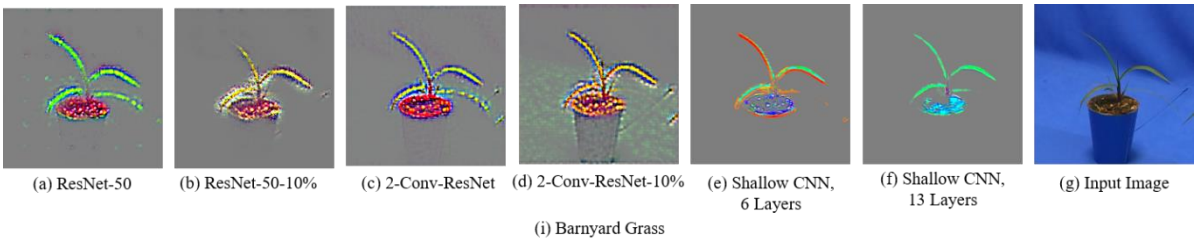
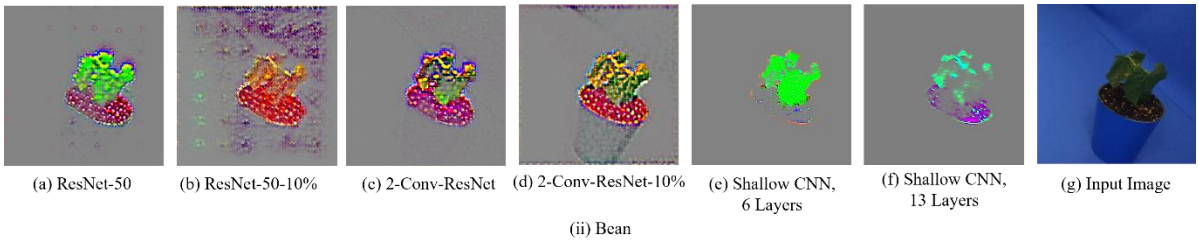
Visualizing Feature Maps for Model Selection in Convolutional Neural Networks



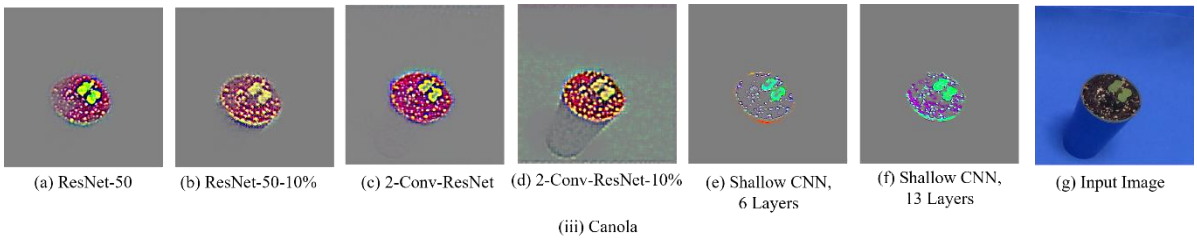
(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

(i) Barnyard Grass



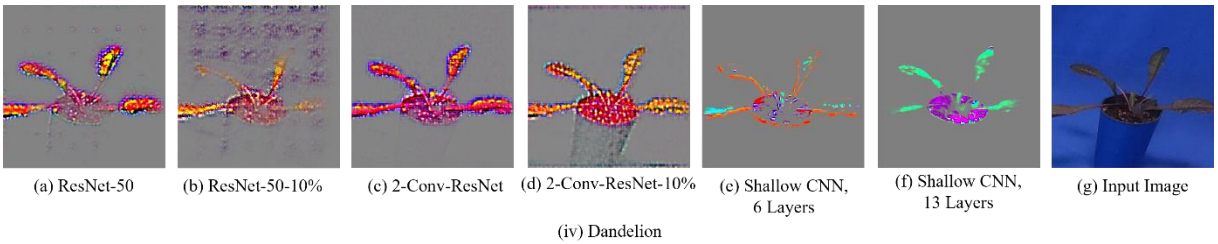
(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

(ii) Bean



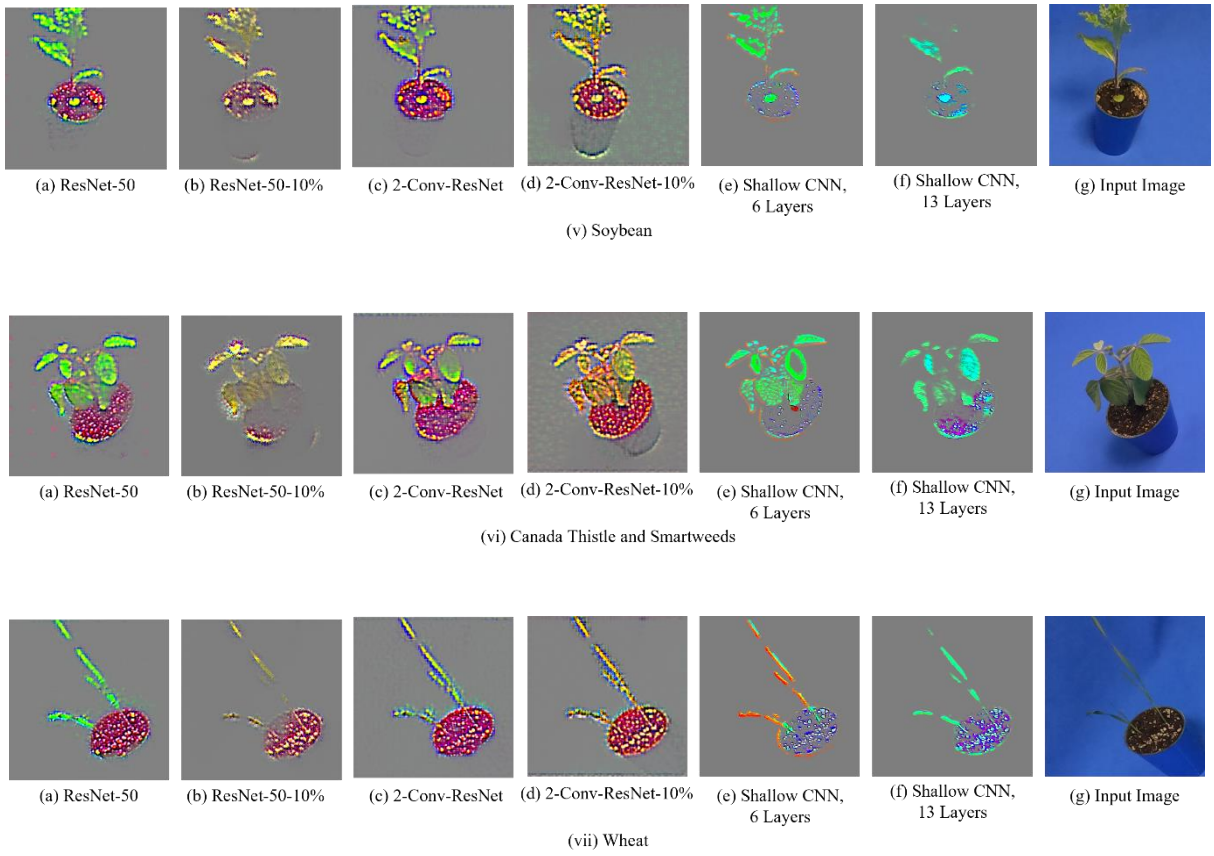
(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

