Detection of morphological changes caused by chemical stress in the cyanobacterium Planktothrix agardhii using convolutional neural networks. [Dataset].

CARLOTO, I., JOHNSTON, P., PESTANA, C.J. and LAWTON, L.A.

2021

Supplementary Material for

Detection of morphological changes caused by chemical stress in the cyanobacterium *Planktothrix agardhii* using convolutional neural networks

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The supporting information includes 31 pages, 13 tables, and 14 figures.

List of content

Table S1

Table S1. Age and initial cell density of *P. agardhii* cultures used for Hydrogen Peroxide oxidation experiments.

Experiment	Age of culture (days)	Initial cell density (cells mL^{-1})
1	25	2,558,408
2	31	3,190,535
3	53	6,884,012

Table S2

Table S2. Accuracy values of all tested combinations.

Architecture	Epochs	Segmentation	Duplicate	Optimizer	Accuracy
3ConvLayer	10	None	1	RMSProp	0.5
3ConvLayer	10	None	1	SDG	0.572
3ConvLayer	10	None	1	Adam	0.5
3ConvLayer	10	None	1	Adagrad	0.5
3ConvLayer	25	None	1	RMSProp	0.5
3ConvLayer	25	None	1	SDG	0.677
3ConvLayer	25	None	1	Adam	0.5
3ConvLayer	25	None	1	Adagrad	0.5
3ConvLayer	30	None	1	RMSProp	0.5
3ConvLayer	30	None	1	SDG	0.615
3ConvLayer	30	None	1	Adam	0.5
3ConvLayer	30	None	1	Adagrad	0.5
AlexNet	10	None	1	RMSProp	0.553
AlexNet	10	None	1	SDG	0.567
AlexNet	10	None	1	Adam	0.514
AlexNet	10	None	1	Adagrad	0.5
AlexNet	25	None	1	RMSProp	0.576
AlexNet	25	None	1	SDG	0.5
AlexNet	25	None	1	Adam	0.574
AlexNet	25	None	1	Adagrad	0.5
AlexNet	30	None	1	RMSProp	0.632
AlexNet	30	None	1	SDG	0.5
AlexNet	30	None	1	Adam	0.5

AlexNet	30	None	1	Adagrad	0.5
2ConvLayer	10	None	1	RMSProp	0.608
2ConvLayer	10	None	1	SDG	0.541
2ConvLayer	10	None	1	Adam	0.5
2ConvLayer	10	None	1	Adagrad	0.5
2ConvLayer	25	None	1	RMSProp	0.763
2ConvLayer	25	None	1	SDG	0.622
2ConvLayer	25	None	1	Adam	0.5
2ConvLayer	25	None	1	Adagrad	0.5
2ConvLayer	30	None	1	RMSProp	0.916
2ConvLayer	30	None	1	SDG	0.622
2ConvLayer	30	None	1	Adam	0.909
2ConvLayer	30	None	1	Adagrad	0.5
3ConvLayer	10	Hp filter	1	RMSProp	0.866
3ConvLayer	10	Hp filter	1	SDG	0.531
3ConvLayer	10	Hp filter	1	Adam	0.844
3ConvLayer	10	Hp filter	1	Adagrad	0.5
3ConvLayer	25	Hp filter	1	RMSProp	0.823
3ConvLayer	25	Hp filter	1	SDG	0.615
3ConvLayer	25	Hp filter	1	Adam	0.859
3ConvLayer	25	Hp filter	1	Adagrad	0.5
3ConvLayer	30	Hp filter	1	RMSProp	0.835
3ConvLayer	30	Hp filter	1	SDG	0.600
3ConvLayer	30	Hp filter	1	Adam	0.887
3ConvLayer	30	Hp filter	1	Adagrad	0.5
AlexNet	10	Hp filter	1	RMSProp	0.708
AlexNet	10	Hp filter	1	SDG	0.5
AlexNet	10	Hp filter	1	Adam	0.502
AlexNet	10	Hp filter	1	Adagrad	0.581
AlexNet	25	Hp filter	1	RMSProp	0.835
AlexNet	25	Hp filter	1	SDG	0.803
AlexNet	25	Hp filter	1	Adam	0.854
AlexNet	25	Hp filter	1	Adagrad	0.840
AlexNet	30	Hp filter	1	RMSProp	0.844
AlexNet	30	Hp filter	1	SDG	0.782
AlexNet	30	Hp filter	1	Adam	0.852
AlexNet	30	Hp filter	1	Adagrad	0.847
2ConvLayer	10	Hp filter	1	RMSProp	0.859
2ConvLayer	10	Hp filter	1	SDG	0.505
2ConvLayer	10	Hp filter	1	Adam	0.847
2ConvLayer	10	Hp filter	1	Adagrad	0.667
2ConvLayer	25	Hp filter	1	RMSProp	0.794
2ConvLayer	25	Hp filter	1	SDG	0.531
2ConvLayer	25	Hp filter	1	Adam	0.816
2ConvLayer	25	Hp filter	1	Adagrad	0.842
2ConvLayer	30	Hp filter	1	RMSProp	0.844
2ConvLayer	30	Hp filter	1	SDG	0.507
2ConvLayer	30	Hp filter	1	Adam	0.856
2ConvLayer	30	Hp filter	1	Adagrad	0.847
3ConvLayer	10	Canny	1	RMSProp	0.598

3ConvLayer	10	Canny	1	SDG	0.579
3ConvLayer	10	Canny	1	Adam	0.545
3ConvLayer	10	Canny	1	Adagrad	0.5
3ConvLayer	25	Canny	1	RMSProp	0.636
3ConvLayer	25	Canny	1	SDG	0.553
3ConvLayer	25	Canny	1	Adam	0.684
3ConvLayer	25	Canny	1	Adagrad	0.5
3ConvLayer	30	Canny	1	RMSProp	0.639
3ConvLayer	30	Canny	1	SDG	0.562
3ConvLayer	30	Canny	1	Adam	0.641
3ConvLayer	30	Canny	1	Adagrad	0.5
AlexNet	10	Canny	1	RMSProp	0.5
AlexNet	10	Canny	1	SDG	0.517
AlexNet	10	Canny	1	Adam	0.615
AlexNet	10	Canny	1	Adagrad	0.591
AlexNet	25	Canny	1	RMSProp	0.803
AlexNet	25	Canny	1	SDG	0.653
AlexNet	25	Canny	1	Adam	0.794
AlexNet	25	Canny	1	Adagrad	0.629
AlexNet	30	Canny	1	RMSProp	0.806
AlexNet	30	Canny	1	SDG	0.730
AlexNet	30	Canny	1	Adam	0.708
AlexNet	30	Canny	1	Adagrad	0.818
2ConvLayer	10	Canny	1	RMSProp	0.703
2ConvLayer	10	Canny	1	SDG	0.536
2ConvLayer	10	Canny	1	Adam	0.658
2ConvLayer	10	Canny	1	Adagrad	0.662
2ConvLayer	25	Canny	1	RMSProp	0.792
2ConvLayer	25	Canny	1	SDG	0.529
2ConvLayer	25	Canny	1	Adam	0.806
2ConvLayer	25	Canny	1	Adagrad	0.768
2ConvLayer	30	Canny	1	RMSProp	0.820
2ConvLayer	30	Canny	1	SDG	0.526
2ConvLayer	30	Canny	1	Adam	0.849
2ConvLayer	30	Canny	1	Adagrad	0.792
3ConvLayer	10	Watershed	1	RMSProp	0.5
3ConvLayer	10	Watershed	1	SDG	0.639
3ConvLayer	10	Watershed	1	Adam	0.5
3ConvLayer	10	Watershed	1	Adagrad	0.5
3ConvLayer	25	Watershed	1	RMSProp	0.5
3ConvLayer	25	Watershed	1	SDG	0.612
3ConvLayer	25	Watershed	1	Adam	0.5
3ConvLayer	25	Watershed	1	Adagrad	0.5
3ConvLayer	30	Watershed	1	RMSProp	0.5
3ConvLayer	30	Watershed	1	SDG	0.639
3ConvLayer	30	Watershed	1	Adam	0.5
3ConvLayer	30	Watershed	1	Adagrad	0.5
AlexNet	10	Watershed	1	RMSProp	0.5
AlexNet	10	Watershed	1	SDG	0.677
AlexNet	10	Watershed	1	Adam	0.5

AlexNet	10	Watershed	1	Adagrad	0.634
AlexNet	25	Watershed	1	RMSProp	0.768
AlexNet	25	Watershed	1	SDG	0.849
AlexNet	25	Watershed	1	Adam	0.502
AlexNet	25	Watershed	1	Adagrad	0.641
AlexNet	30	Watershed	1	RMSProp	0.514
AlexNet	30	Watershed	1	SDG	0.634
AlexNet	30	Watershed	1	Adam	0.679
AlexNet	30	Watershed	1	Adagrad	0.713
2ConvLayer	10	Watershed	1	RMSProp	0.710
2ConvLayer	10	Watershed	1	SDG	0.538
2ConvLayer	10	Watershed	1	Adam	0.749
2ConvLayer	10	Watershed	1	Adagrad	0.5
2ConvLayer	25	Watershed	1	RMSProp	0.828
2ConvLayer	25	Watershed	1	SDG	0.660
2ConvLayer	25	Watershed	1	Adam	0.854
2ConvLayer	25	Watershed	1	Adagrad	0.5
2ConvLayer	30	Watershed	1	RMSProp	0.5
2ConvLayer	30	Watershed	1	SDG	0.641
2ConvLayer	30	Watershed	1	Adam	0.861
2ConvLayer	30	Watershed	1	Adagrad	0.5
3ConvLayer	10	Morph. filter	1	RMSProp	0.816
3ConvLayer	10	Morph. filter	1	SDG	0.531
3ConvLayer	10	Morph. filter	1	Adam	0.842
3ConvLayer	10	Morph. filter	1	Adagrad	0.5
3ConvLayer	25	Morph. filter	1	RMSProp	0.840
3ConvLayer	25	Morph. filter	1	SDG	0.562
3ConvLayer	25	Morph. filter	1	Adam	0.866
3ConvLayer	25	Morph. filter	1	Adagrad	0.5
3ConvLayer	30	Morph. filter	1	RMSProp	0.873
3ConvLayer	30	Morph. filter	1	SDG	0.560
3ConvLayer	30	Morph. filter	1	Adam	0.5
3ConvLayer	30	Morph. filter	1	Adagrad	0.5
AlexNet	10	Morph. filter	1	RMSProp	0.579
AlexNet	10	Morph. filter	1	SDG	0.502
AlexNet	10	Morph. filter	1	Adam	0.550
AlexNet	10	Morph. filter	1	Adagrad	0.617
AlexNet	25	Morph. filter	1	RMSProp	0.832
AlexNet	25	Morph. filter	1	SDG	0.823
AlexNet	25	Morph. filter	1	Adam	0.864
AlexNet	25	Morph. filter	1	Adagrad	0.809
AlexNet	30	Morph. filter	1	RMSProp	0.887
AlexNet	30	Morph. filter	1	SDG	0.797
AlexNet	30	Morph. filter	1	Adam	0.847
AlexNet	30	Morph. filter	1	Adagrad	0.854
2ConvLayer	10	Morph. filter	1	RMSProp	0.856
2ConvLayer	10	Morph. filter	1	SDG	0.543
2ConvLayer	10	Morph. filter	1	Adam	0.847
2ConvLayer	10	Morph. filter	1	Adagrad	0.849
2ConvLayer	25	Morph. filter	1	RMSProp	0.854

