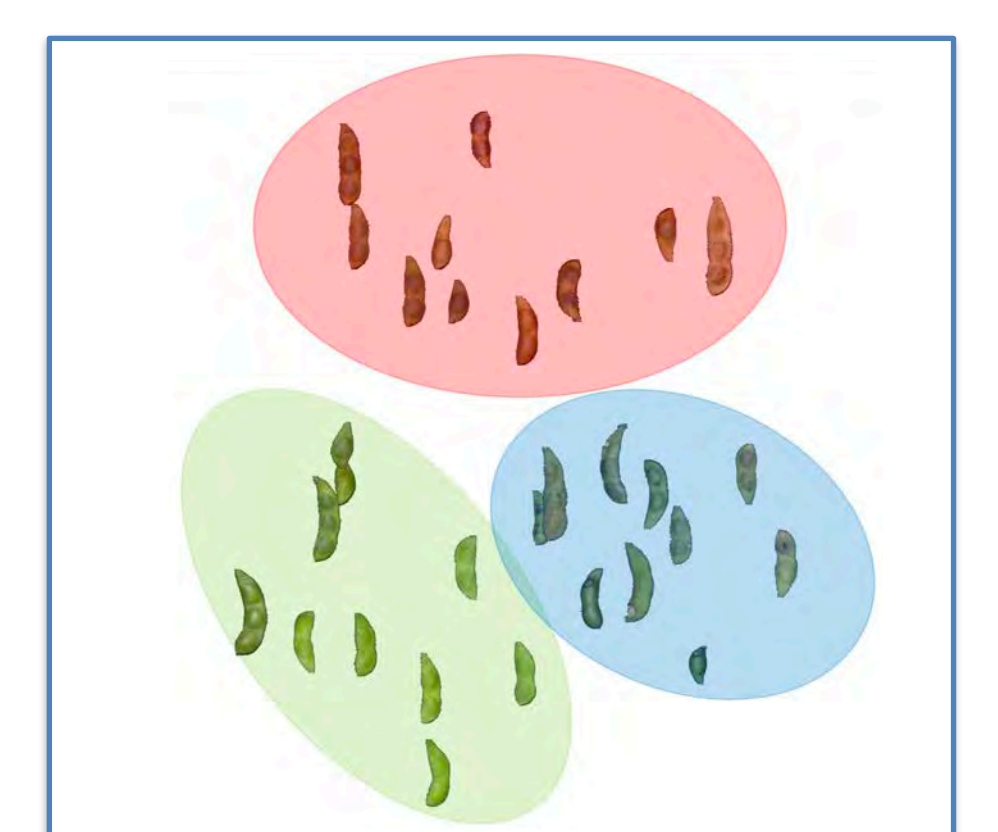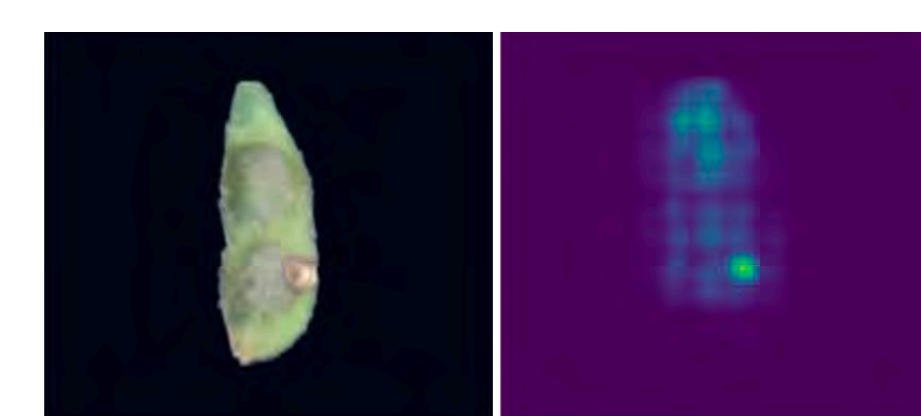

Results

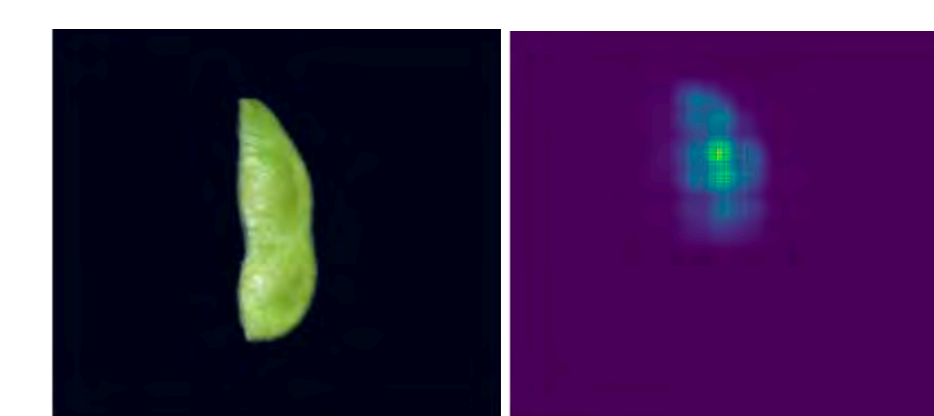Images