(iii) Canola

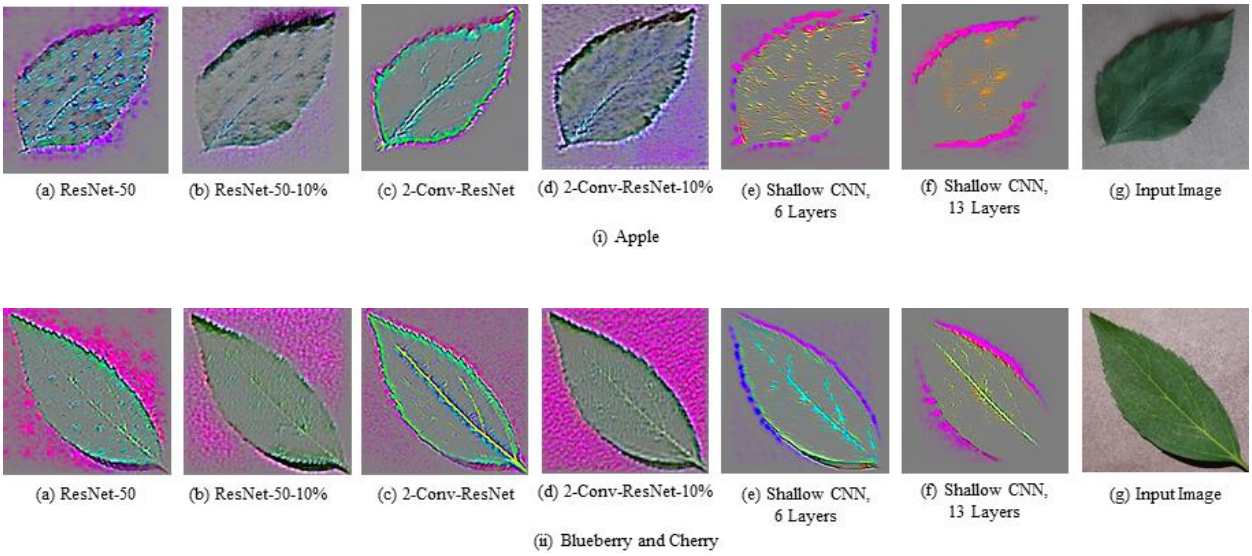


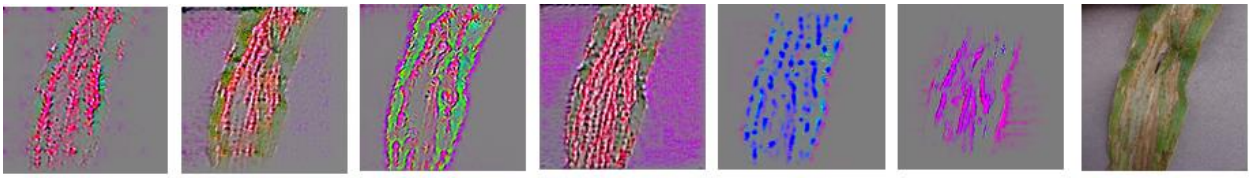
(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

(iv) Dandelion



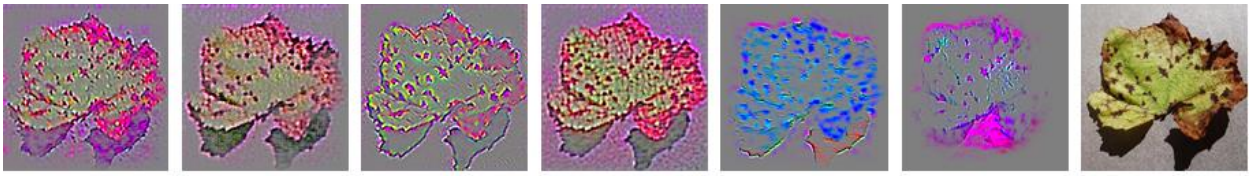
Supplementary Figure 1: GBP visualization of the last convolutional layer of different CNN models for different classes of the Weedling dataset.