2ConvLayer	25	Morph. filter	1	SDG	0.529
2ConvLayer	25	Morph. filter	1	Adam	0.864
2ConvLayer	25	Morph. filter	1	Adagrad	0.852
2ConvLayer	30	Morph. filter	1	RMSProp	0.866
2ConvLayer	30	Morph. filter	1	SDG	0.529
2ConvLayer	30	Morph. filter	1	Adam	0.871
2ConvLayer	30	Morph. filter	1	Adagrad	0.866
3ConvLayer	10	GrabCut	1	RMSProp	0.907
3ConvLayer	10	GrabCut	1	SDG	0.529
3ConvLayer	10	GrabCut	1	Adam	0.914
3ConvLayer	10	GrabCut	1	Adagrad	0.5
3ConvLayer	25	GrabCut	1	RMSProp	0.928
3ConvLayer	25	GrabCut	1	SDG	0.512
3ConvLayer	25	GrabCut	1	Adam	0.928
3ConvLayer	25	GrabCut	1	Adagrad	0.5
3ConvLayer	30	GrabCut	1	RMSProp	0.899
3ConvLayer	30	GrabCut	1	SDG	0.545
3ConvLayer	30	GrabCut	1	Adam	0.935
3ConvLayer	30	GrabCut	1	Adagrad	0.5
AlexNet	10	GrabCut	1	RMSProp	0.545
AlexNet	10	GrabCut	1	SDG	0.5
AlexNet	10	GrabCut	1	Adam	0.873
AlexNet	10	GrabCut	1	Adagrad	0.909
AlexNet	25	GrabCut	1	RMSProp	0.916
AlexNet	25	GrabCut	1	SDG	0.828
AlexNet	25	GrabCut	1	Adam	0.883
AlexNet	25	GrabCut	1	Adagrad	0.931
AlexNet	30	GrabCut	1	RMSProp	0.921
AlexNet	30	GrabCut	1	SDG	0.931
AlexNet	30	GrabCut	1	Adam	0.887
AlexNet	30	GrabCut	1	Adagrad	0.928
2ConvLayer	10	GrabCut	1	RMSProp	0.863
2ConvLayer	10	GrabCut	1	SDG	0.519
2ConvLayer	10	GrabCut	1	Adam	0.926
2ConvLayer	10	GrabCut	1	Adagrad	0.859
2ConvLayer	25	GrabCut	1	RMSProp	0.720
2ConvLayer	25	GrabCut	1	SDG	0.531
2ConvLayer	25	GrabCut	1	Adam	0.928
2ConvLayer	25	GrabCut	1	Adagrad	0.919
2ConvLayer	30	GrabCut	1	RMSProp	0.930
2ConvLayer	30	GrabCut	1	SDG	0.548
2ConvLayer	30	GrabCut	1	Adam	0.923
2ConvLayer	30	GrabCut	1	Adagrad	0.926
3ConvLayer	10	None	2	RMSProp	0.5
3ConvLayer	10	None	2	SDG	0.5
3ConvLayer	10	None	2	Adam	0.5
3ConvLayer	10	None	2	Adagrad	0.5
3ConvLayer	25	None	2	RMSProp	0.5
3ConvLayer	25	None	2	SDG	0.655
3ConvLayer	25	None	2	Adam	0.5

3ConvLayer	25	None	2	Adagrad	0.5
3ConvLayer	30	None	2	RMSProp	0.5
3ConvLayer	30	None	2	SDG	0.655
3ConvLayer	30	None	2	Adam	0.5
3ConvLayer	30	None	2	Adagrad	0.5
AlexNet	10	None	2	RMSProp	0.5
AlexNet	10	None	2	SDG	0.5
AlexNet	10	None	2	Adam	0.5
AlexNet	10	None	2	Adagrad	0.5
AlexNet	25	None	2	RMSProp	0.694
AlexNet	25	None	2	SDG	0.677
AlexNet	25	None	2	Adam	0.570
AlexNet	25	None	2	Adagrad	0.521
AlexNet	30	None	2	RMSProp	0.5
AlexNet	30	None	2	SDG	0.5
AlexNet	30	None	2	Adam	0.5
AlexNet	30	None	2	Adagrad	0.5
2ConvLayer	10	None	2	RMSProp	0.816
2ConvLayer	10	None	2	SDG	0.5
2ConvLayer	10	None	2	Adam	0.706
2ConvLayer	10	None	2	Adagrad	0.5
2ConvLayer	25	None	2	RMSProp	0.876
2ConvLayer	25	None	2	SDG	0.622
2ConvLayer	25	None	2	Adam	0.502
2ConvLayer	25	None	2	Adagrad	0.5
2ConvLayer	30	None	2	RMSProp	0.835
2ConvLayer	30	None	2	SDG	0.660
2ConvLayer	30	None	2	Adam	0.5
2ConvLayer	30	None	2	Adagrad	0.5
3ConvLayer	10	Hp filter	2	RMSProp	0.842
3ConvLayer	10	Hp filter	2	SDG	0.560
3ConvLayer	10	Hp filter	2	Adam	0.811
3ConvLayer	10	Hp filter	2	Adagrad	0.5
3ConvLayer	25	Hp filter	2	RMSProp	0.868
3ConvLayer	25	Hp filter	2	SDG	0.502
3ConvLayer	25	Hp filter	2	Adam	0.866
3ConvLayer	25	Hp filter	2	Adagrad	0.5
3ConvLayer	30	Hp filter	2	RMSProp	0.859
3ConvLayer	30	Hp filter	2	SDG	0.624
3ConvLayer	30	Hp filter	2	Adam	0.880
3ConvLayer	30	Hp filter	2	Adagrad	0.5
AlexNet	10	Hp filter	2	RMSProp	0.722
AlexNet	10	Hp filter	2	SDG	0.502
AlexNet	10	Hp filter	2	Adam	0.564
AlexNet	10	Hp filter	2	Adagrad	0.557
AlexNet	25	Hp filter	2	RMSProp	0.828
AlexNet	25	Hp filter	2	SDG	0.792
AlexNet	25	Hp filter	2	Adam	0.837
AlexNet	25	Hp filter	2	Adagrad	0.854
AlexNet	30	Hp filter	2	RMSProp	0.842

AlexNet	30	Hp filter	2	SDG	0.797
AlexNet	30	Hp filter	2	Adam	0.816
AlexNet	30	Hp filter	2	Adagrad	0.852
2ConvLayer	10	Hp filter	2	RMSProp	0.856
2ConvLayer	10	Hp filter	2	SDG	0.517
2ConvLayer	10	Hp filter	2	Adam	0.837
2ConvLayer	10	Hp filter	2	Adagrad	0.801
2ConvLayer	25	Hp filter	2	RMSProp	0.847
2ConvLayer	25	Hp filter	2	SDG	0.474
2ConvLayer	25	Hp filter	2	Adam	0.840
2ConvLayer	25	Hp filter	2	Adagrad	0.837
2ConvLayer	30	Hp filter	2	RMSProp	0.820
2ConvLayer	30	Hp filter	2	SDG	0.529
2ConvLayer	30	Hp filter	2	Adam	0.842
2ConvLayer	30	Hp filter	2	Adagrad	0.859
3ConvLayer	10	Canny	2	RMSProp	0.584
3ConvLayer	10	Canny	2	SDG	0.541
3ConvLayer	10	Canny	2	Adam	0.517
3ConvLayer	10	Canny	2	Adagrad	0.5
3ConvLayer	25	Canny	2	RMSProp	0.562
3ConvLayer	25	Canny	2	SDG	0.605
3ConvLayer	25	Canny	2	Adam	0.529
3ConvLayer	25	Canny	2	Adagrad	0.5
3ConvLayer	30	Canny	2	RMSProp	0.596
3ConvLayer	30	Canny	2	SDG	0.572
3ConvLayer	30	Canny	2	Adam	0.5
3ConvLayer	30	Canny	2	Adagrad	0.541
AlexNet	10	Canny	2	RMSProp	0.639
AlexNet	10	Canny	2	SDG	0.596
AlexNet	10	Canny	2	Adam	0.579
AlexNet	10	Canny	2	Adagrad	0.502
AlexNet	25	Canny	2	RMSProp	0.725
AlexNet	25	Canny	2	SDG	0.636
AlexNet	25	Canny	2	Adam	0.787
AlexNet	25	Canny	2	Adagrad	0.646
AlexNet	30	Canny	2	RMSProp	0.741
AlexNet	30	Canny	2	SDG	0.689
AlexNet	30	Canny	2	Adam	0.612
AlexNet	30	Canny	2	Adagrad	0.694
2ConvLayer	10	Canny	2	RMSProp	0.624
2ConvLayer	10	Canny	2	SDG	0.507
2ConvLayer	10	Canny	2	Adam	0.629
2ConvLayer	10	Canny	2	Adagrad	0.509
2ConvLayer	25	Canny	2	RMSProp	0.782
2ConvLayer	25	Canny	2	SDG	0.550
2ConvLayer	25	Canny	2	Adam	0.775
2ConvLayer	25	Canny	2	Adagrad	0.732
2ConvLayer	30	Canny	2	RMSProp	0.777
2ConvLayer	30	Canny	2	SDG	0.531
2ConvLayer	30	Canny	2	Adam	0.775

2ConvLayer	30	Canny	2	Adagrad	0.722
3ConvLayer	10	Watershed	2	RMSProp	0.5
3ConvLayer	10	Watershed	2	SDG	0.665
3ConvLayer	10	Watershed	2	Adam	0.5
3ConvLayer	10	Watershed	2	Adagrad	0.5
3ConvLayer	25	Watershed	2	RMSProp	0.5
3ConvLayer	25	Watershed	2	SDG	0.5
3ConvLayer	25	Watershed	2	Adam	0.5
3ConvLayer	25	Watershed	2	Adagrad	0.5
3ConvLayer	30	Watershed	2	RMSProp	0.5
3ConvLayer	30	Watershed	2	SDG	0.560
3ConvLayer	30	Watershed	2	Adam	0.5
3ConvLayer	30	Watershed	2	Adagrad	0.5
AlexNet	10	Watershed	2	RMSProp	0.533
AlexNet	10	Watershed	2	SDG	0.576
AlexNet	10	Watershed	2	Adam	0.502
AlexNet	10	Watershed	2	Adagrad	0.641
AlexNet	25	Watershed	2	RMSProp	0.5
AlexNet	25	Watershed	2	SDG	0.514
AlexNet	25	Watershed	2	Adam	0.502
AlexNet	25	Watershed	2	Adagrad	0.584
AlexNet	30	Watershed	2	RMSProp	0.488
AlexNet	30	Watershed	2	SDG	0.687
AlexNet	30	Watershed	2	Adam	0.512
AlexNet	30	Watershed	2	Adagrad	0.521
2ConvLayer	10	Watershed	2	RMSProp	0.624
2ConvLayer	10	Watershed	2	SDG	0.564
2ConvLayer	10	Watershed	2	Adam	0.741
2ConvLayer	10	Watershed	2	Adagrad	0.5
2ConvLayer	25	Watershed	2	RMSProp	0.797
2ConvLayer	25	Watershed	2	SDG	0.655
2ConvLayer	25	Watershed	2	Adam	0.928
2ConvLayer	25	Watershed	2	Adagrad	0.5
2ConvLayer	30	Watershed	2	RMSProp	0.820
2ConvLayer	30	Watershed	2	SDG	0.624
2ConvLayer	30	Watershed	2	Adam	0.873
2ConvLayer	30	Watershed	2	Adagrad	0.5
3ConvLayer	10	Morph. filter	2	RMSProp	0.823
3ConvLayer	10	Morph. filter	2	SDG	0.552
3ConvLayer	10	Morph. filter	2	Adam	0.825
3ConvLayer	10	Morph. filter	2	Adagrad	0.5
3ConvLayer	25	Morph. filter	2	RMSProp	0.5
3ConvLayer	25	Morph. filter	2	SDG	0.565
3ConvLayer	25	Morph. filter	2	Adam	0.864
3ConvLayer	25	Morph. filter	2	Adagrad	0.5
3ConvLayer	30	Morph. filter	2	RMSProp	0.880
3ConvLayer	30	Morph. filter	2	SDG	0.572
3ConvLayer	30	Morph. filter	2	Adam	0.852
3ConvLayer	30	Morph. filter	2	Adagrad	0.5
AlexNet	10	Morph. filter	2	RMSProp	0.687