of Soybeans:

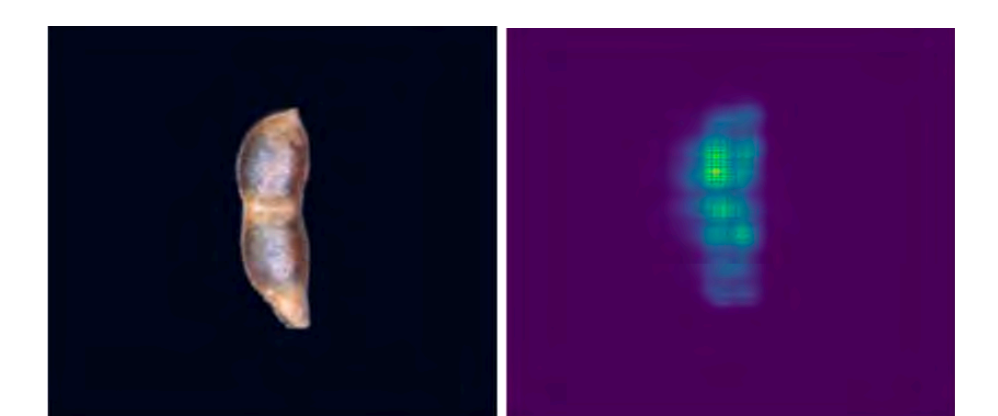(a) Initial Layout (b) Interaction (c) Updated Layout