(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

(iii) Corn

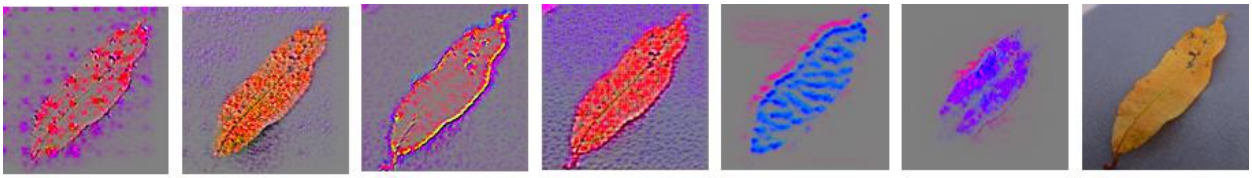


(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

(iv) Grape

(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

(v) Orange



(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

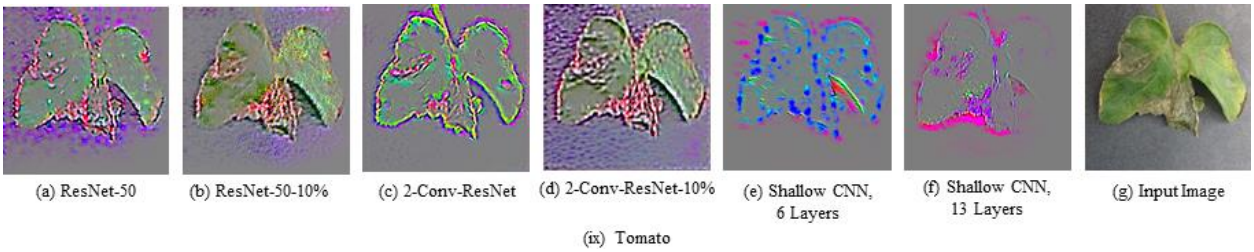
(vi) Peach and Pepper

(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

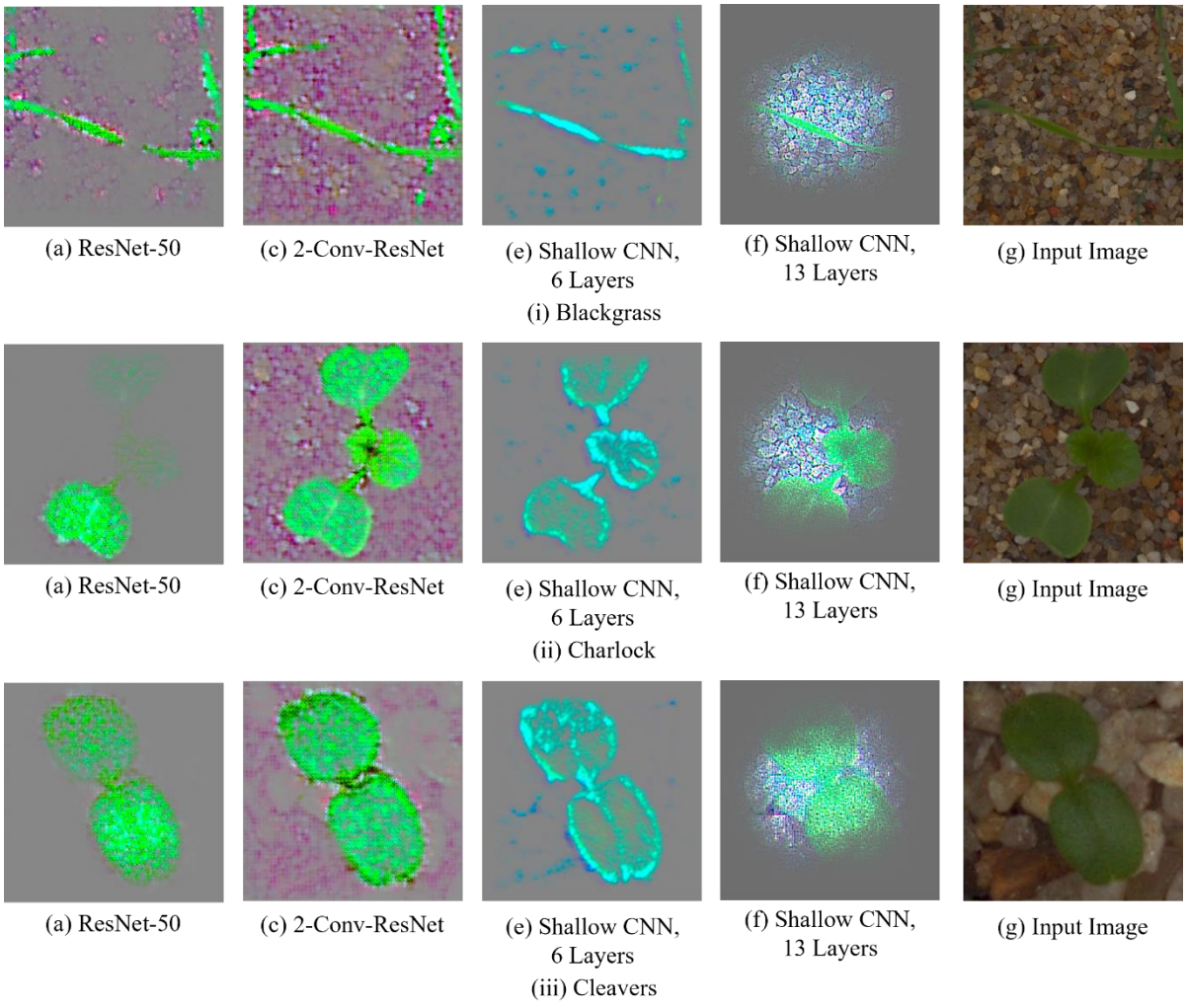
(vii) Soybean

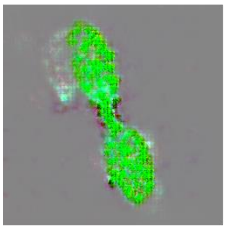
(a) ResNet-50 (b) ResNet-50-10% (c) 2-Conv-ResNet (d) 2-Conv-ResNet-10% (e) Shallow CNN, 6 Layers (f) Shallow CNN, 13 Layers (g) Input Image

(viii) Strawberry and Squash

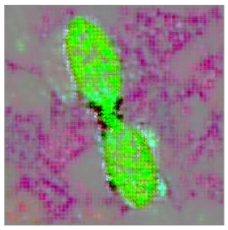


Supplementary Figure 2: GBP visualization of the last convolutional layer of different CNN models for different classes of the Plant Village dataset.