AlexNet	10	Morph. filter	2	SDG	0.5
AlexNet	10	Morph. filter	2	Adam	0.663
AlexNet	10	Morph. filter	2	Adagrad	0.526
AlexNet	25	Morph. filter	2	RMSProp	0.837
AlexNet	25	Morph. filter	2	SDG	0.730
AlexNet	25	Morph. filter	2	Adam	0.835
AlexNet	25	Morph. filter	2	Adagrad	0.832
AlexNet	30	Morph. filter	2	RMSProp	0.835
AlexNet	30	Morph. filter	2	SDG	0.811
AlexNet	30	Morph. filter	2	Adam	0.854
AlexNet	30	Morph. filter	2	Adagrad	0.832
2ConvLayer	10	Morph. filter	2	RMSProp	0.847
2ConvLayer	10	Morph. filter	2	SDG	0.560
2ConvLayer	10	Morph. filter	2	Adam	0.811
2ConvLayer	10	Morph. filter	2	Adagrad	0.852
2ConvLayer	25	Morph. filter	2	RMSProp	0.830
2ConvLayer	25	Morph. filter	2	SDG	0.603
2ConvLayer	25	Morph. filter	2	Adam	0.849
2ConvLayer	25	Morph. filter	2	Adagrad	0.878
2ConvLayer	30	Morph. filter	2	RMSProp	0.849
2ConvLayer	30	Morph. filter	2	SDG	0.569
2ConvLayer	30	Morph. filter	2	Adam	0.842
2ConvLayer	30	Morph. filter	2	Adagrad	0.873
2ConvLayer	10	GrabCut	2	RMSProp	0.622
2ConvLayer	10	GrabCut	2	SDG	0.545
2ConvLayer	10	GrabCut	2	Adam	0.856
2ConvLayer	10	GrabCut	2	Adagrad	0.837
2ConvLayer	25	GrabCut	2	RMSProp	0.914
2ConvLayer	25	GrabCut	2	SDG	0.524
2ConvLayer	25	GrabCut	2	Adam	0.933
2ConvLayer	25	GrabCut	2	Adagrad	0.926
2ConvLayer	30	GrabCut	2	RMSProp	0.603
2ConvLayer	30	GrabCut	2	SDG	0.545
2ConvLayer	30	GrabCut	2	Adam	0.900
2ConvLayer	30	GrabCut	2	Adagrad	0.870
AlexNet	10	GrabCut	2	RMSProp	0.653
AlexNet	10	GrabCut	2	SDG	0.517
AlexNet	10	GrabCut	2	Adam	0.878
AlexNet	10	GrabCut	2	Adagrad	0.512
AlexNet	25	GrabCut	2	RMSProp	0.689
AlexNet	25	GrabCut	2	SDG	0.847
AlexNet	25	GrabCut	2	Adam	0.780
AlexNet	25	GrabCut	2	Adagrad	0.938
AlexNet	30	GrabCut	2	RMSProp	0.852
AlexNet	30	GrabCut	2	SDG	0.916
AlexNet	30	GrabCut	2	Adam	0.899
AlexNet	30	GrabCut	2	Adagrad	0.954
3ConvLayer	10	GrabCut	2	RMSProp	0.861
3ConvLayer	10	GrabCut	2	SDG	0.564
3ConvLayer	10	GrabCut	2	Adam	0.902

3ConvLayer	10	GrabCut	2	Adagrad	0.5
3ConvLayer	25	GrabCut	2	RMSProp	0.945
3ConvLayer	25	GrabCut	2	SDG	0.567
3ConvLayer	25	GrabCut	2	Adam	0.942
3ConvLayer	25	GrabCut	2	Adagrad	0.5
3ConvLayer	30	GrabCut	2	RMSProp	0.859
3ConvLayer	30	GrabCut	2	SDG	0.531
3ConvLayer	30	GrabCut	2	Adam	0.931
3ConvLayer	30	GrabCut	2	Adagrad	0.5

Morph. Filter = Morphological filter; None = No image segmentation applied.

Figure S1

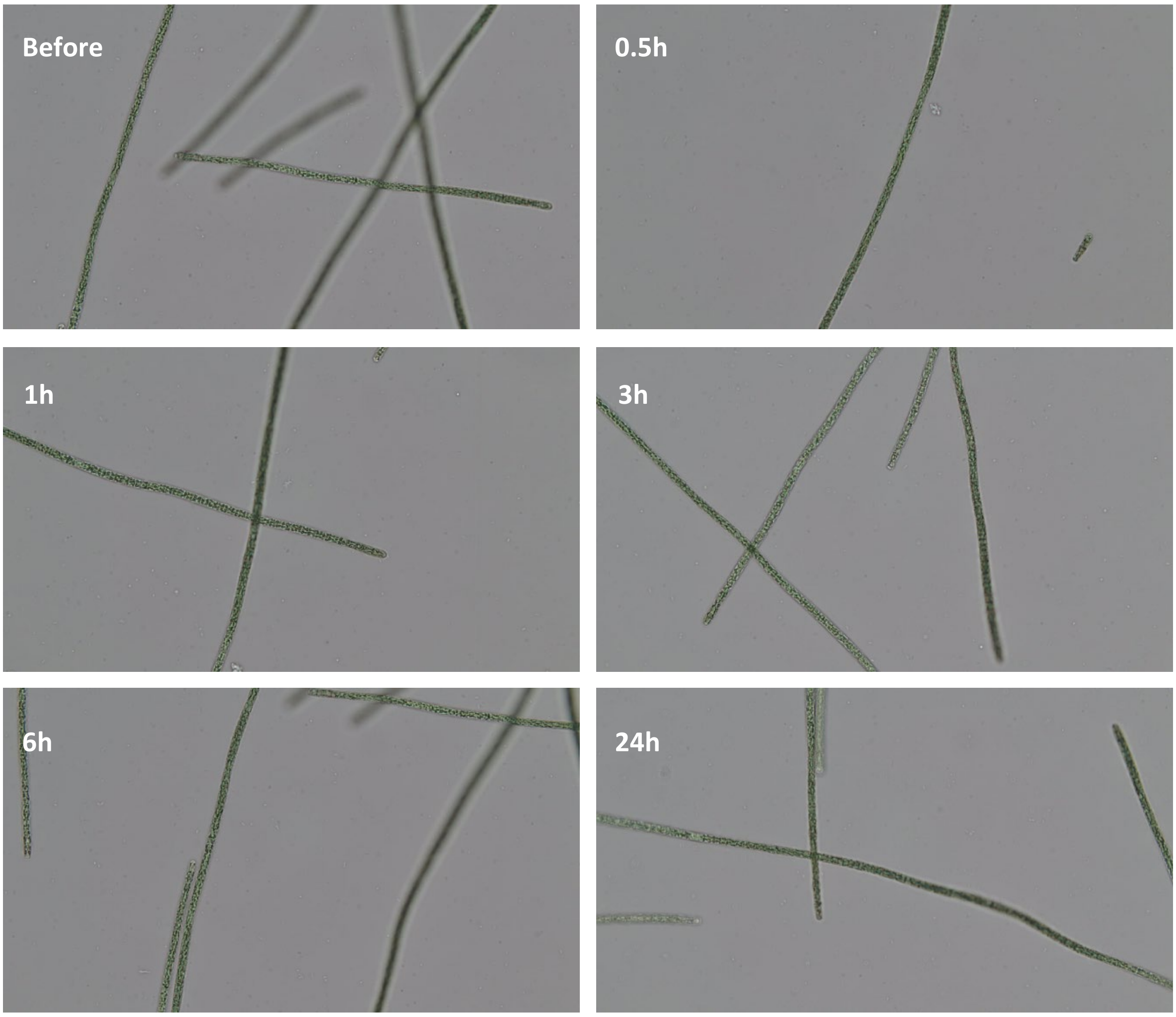


Figure S1. Effect of 5 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes at selected time points (Magnification 500x). First Experiment.

Figure S2

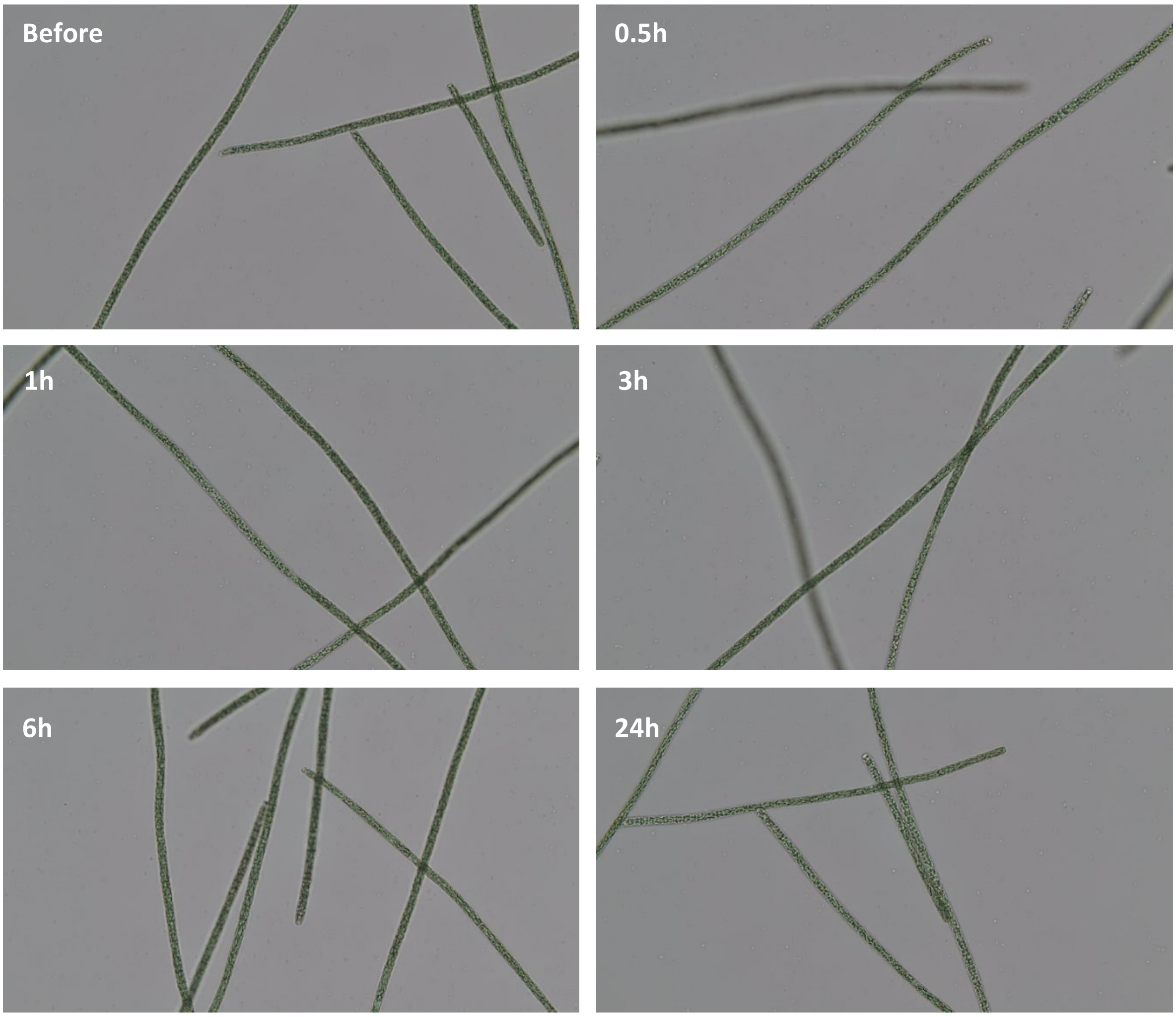


Figure S2. Effect of 10 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes at selected time points (Magnification 500x). First Experiment.