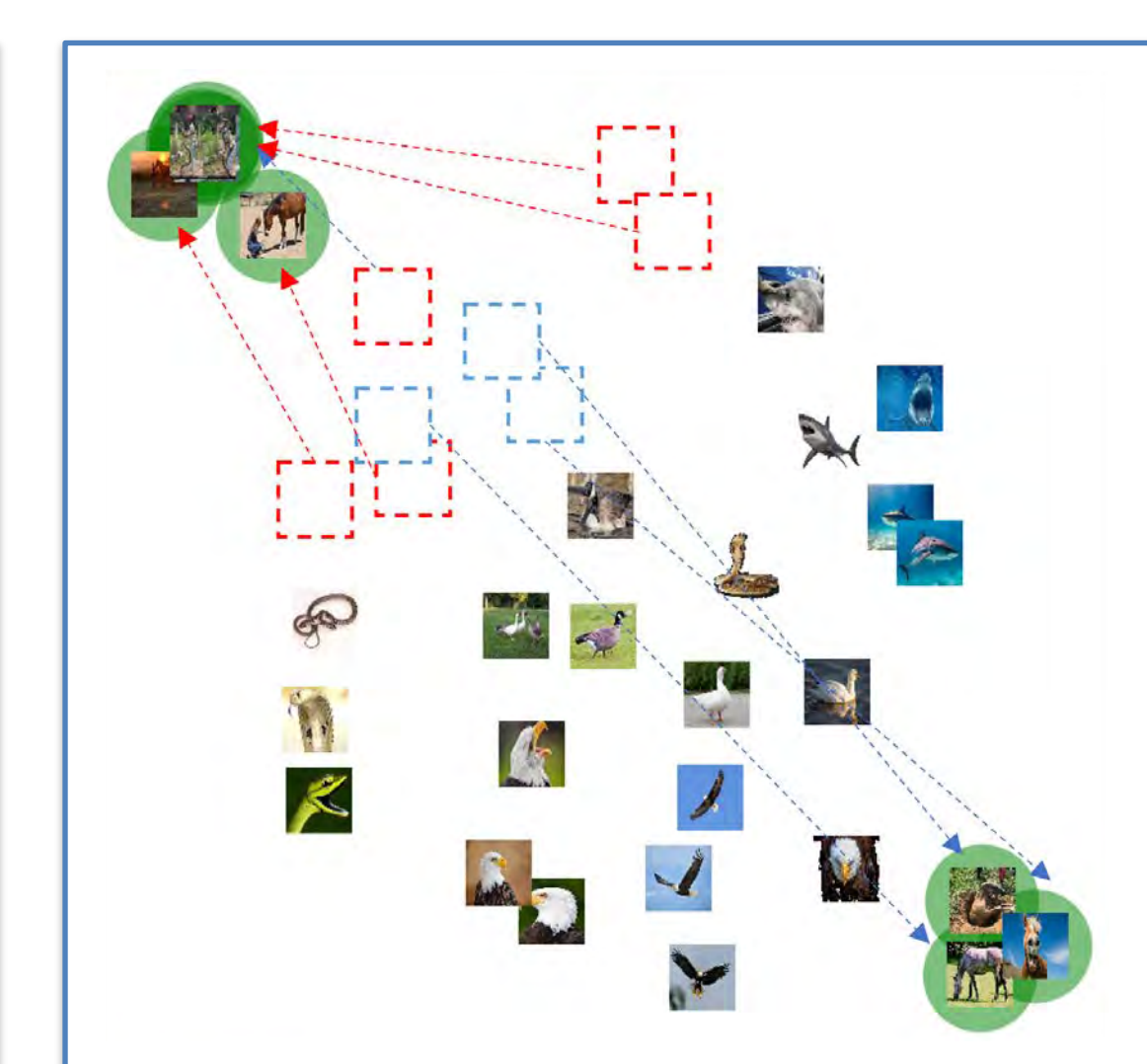(d) Diseased Pod (e) Ready-to-Harvest Pod (f) Late-to-Harvest Pod

The images of soybeans fall into three categories: ready-to-harvest, late-to-harvest, and diseased. The user interaction aims to teach the projection how to differentiate between the three categories.
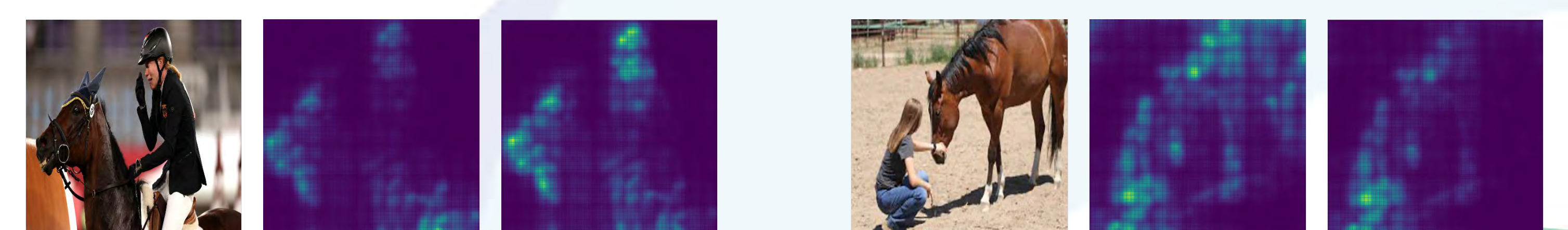
Images of Animals:

(a) Initial Layout (b) Interaction (c) Updated Layout

(d) Visual Explanations Before and After Interaction

The data contains 5 types of animals, some with humans in the picture. The interaction aims to teach the projection how to differentiate between images with and without humans.

References

[1] Han, H., Faust, R., Norambuena, B.F.K., Prabhu, R., Smith, T., North, C., 2022. Interactive Dimension Reduction with Explainable Deep Learning for Image Sorting. Submitted to IEEE VIS 2022.
[2] Bojarski, M., Choromanska, A., Choromanski, K., Firner, B., Jackel, L., Muller, U. and Zieba, K., 2016. Visualbackprop: efficient visualization of cnns. *arXiv preprint arXiv:1611.05418.*