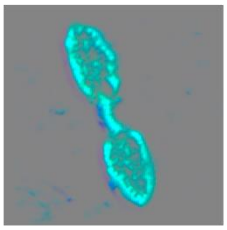




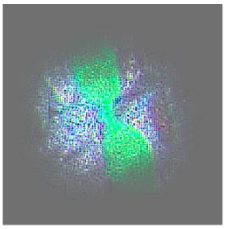
(a) ResNet-50



(c) 2-Conv-ResNet



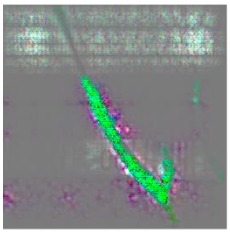
(e) Shallow CNN, 6 Layers



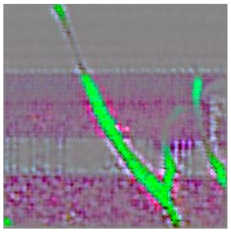
(f) Shallow CNN, 13 Layers

(g) Input Image

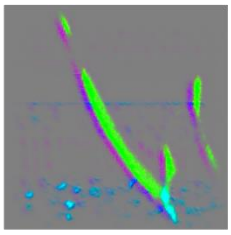
(iv) Chickweed



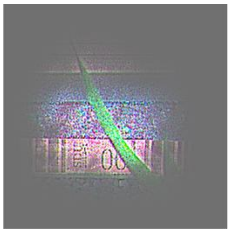
(a) ResNet-50



(c) 2-Conv-ResNet



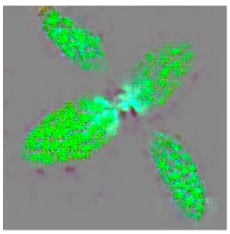
(e) Shallow CNN, 6 Layers



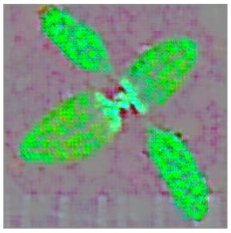
(f) Shallow CNN, 13 Layers

(g) Input Image

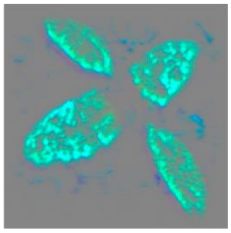
(v) Wheat



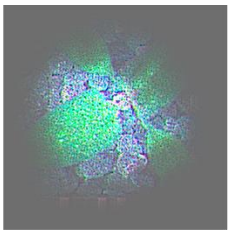
(a) ResNet-50



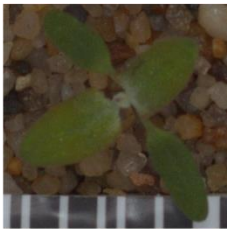
(c) 2-Conv-ResNet



(e) Shallow CNN, 6 Layers

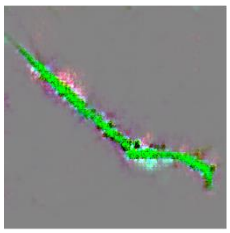


(f) Shallow CNN, 13 Layers