Figure S3

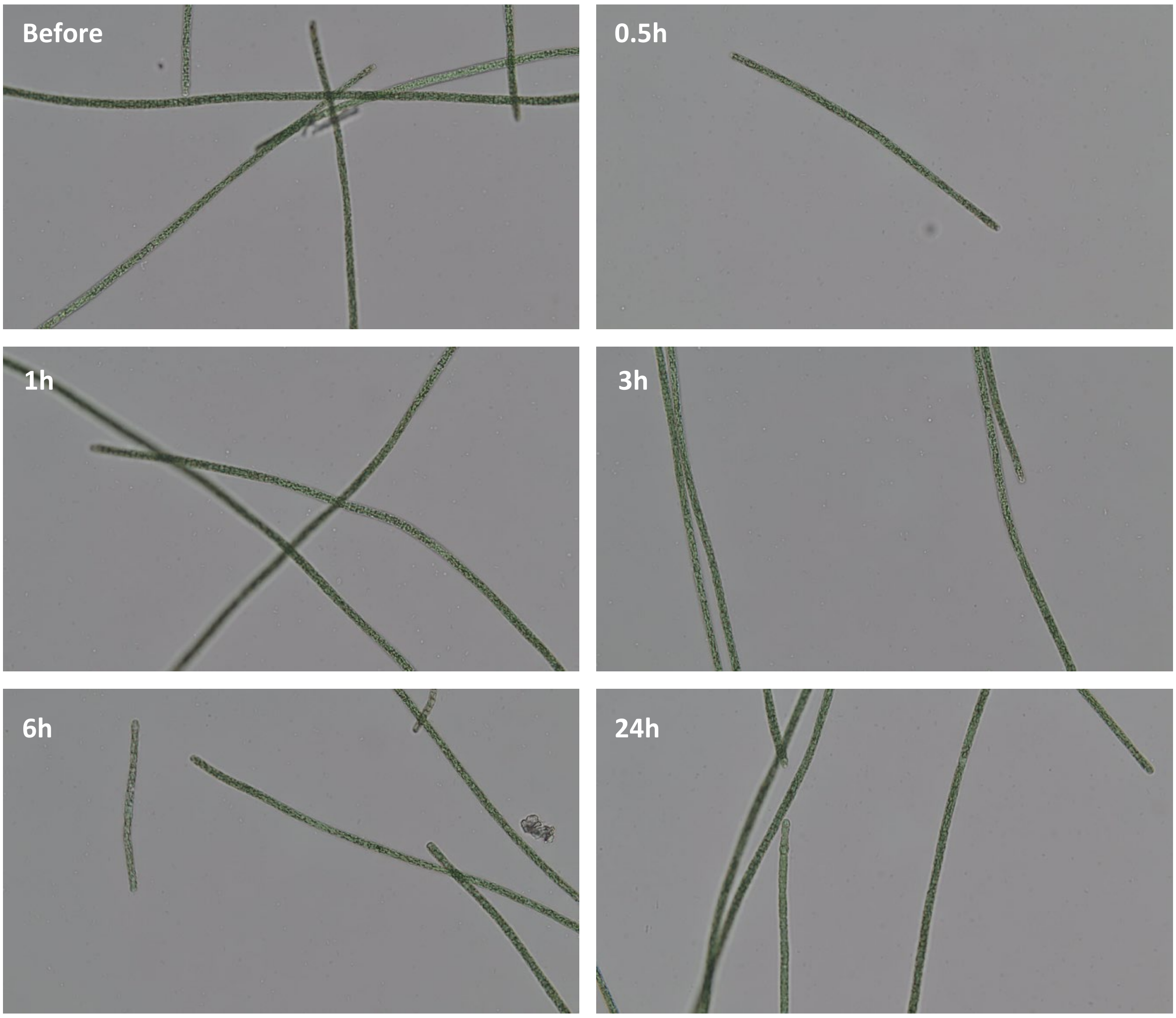


Figure S3. Effect of 15 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes at selected time points (Magnification 500x). First Experiment.

Figure S4

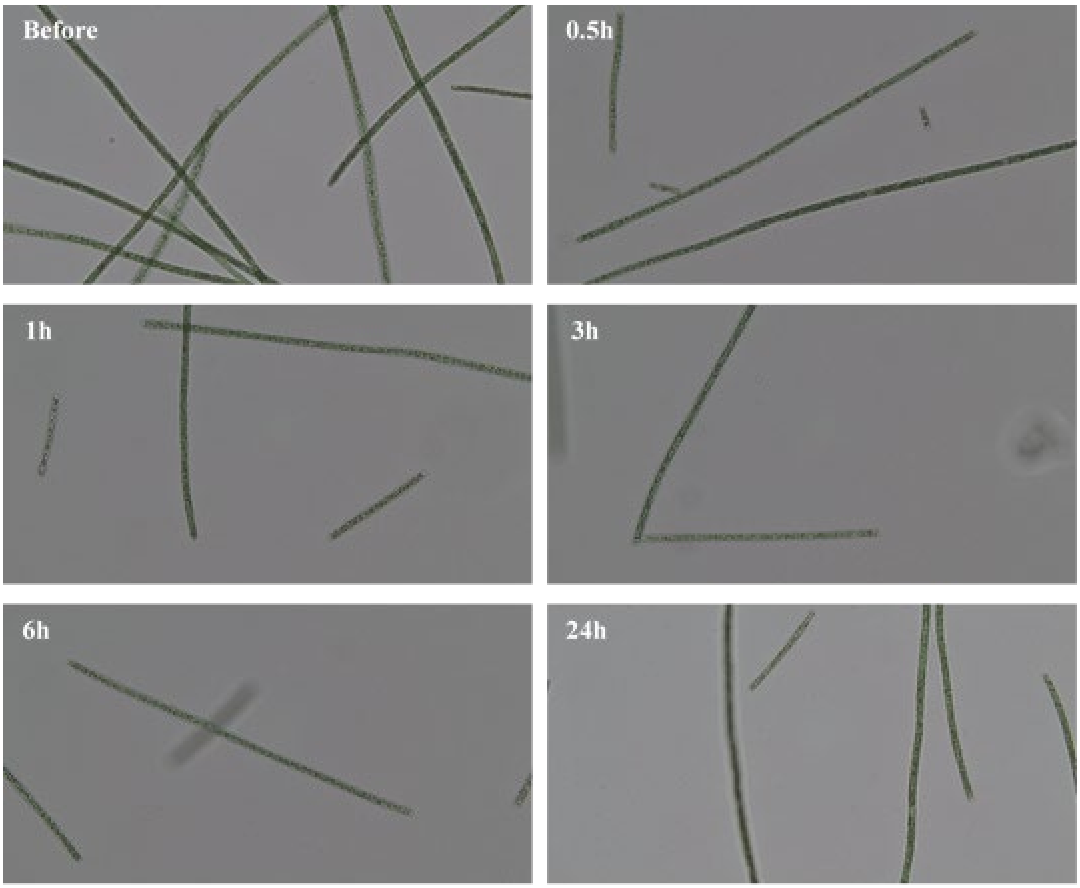


Figure S4. Effect of 20 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes at selected time points (Magnification 500x). First Experiment.

Figure S5

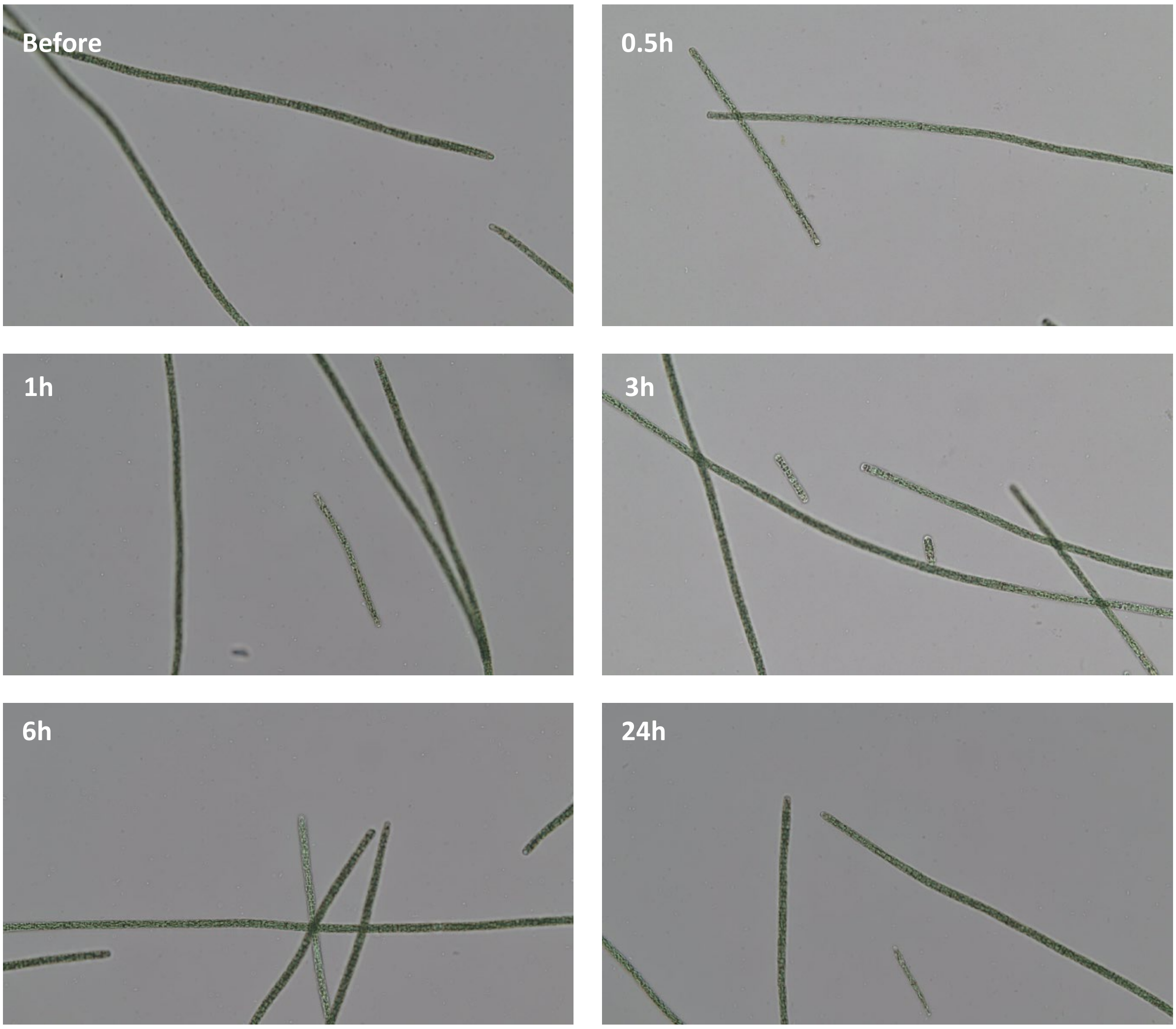


Figure S5. Effect of 30 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes at selected time points (Magnification 500x). Second Experiment.

Figure S6

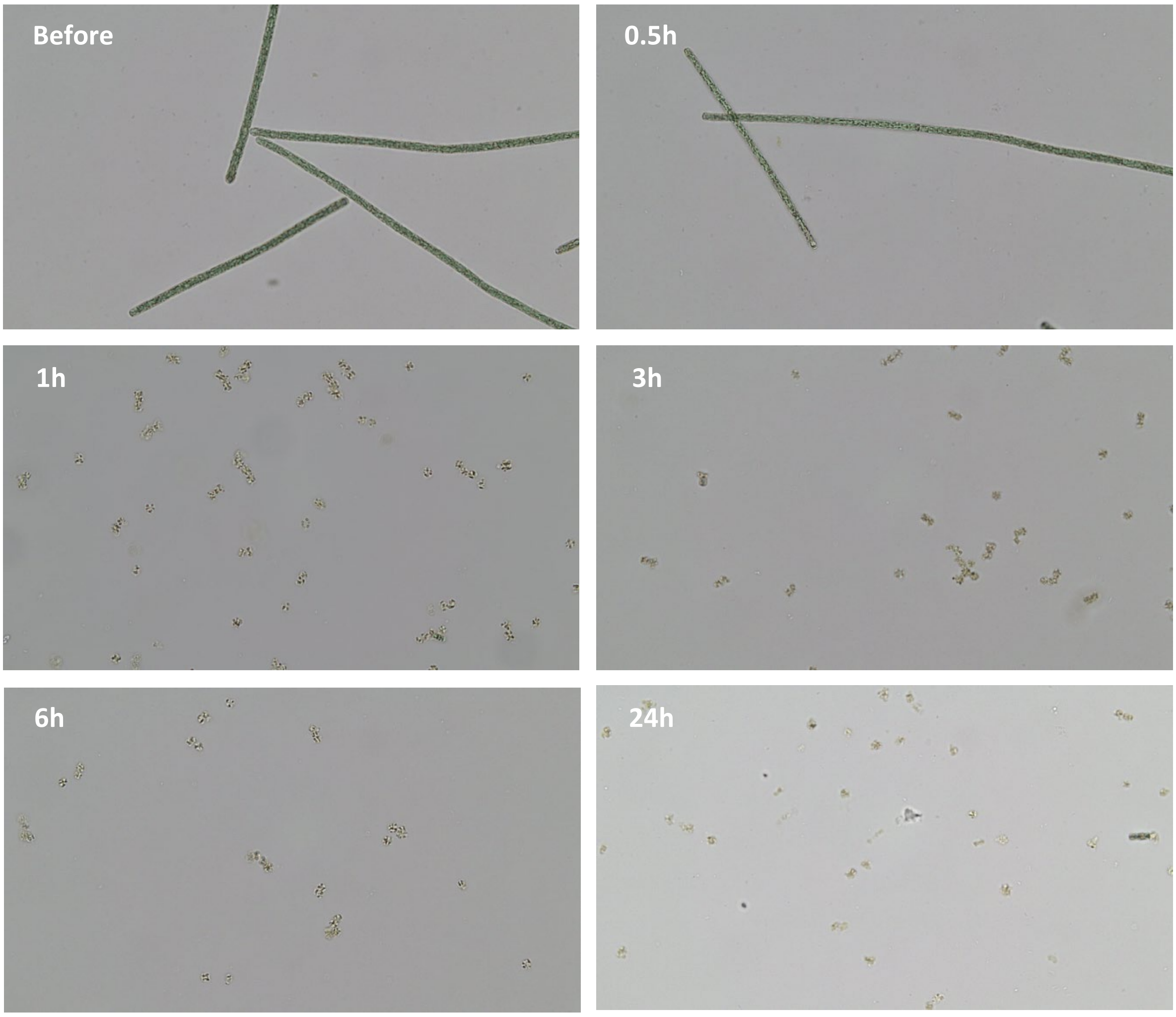


Figure S6. Effect of 40 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes at selected time points (Magnification 500x). Second Experiment.

Figure S7

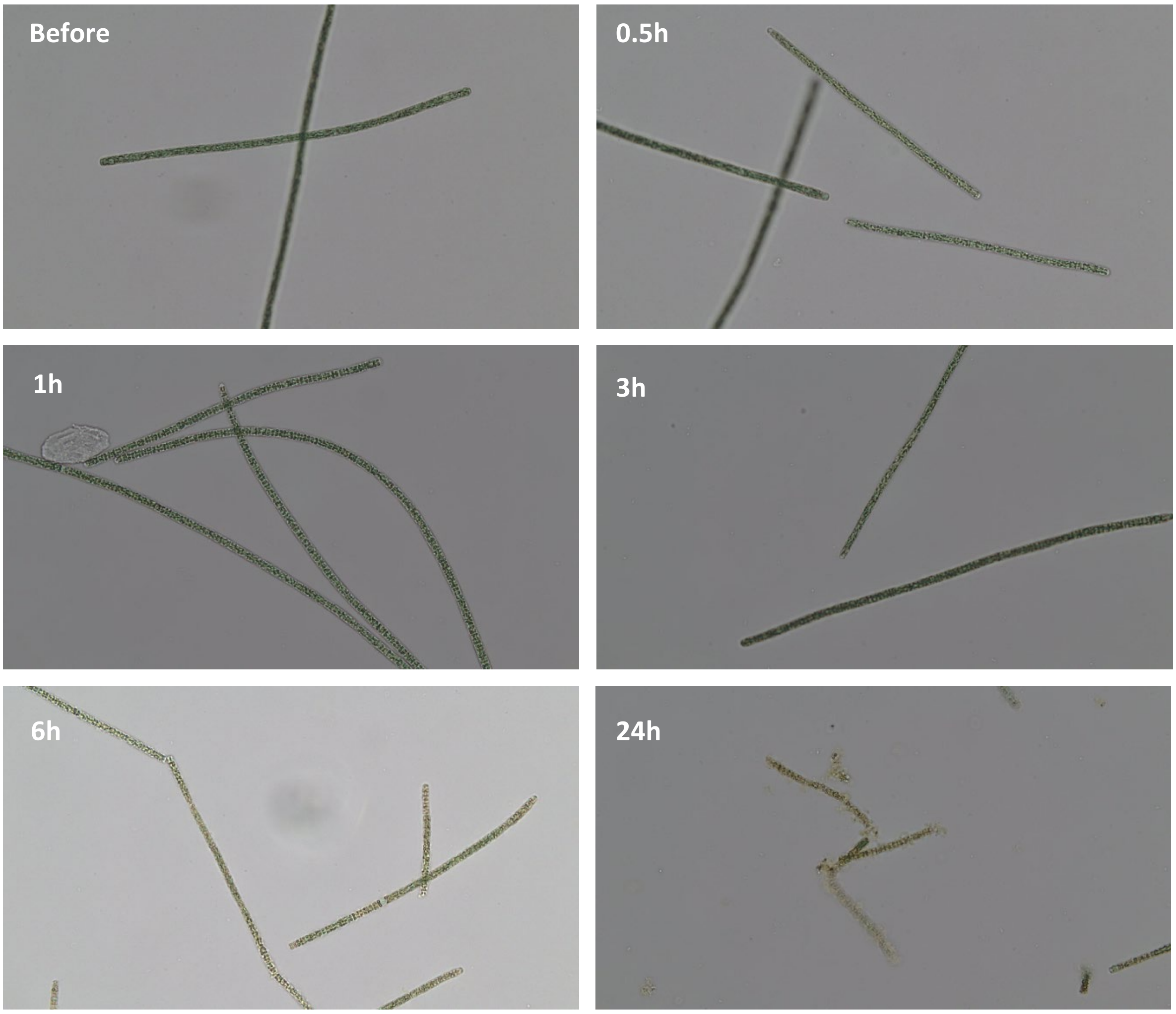


Figure S7. Effect of 80 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes at selected time points (Magnification 500x). Second Experiment.