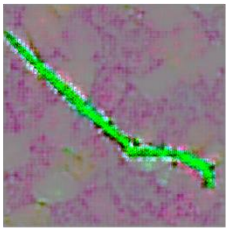


(g) Input Image

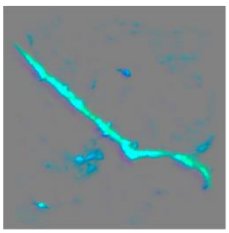
(vi) Fat hen



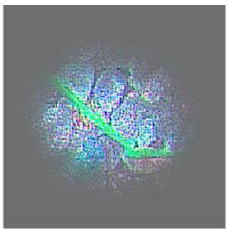
(a) ResNet-50



(c) 2-Conv-ResNet



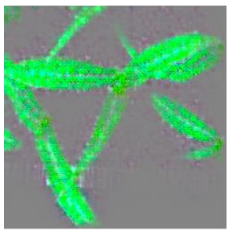
(e) Shallow CNN, 6 Layers



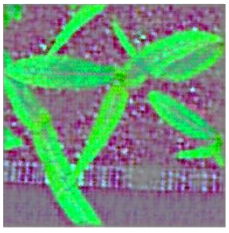
(f) Shallow CNN, 13 Layers

(g) Input Image

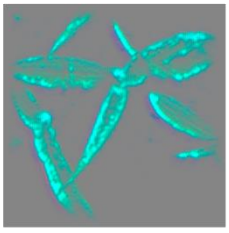
(vii) Loose silky-bent



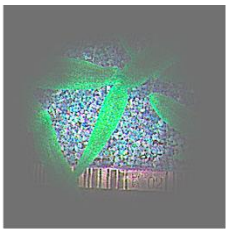
(a) ResNet-50



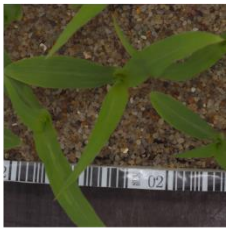
(c) 2-Conv-ResNet



(e) Shallow CNN, 6 Layers

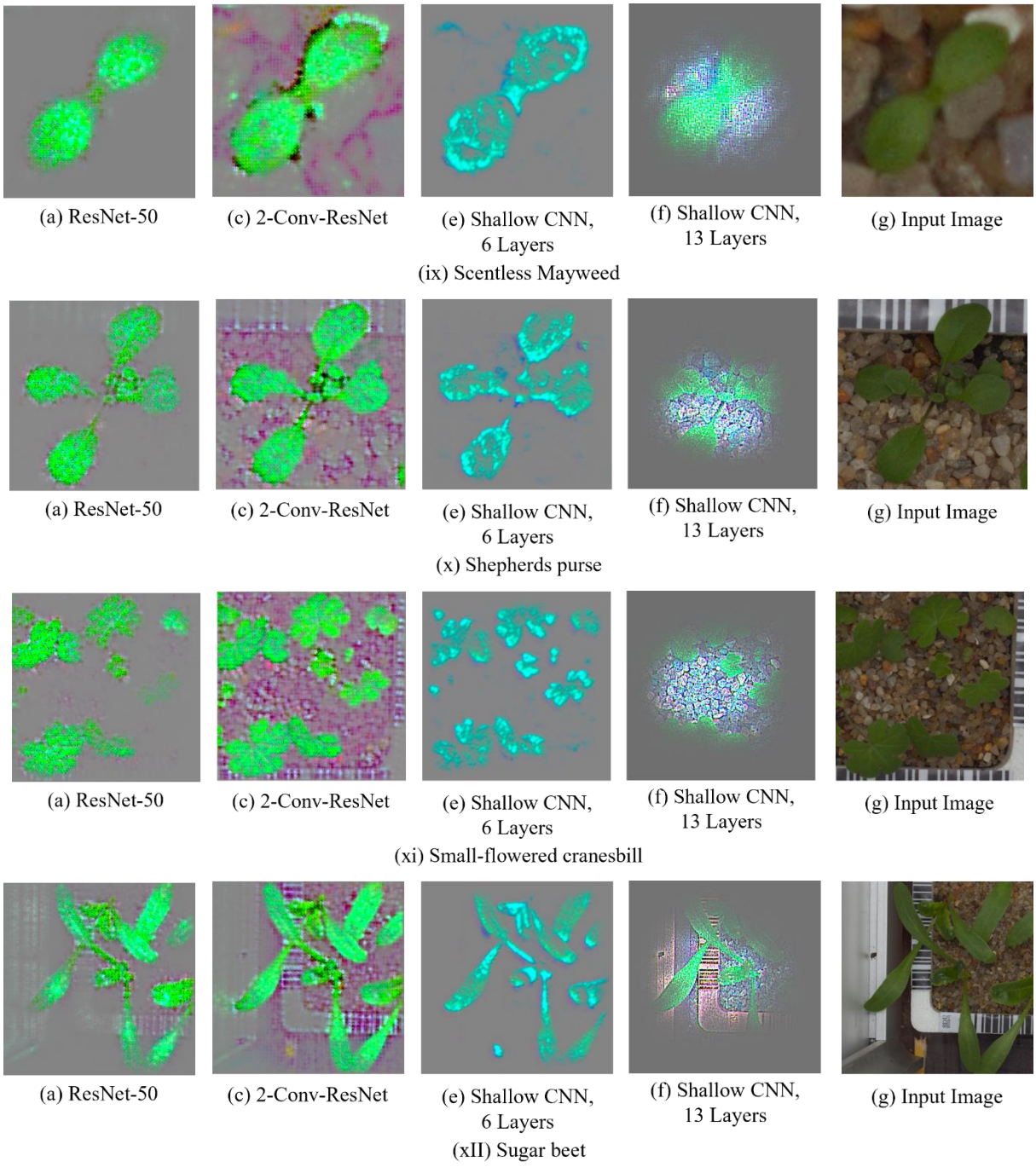


(f) Shallow CNN, 13 Layers

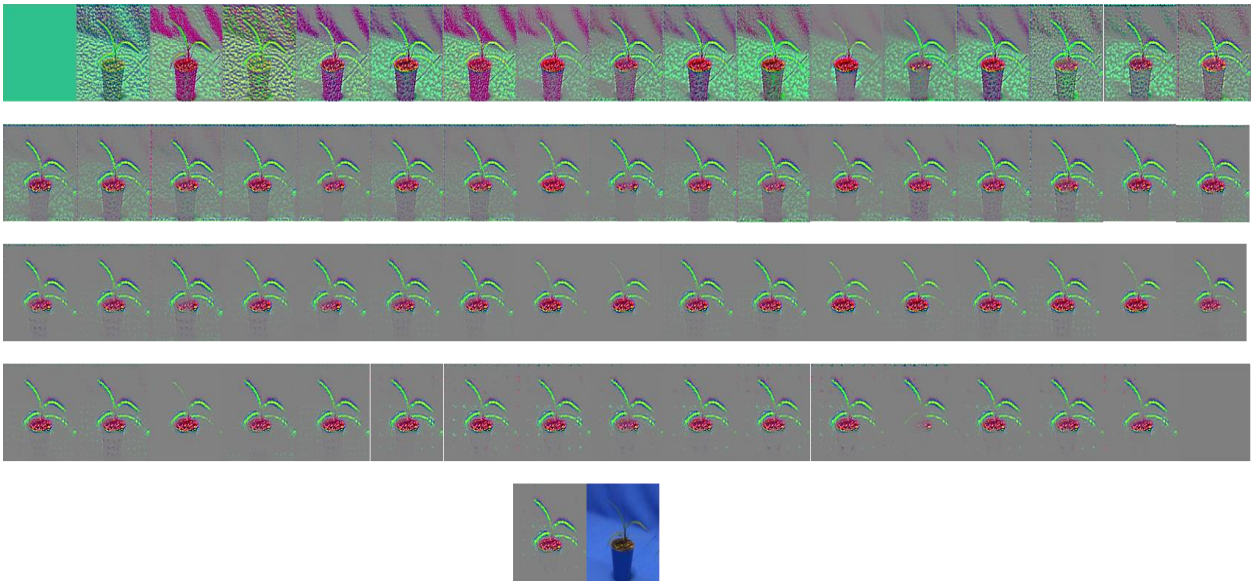


(g) Input Image

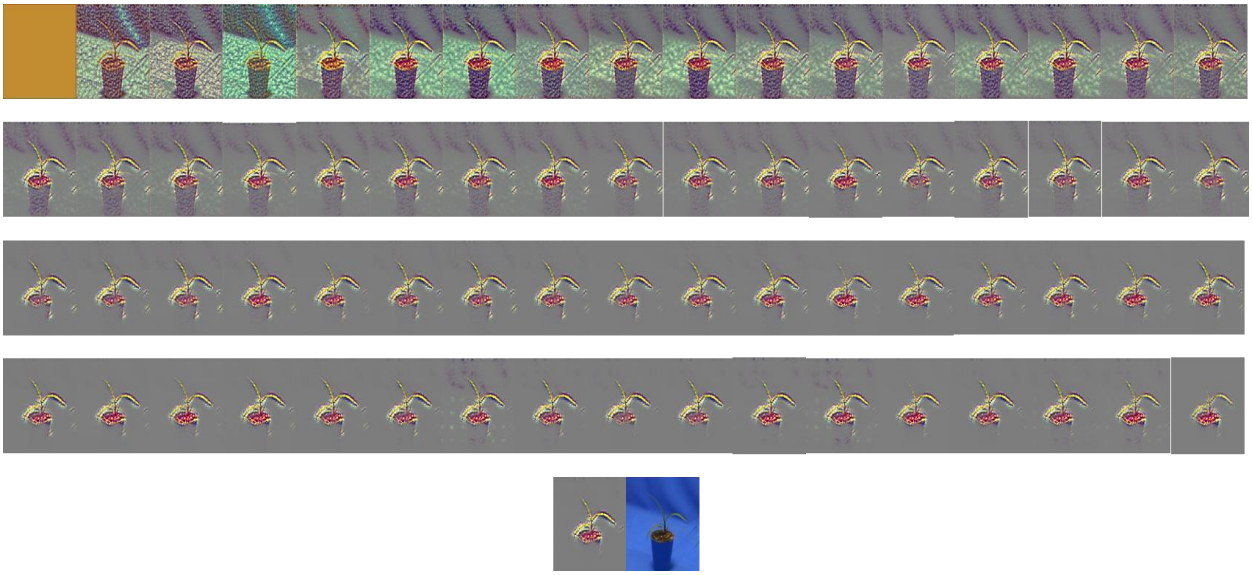
(viii) Maize



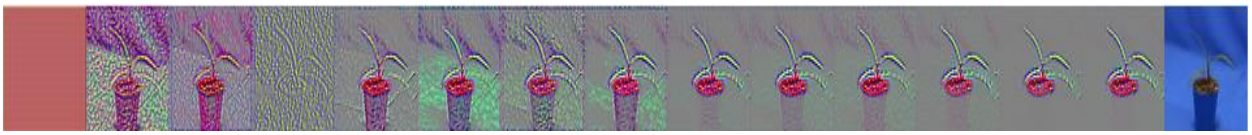
Supplementary Figure 3: GBP visualization of the last convolutional layer of different CNN models for the different classes of the Plant Seedling dataset.



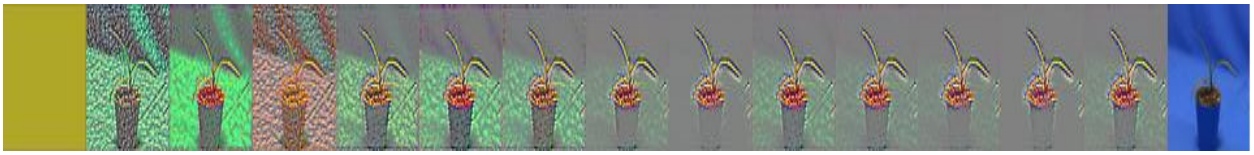
Supplementary Figure 4: Visualization of the learning of the intermediate layers of ResNet-50 using GBP for Barnyard Grass of the Weedling dataset.



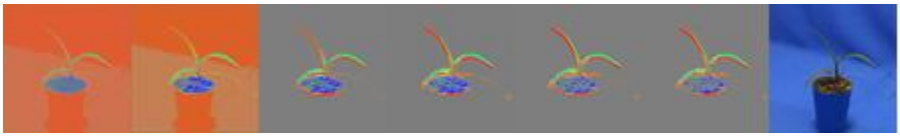
Supplementary Figure 5: Visualization of the learning of the intermediate layers of ResNet-50-10% using GBP for Barnyard Grass of the Weedling dataset.



Supplementary Figure 6: Visualization of the learning of the intermediate layers of 2-Conv-ResNet using GBP for Barnyard Grass of the Weedling dataset.

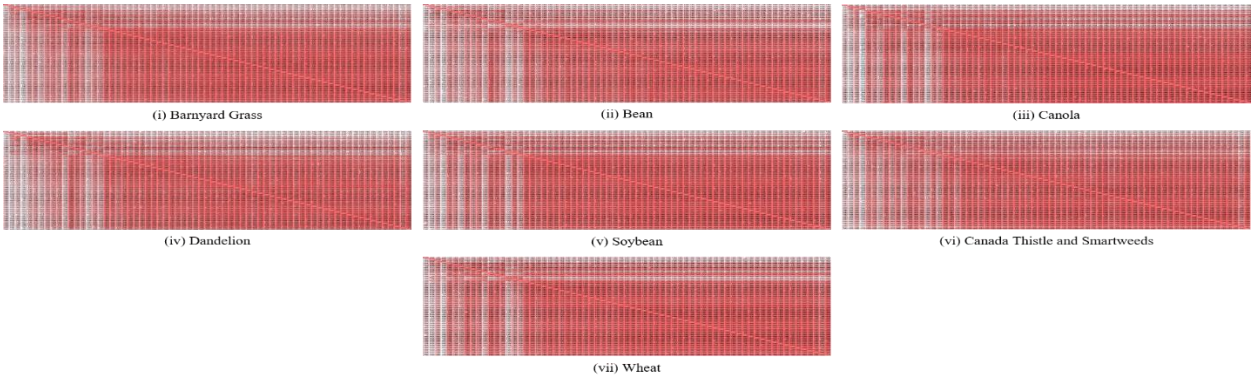


Supplementary Figure 7: Visualization of the learning of the intermediate layers of 2-Conv-ResNet-10% using GBP for Barnyard Grass of the Weedling dataset.