Figure S8

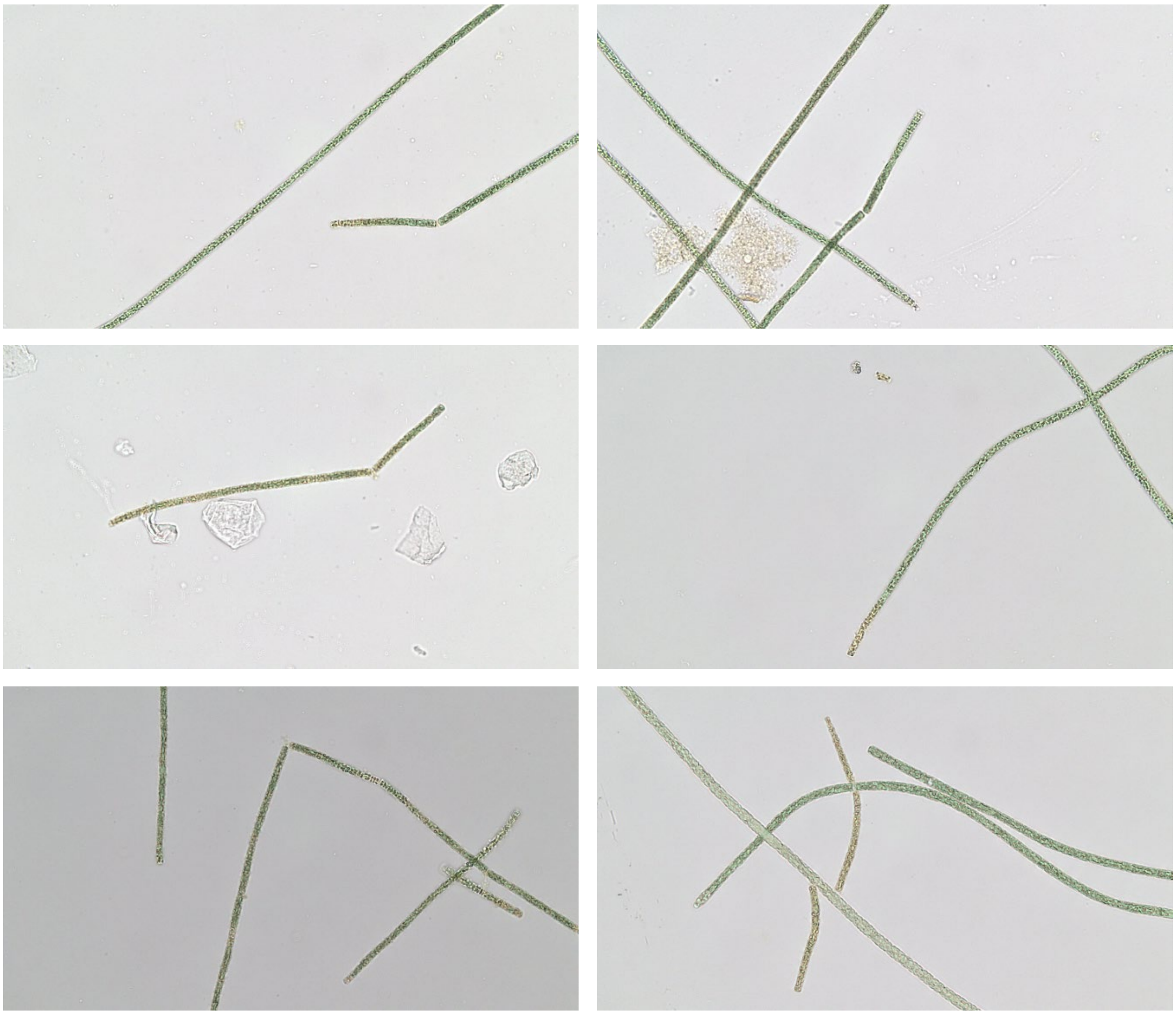


Figure S8. Effect of 80 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes after 6h of exposure (Magnification 500x). Time chosen to create the library of "after treatment" images to train the CNN. Second Experiment.

Figure S9

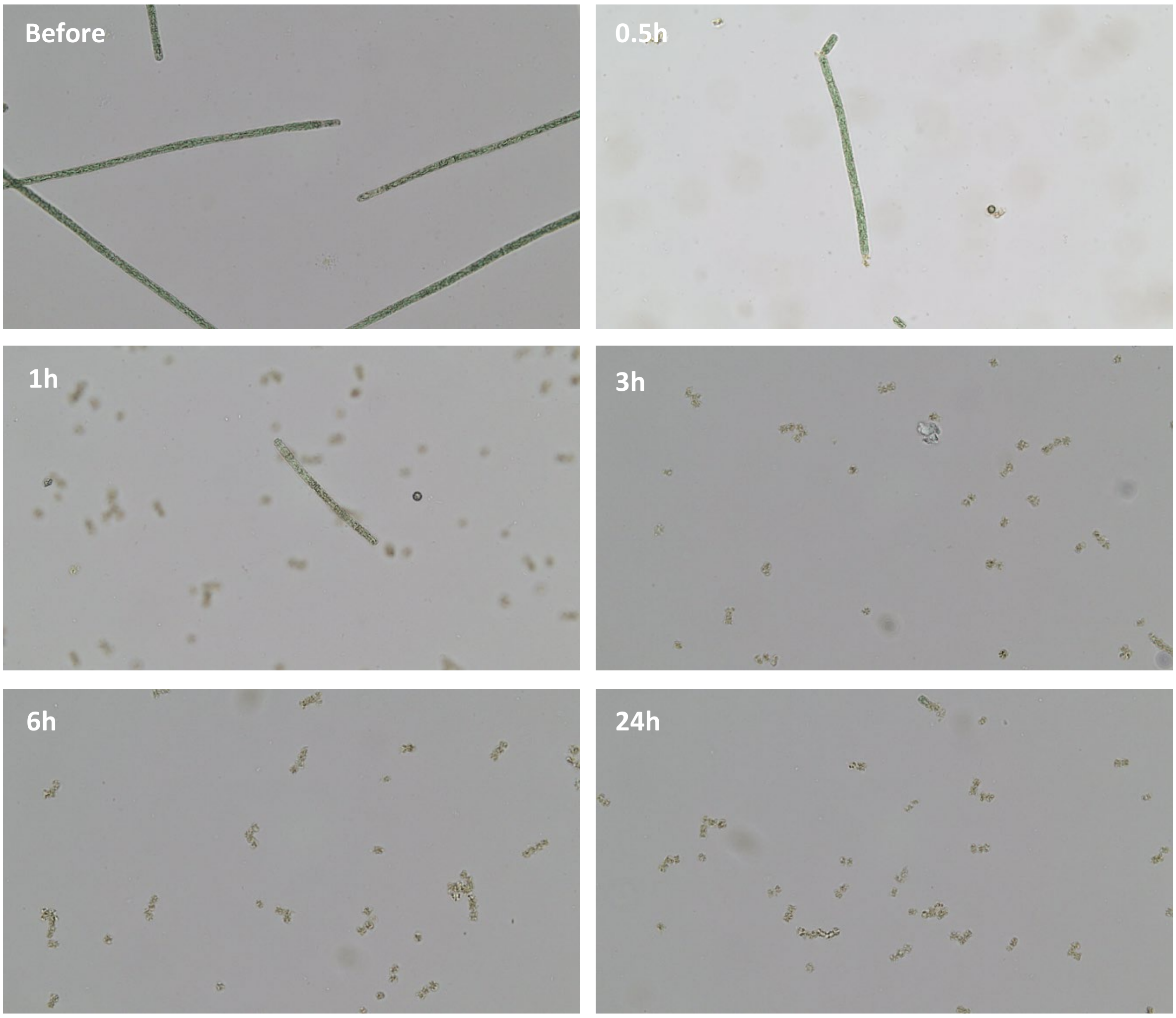


Figure S9. Effect of 40 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes at selected time points (Magnification 500x). Third Experiment.

Figure S10

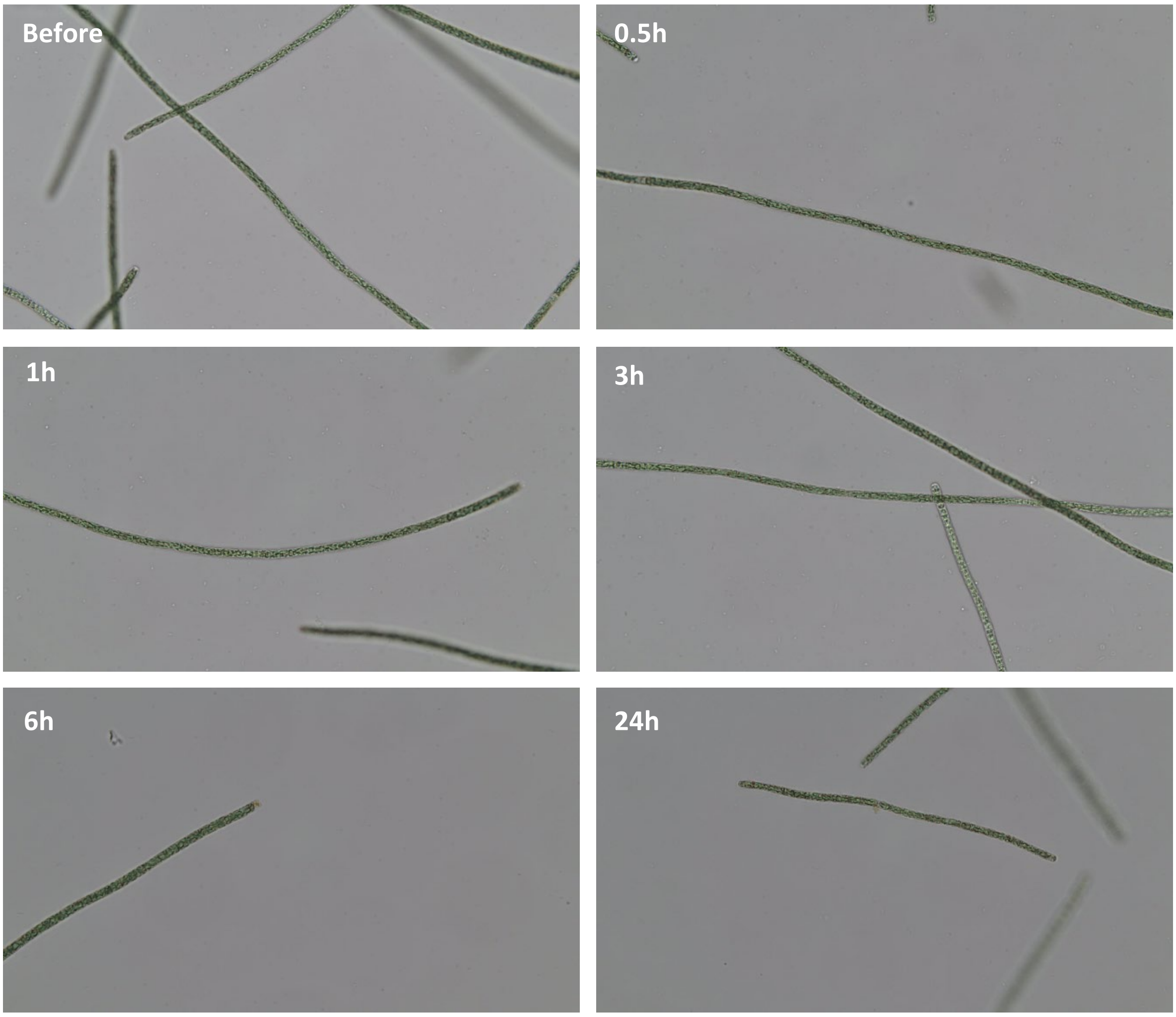


Figure S10. Effect of 80 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes at selected time points (Magnification 500x). Third Experiment.

Figure S11

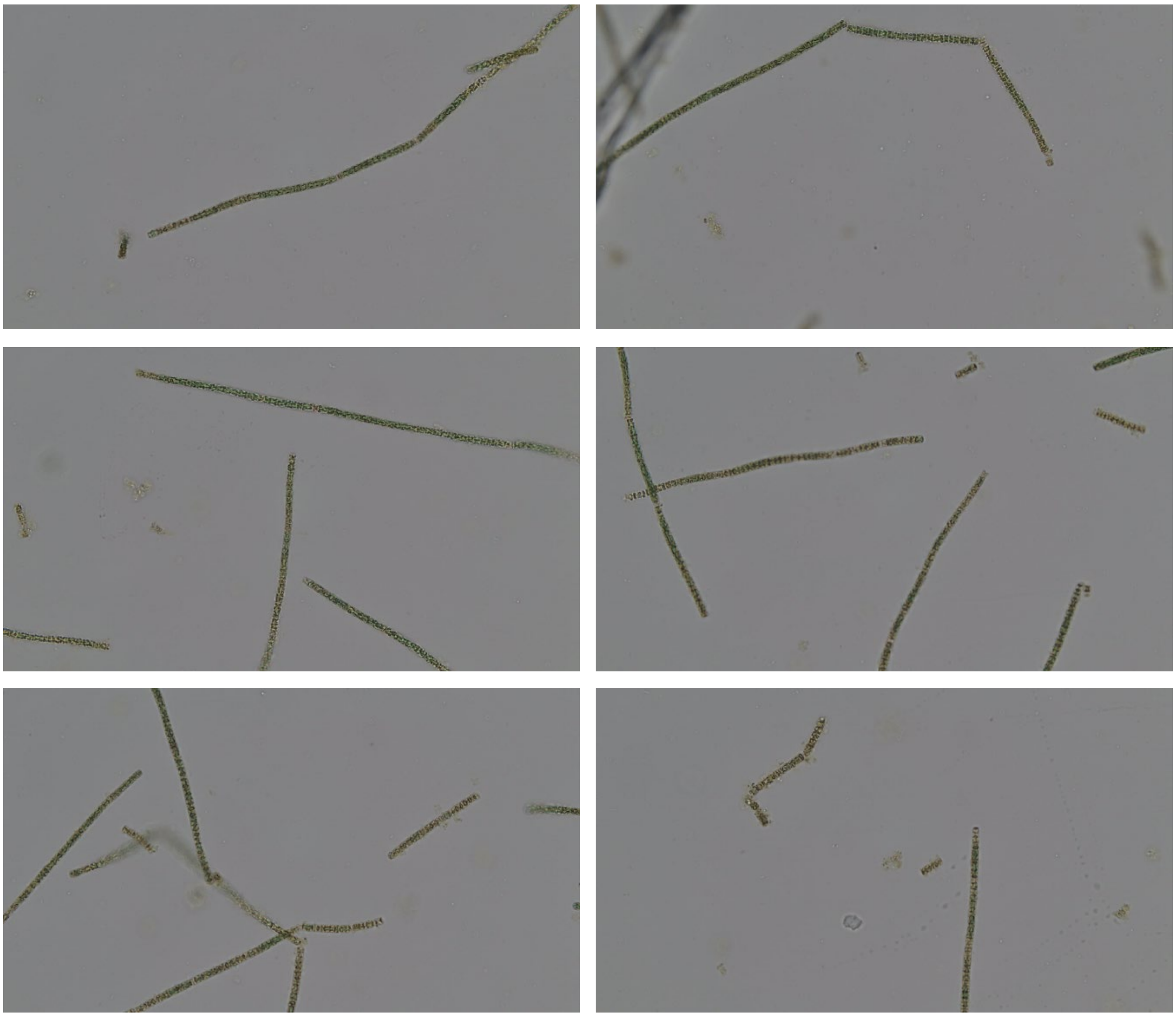
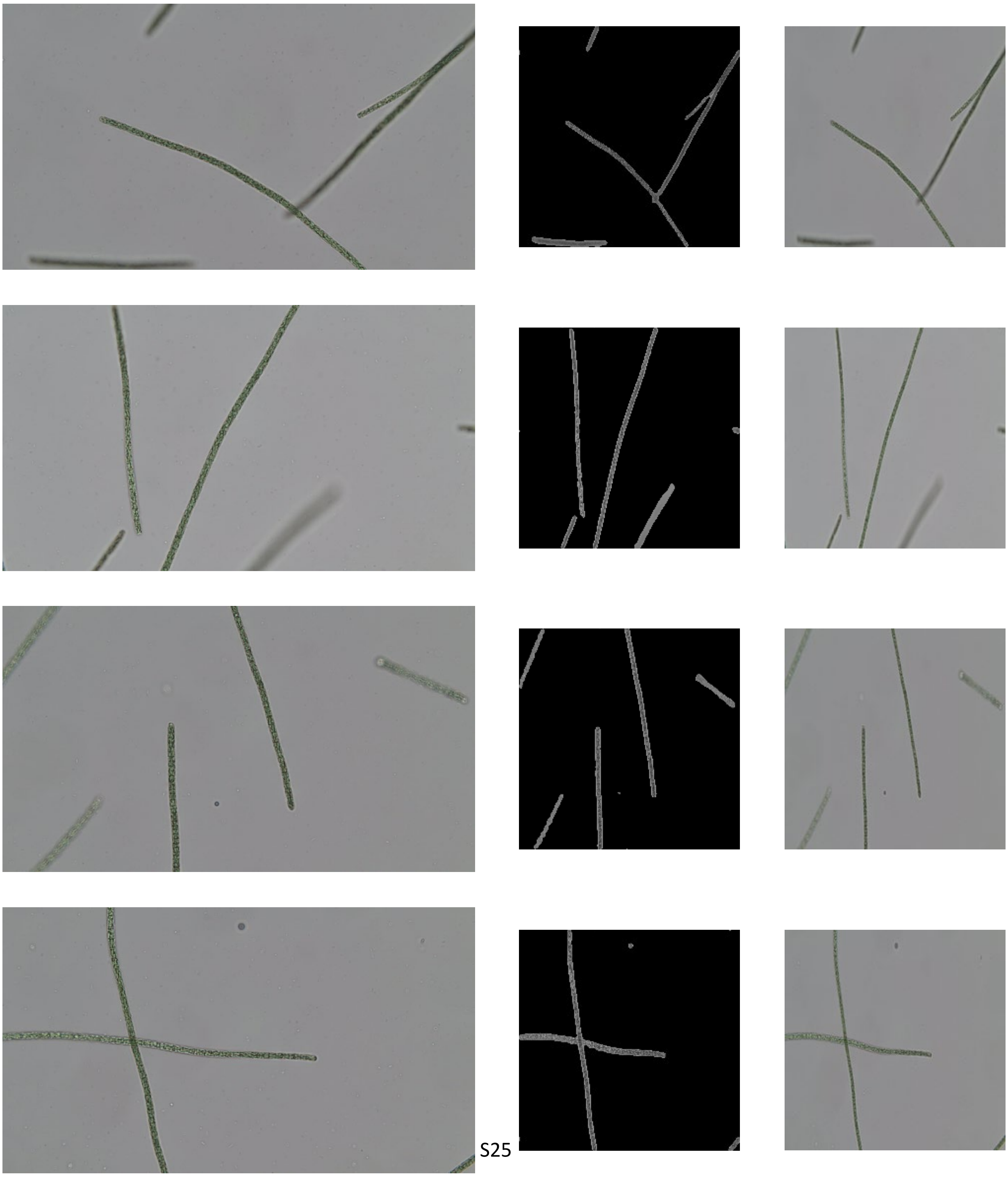


Figure S11. Effect of 80 mg L^{-1} of H_2O_2 on *P. agardhii* trichomes after 24h of exposure (Magnification 500x). Third Experiment.

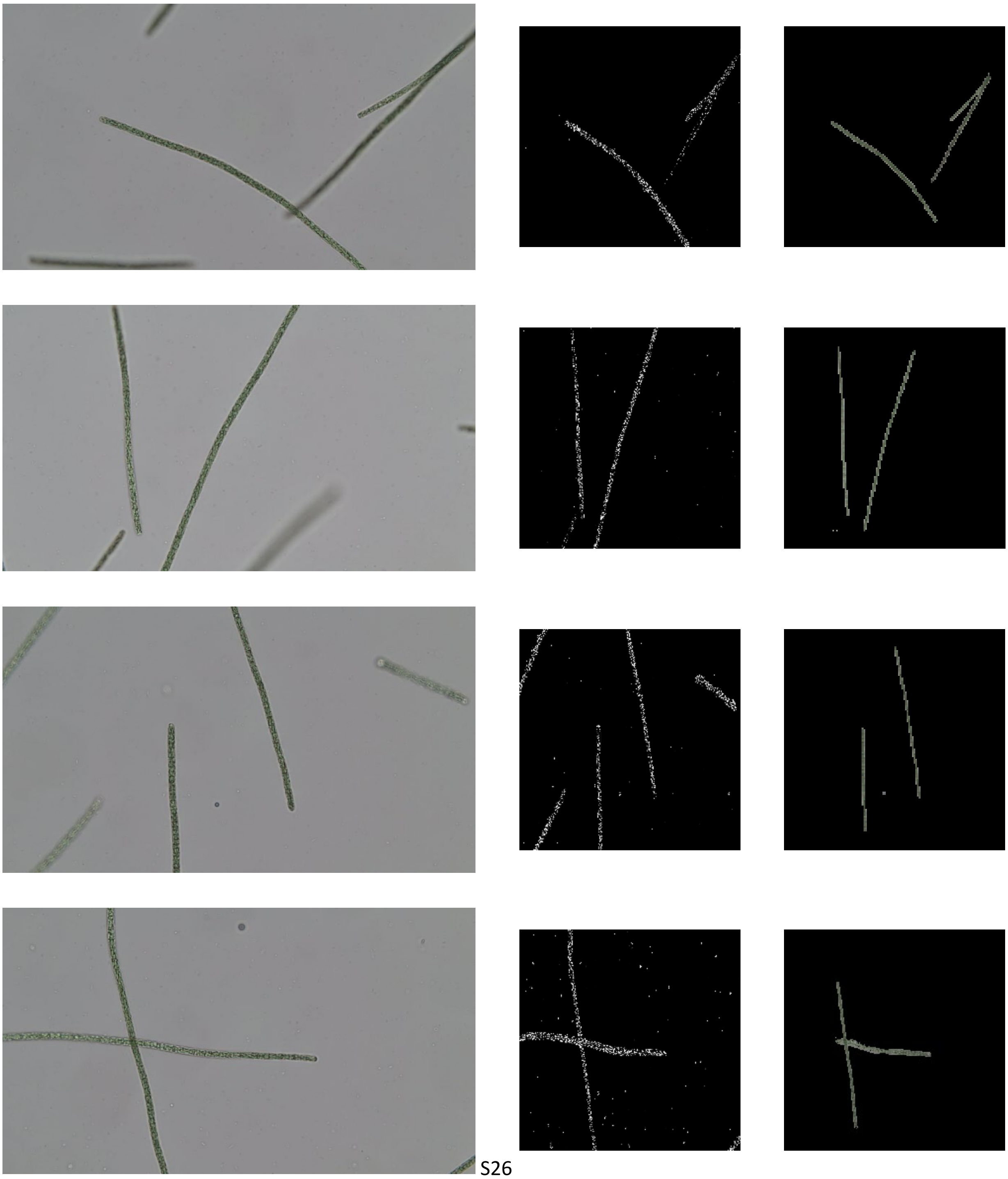
Figure S12



Original images HP filter None (Resized)

Figure S12. Original images and the results of applied segmentations: HP filter and No image segmentation (Resized images).

Figure S13



Original images Canny Edge Detector GrabCut

Figure S13. Original images and the results of applied segmentations: Canny Edge Detector and GrabCut.