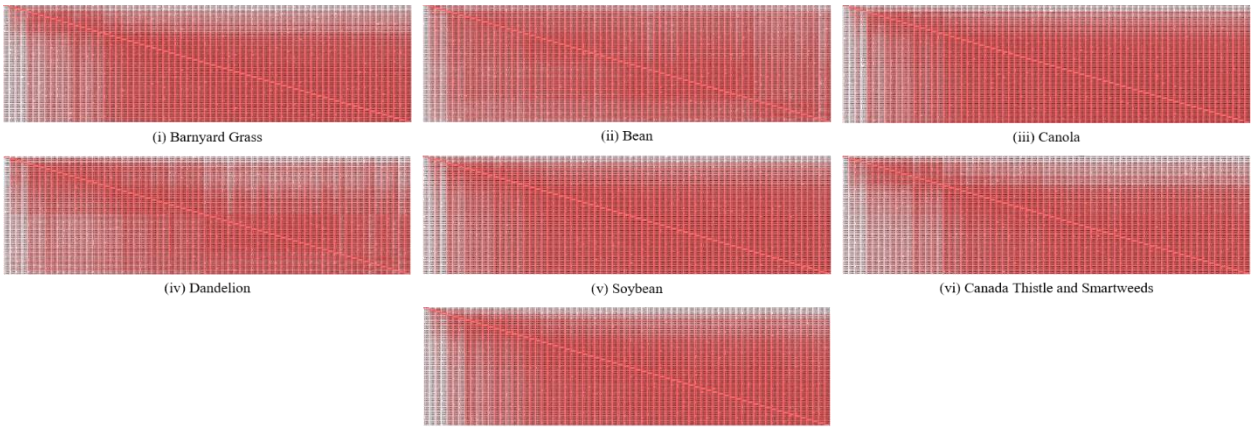


Supplementary Figure 8: Visualization of the learning of the intermediate layers of Shallow-CNN, 6 layers using GBP for Barnyard Grass of the Weedling dataset.

Supplementary Figure 9: Visualization of the learning of the intermediate layers of Shallow-CNN, 13 layers using GBP for Barnyard Grass of the Weedling dataset.



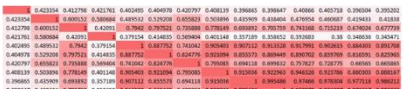
(a) ResNet-50



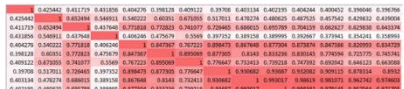
(b) ResNet-50-10%

(i) Barnyard Grass

(ii) Bean



(iii) Canola



(iv) Dandelion

(v) Soybean

(vi) Canada Thistle and Smartweeds

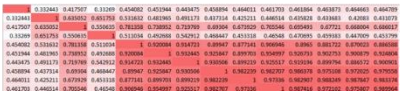
(vii) Wheat

(c) 2-Conv-ResNet

(i) Barnyard Grass

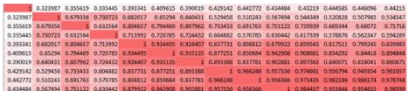
(ii) Bean

(iii) Canola



(iv) Dandelion

(v) Soybean



(vi) Canada Thistle and Smartweeds

(vii) Wheat

(d) 2-Conv-ResNet-10%

1	0.968888	0.862261	0.85791	0.859287	0.86172
0.968888	1	0.858899	0.855433	0.853906	0.8558
0.862261	0.858899	1	0.982516	0.97551	0.974613
0.85791	0.855433	0.982516	1	0.987809	0.984907
0.859287	0.853906	0.97551	0.987809	1	0.991084
0.86172	0.8558	0.974613	0.984907	0.991084	1

(i) Barnyard Grass

1	0.935738	0.851856	0.850385	0.846922	0.845728
0.935738	1	0.905575	0.903982	0.897934	0.893935
0.851856	0.905575	1	0.98367	0.974166	0.967508
0.850385	0.903982	0.98367	1	0.979536	0.97754
0.846922	0.897934	0.974166	0.979536	1	0.986114
0.845728	0.893935	0.967508	0.97754	0.986114	1

(ii) Bean

1	0.964234	0.840764	0.842911	0.844213	0.848503
0.964234	1	0.824434	0.826602	0.826712	0.827868
0.840764	0.824434	1	0.985641	0.976963	0.971389
0.842911	0.826602	0.985641	1	0.987808	0.981532
0.844213	0.826712	0.976963	0.987808	1	0.989648
0.848503	0.827868	0.971389	0.981532	0.989648	1

(iii) Canola

1	0.968283	0.840693	0.846968	0.838454	0.844898
0.968283	1	0.842873	0.848425	0.840209	0.844692
0.840693	0.842873	1	0.966187	0.955779	0.953099
0.846968	0.848425	0.966187	1	0.975487	0.975076
0.838454	0.840209	0.955779	0.975487	1	0.983199
0.844898	0.844692	0.953099	0.975076	0.983199	1

(iv) Dandelion

1	0.938164	0.855906	0.855517	0.853136	0.851882
0.938164	1	0.893095	0.88974	0.88415	0.87799
0.855906	0.893095	1	0.983134	0.970841	0.960202
0.855517	0.88974	0.983134	1	0.98368	0.971555
0.853136	0.88415	0.970841	0.98368	1	0.982674
0.851882	0.87799	0.960202	0.971555	0.982674	1

(v) Soybean

1	0.914373	0.824087	0.831321	0.823245	0.819705
0.914373	1	0.851504	0.848104	0.844394	0.835137
0.824087	0.851504	1	0.968212	0.954261	0.937325
0.831321	0.848104	0.968212	1	0.972415	0.955009
0.823245	0.844394	0.954261	0.972415	1	0.9685
0.819705	0.835137	0.937325	0.955009	0.9685	1