Figure S14

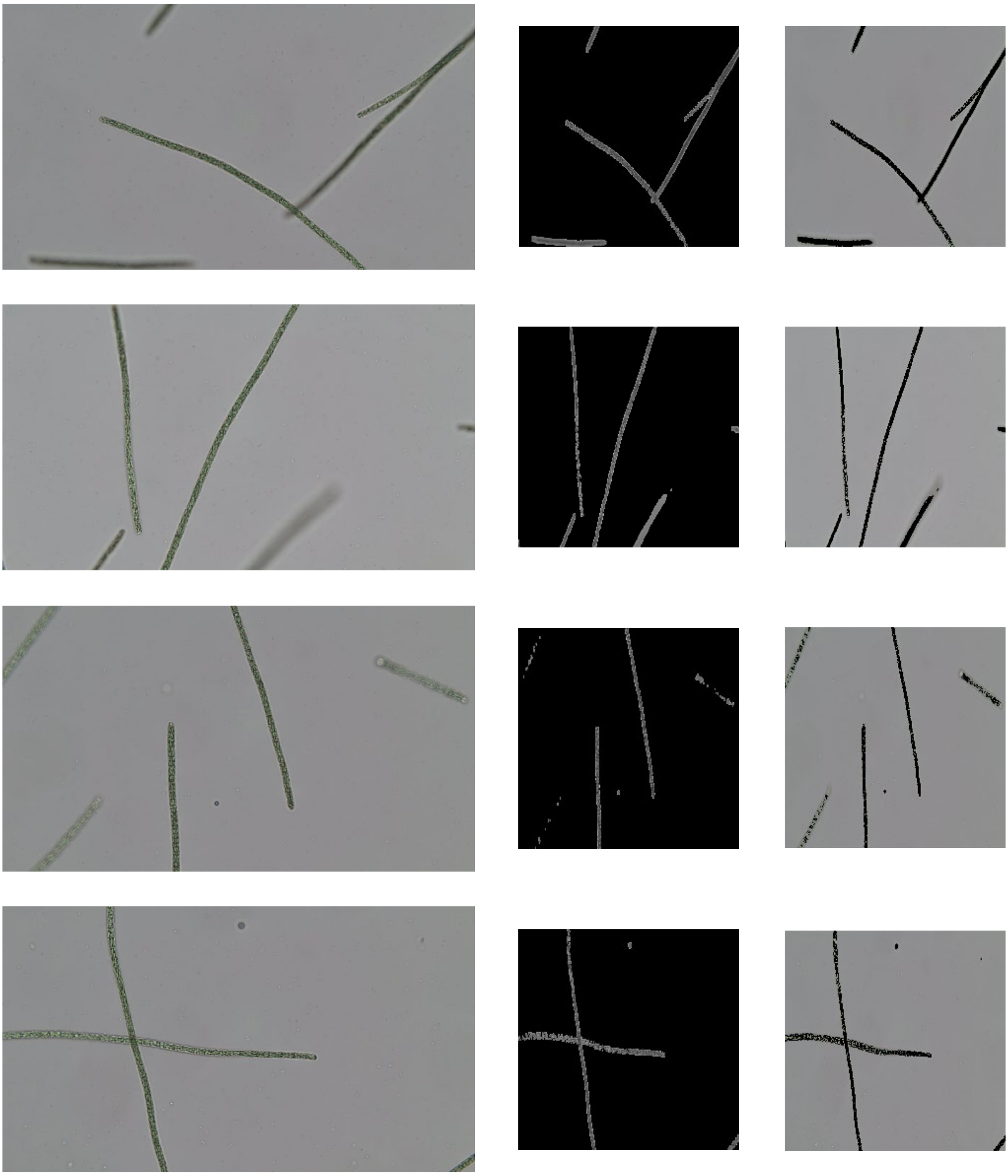


Figure S14. Original images and the results of applied segmentations: Morphological filter and Watershed segmentation.

Table S3

Table S3. P-values from Pairwise Wilcoxon Test from the overall comparison of image segmentations.

Seg.	Canny	GrabCut	HP filter	Morph. filter	None
GrabCut	$1.5\ 10^{-5}$	-	-	-	-
HP filter	$5.2\ 10^{-5}$	$8.3\ 10^{-4}$	-	-	-
Morph. filter	$8.7\ 10^{-5}$	$1.9\ 10^{-3}$	0.7	-	-
None	$2.9\ 10^{-7}$	$2.4\ 10^{-11}$	$4.6\ 10^{-10}$	$7.2\ 10^{-10}$	-
Watershed	$1.9\ 10^{-3}$	$4\ 10^{-9}$	$2.9\ 10^{-7}$	$2.9\ 10^{-7}$	$4.6\ 10^{-2}$

Table S4

Table S4. P-values from Pairwise Wilcoxon Test from the overall comparison of optimizers.

Optimizer	Adagrad	Adam	RMSProp
Adam	$4.2\ 10^{-5}$	-	-
RMSProp	$1.4\ 10^{-4}$	0.49	-
SGD	0.19	$1.6\ 10^{-5}$	$2.2\ 10^{-7}$

Table S5

Table S5. P-values from Pairwise Wilcoxon Test from the comparison of image segmentations for AlexNet.

	Canny	GrabCut	HP filter	Morph. filter	None
GrabCut	$7.00\ 10^{-4}$	-	-	-	-
HP filter	$1.18\ 10^{-2}$	$1.13\ 10^{-2}$			-
Morph. filter	$1.34\ 10^{-2}$	$1.18\ 10^{-2}$	$9.92\ 10^{-1}$		-
None	$1.00\ 10^{-5}$	$5.00\ 10^{-6}$	$5.00\ 10^{-6}$		-
Watershed	$1.18\ 10^{-2}$	$3.80\ 10^{-5}$	$5.60\ 10^{-4}$	$5.50\ 10^{-4}$	$1.29\ 10^{-2}$

Table S6

Table S6. P-values from Pairwise Wilcoxon Test from the comparison of optimizers for AlexNet.

	Adagrad	Adam	RMSProp
Adam	0.96	-	-
RMSProp	0.96	0.96	-
SGD	0.76	0.76	0.76

Table S7

Table S7. P-values from Pairwise Wilcoxon Test from the comparison of image segmentations for 3ConvLayer.

	Canny	GrabCut	HP filter	Morph. filter	None
GrabCut	$1.61\ 10^{-1}$	-	-	-	-
HP filter	$5.52\ 10^{-2}$	$3.27\ 10^{-1}$	-	-	-
Morph. filter	$3.65\ 10^{-1}$	$1.67\ 10^{-1}$	$4.20\ 10^{-1}$	-	-
None	$8.84\ 10^{-3}$	$5.60\ 10^{-4}$	$5.60\ 10^{-4}$	$3.10\ 10^{-3}$	-
Watershed	$6.84\ 10^{-3}$	$5.60\ 10^{-4}$	$5.60\ 10^{-4}$	$2.93\ 10^{-3}$	$9.30\ 10^{-1}$

Table S8

Table S8. P-values from Pairwise Wilcoxon Test from the comparison of optimizers for 3Convlayer.

	Adagrad	Adam	RMSProp
Adam	$2.90\ 10^{-7}$	-	-
RMSProp	$1.40\ 10^{-7}$	$8.50\ 10^{-1}$	-
SGD	$1.5\ 10^{-12}$	$5.70\ 10^{-1}$	$2.3\ 10^{-1}$

Table S9

Table S9. P-values from Pairwise Wilcoxon Test from the comparison of image segmentations for 2ConvLayer.

	Canny	GrabCut	HP filter	morph. filter	None
GrabCut	$2.16\ 10^{-2}$	-	-	-	-
HP filter	$2.16\ 10^{-2}$	$4.79\ 10^{-2}$	-	-	-
morph. filter	$4.00\ 10^{-3}$	$2.28\ 10^{-1}$	$5.09\ 10^{-2}$	-	-
None	$5.09\ 10^{-2}$	$4.00\ 10^{-3}$	$1.86\ 10^{-2}$	$5.50\ 10^{-3}$	-
Watershed	$5.49\ 10^{-1}$	$2.05\ 10^{-2}$	$5.92\ 10^{-2}$	$1.86\ 10^{-2}$	$3.12\ 10^{-1}$

Table S10

Table S10. P-values from Pairwise Wilcoxon Test from the comparison of optimizers for 2ConvLayer.

	Adagrad	Adam	RMSProp
Adam	$6.10\ 10^{-2}$	-	-
RMSProp	$2.42\ 10^{-1}$	$2.95\ 10^{-1}$	-
SGD	$4.40\ 10^{-2}$	$4.710\ 10^{-8}$	$3.60\ 10^{-10}$

Table S11

Table S11. Summary information of the combinations which provided accuracy values equal or higher than 90.0%.

Architecture	Count	Segmentation	Count	Optimizer	Count
AlexNet	9	GrabCut	28	Adagrad	8
3ConvLayer	9	None	2	Adam	13
2ConvLayer	13	Watershed	1	RMSProp	8
-	-	-	-	SGD	2

Table S12

Table S12. Accuracy values of the chosen best combinations.

Architecture	Epochs	Segmentation	Optimizer	Accuracy
2ConvLayer	10	GrabCut	Adam	0.933
2ConvLayer	10	GrabCut	Adam	0.928
2ConvLayer	10	GrabCut	Adam	0.935
2ConvLayer	10	GrabCut	Adam	0.928
2ConvLayer	10	GrabCut	Adam	0.933
2ConvLayer	10	GrabCut	Adam	0.933
2ConvLayer	10	GrabCut	Adam	0.937
2ConvLayer	10	GrabCut	Adam	0.942
2ConvLayer	10	GrabCut	Adam	0.923
2ConvLayer	10	GrabCut	Adam	0.895

AlexNet	25	GrabCut	Adagrad	0.921
AlexNet	25	GrabCut	Adagrad	0.911
AlexNet	25	GrabCut	Adagrad	0.895
AlexNet	25	GrabCut	Adagrad	0.954
AlexNet	25	GrabCut	Adagrad	0.952
AlexNet	25	GrabCut	Adagrad	0.940
AlexNet	25	GrabCut	Adagrad	0.931
AlexNet	25	GrabCut	Adagrad	0.930
AlexNet	25	GrabCut	Adagrad	0.901
AlexNet	25	GrabCut	Adagrad	0.925
3ConvLayer	25	GrabCut	RMSProp	0.840
3ConvLayer	25	GrabCut	RMSProp	0.926
3ConvLayer	25	GrabCut	RMSProp	0.816
3ConvLayer	25	GrabCut	RMSProp	0.914
3ConvLayer	25	GrabCut	RMSProp	0.909
3ConvLayer	25	GrabCut	RMSProp	0.901
3ConvLayer	25	GrabCut	RMSProp	0.904
3ConvLayer	25	GrabCut	RMSProp	0.919
3ConvLayer	25	GrabCut	RMSProp	0.921
3ConvLayer	25	GrabCut	RMSProp	0.911
2ConvLayer	30	None	RMSProp	0.907
2ConvLayer	30	None	RMSProp	0.900
2ConvLayer	30	None	RMSProp	0.823
2ConvLayer	30	None	RMSProp	0.5
2ConvLayer	30	None	RMSProp	0.837
2ConvLayer	30	None	RMSProp	0.859
2ConvLayer	30	None	RMSProp	0.5
2ConvLayer	30	None	RMSProp	0.560
2ConvLayer	30	None	RMSProp	0.758
2ConvLayer	30	None	RMSProp	0.928
2ConvLayer	30	None	Adam	0.5
2ConvLayer	30	None	Adam	0.871
2ConvLayer	30	None	Adam	0.5
2ConvLayer	30	None	Adam	0.5
2ConvLayer	30	None	Adam	0.885
2ConvLayer	30	None	Adam	0.5
2ConvLayer	30	None	Adam	0.658
2ConvLayer	30	None	Adam	0.5
2ConvLayer	30	None	Adam	0.878
2ConvLayer	30	None	Adam	0.5

Table S13

Table S13. P-values from Pairwise Wilcoxon Test from the comparison of the 5 final best combinations.

	C1	C2	C3	C4

C2	$5.96\ 10^{-1}$	-	-	-
C3	$3.60\ 10^{-3}$	$5.13\ 10^{-2}$	-	-
C4	$2.15\ 10^{-3}$	$3.40\ 10^{-3}$	$3.67\ 10^{-2}$	-
C5	$7.50\ 10^{-4}$	$7.50\ 10^{-4}$	$2.15\ 10^{-3}$	$1.42\ 10^{-1}$