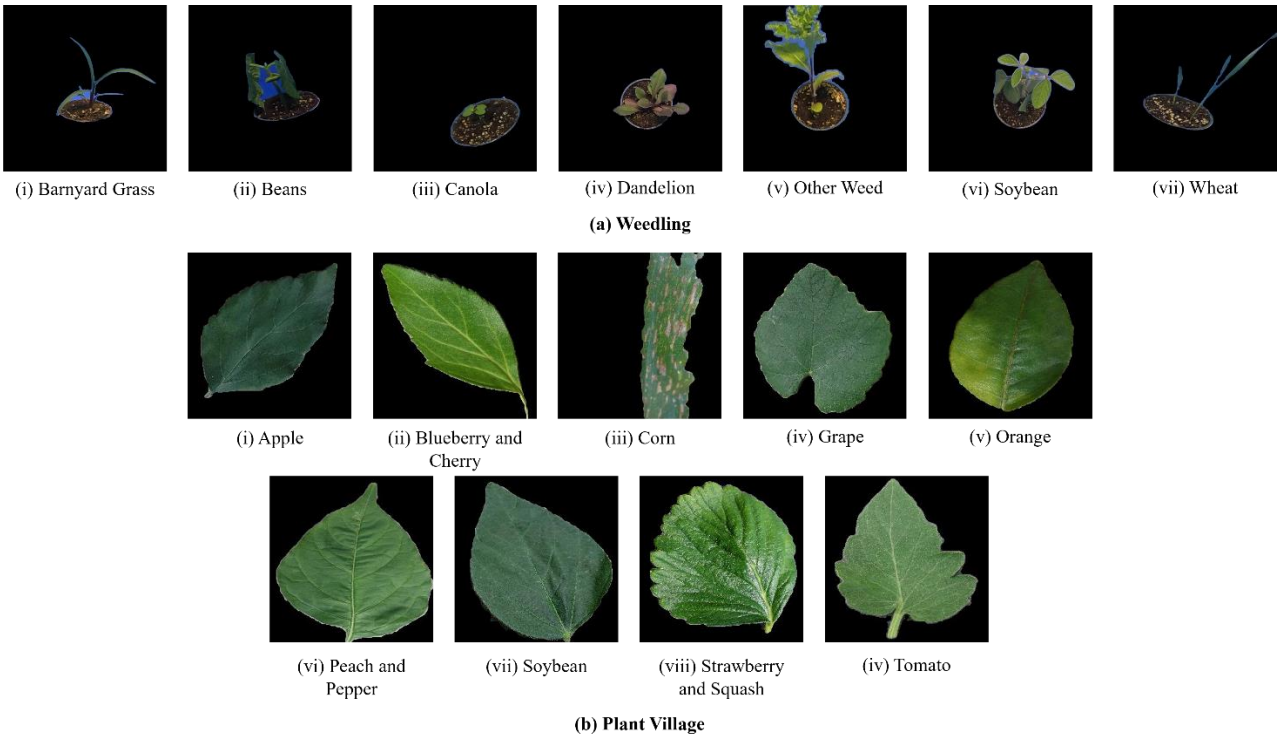
(vi) Canada Thistle and Smartweeds

1	0.959073	0.843918	0.835654	0.834253	0.838359
0.959073	1	0.844005	0.835215	0.830199	0.830727
0.843918	0.844005	1	0.973908	0.961758	0.957357
0.835654	0.835215	0.973908	1	0.981283	0.976846
0.834253	0.830199	0.961758	0.981283	1	0.988287
0.838359	0.830727	0.957357	0.976846	0.988287	1

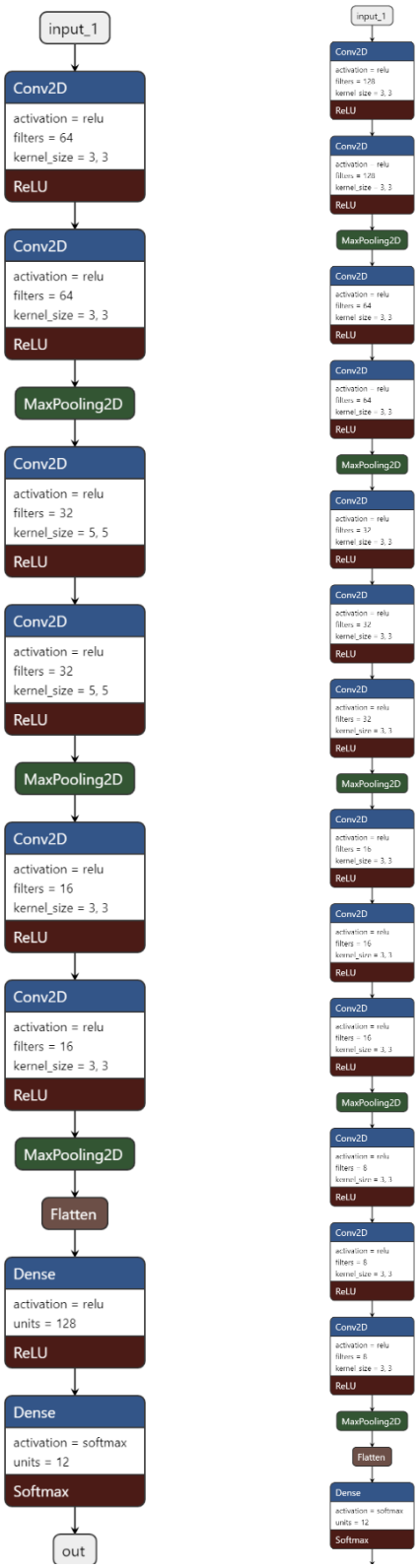
(vii) Wheat

(e) Shallow CNN, 6 Layers

Supplementary Figure 10: SSIM between every pair of images generated with GBP for different classes of the Weedling dataset.



Supplementary Figure 11: Example of segmented images for every class of the (a) Weedling and (b) Plant Village dataset.



Supplementary Figure 12: Model Architecture of the Shallow CNN, 6 Layers (left), and Shallow CNN, 13 Layers (right)