Unfair CNN? Debias.

Group of Horribly Optimistic STatisticians

Enhancing Fairness in Neural Networks with Debiasing Techniques

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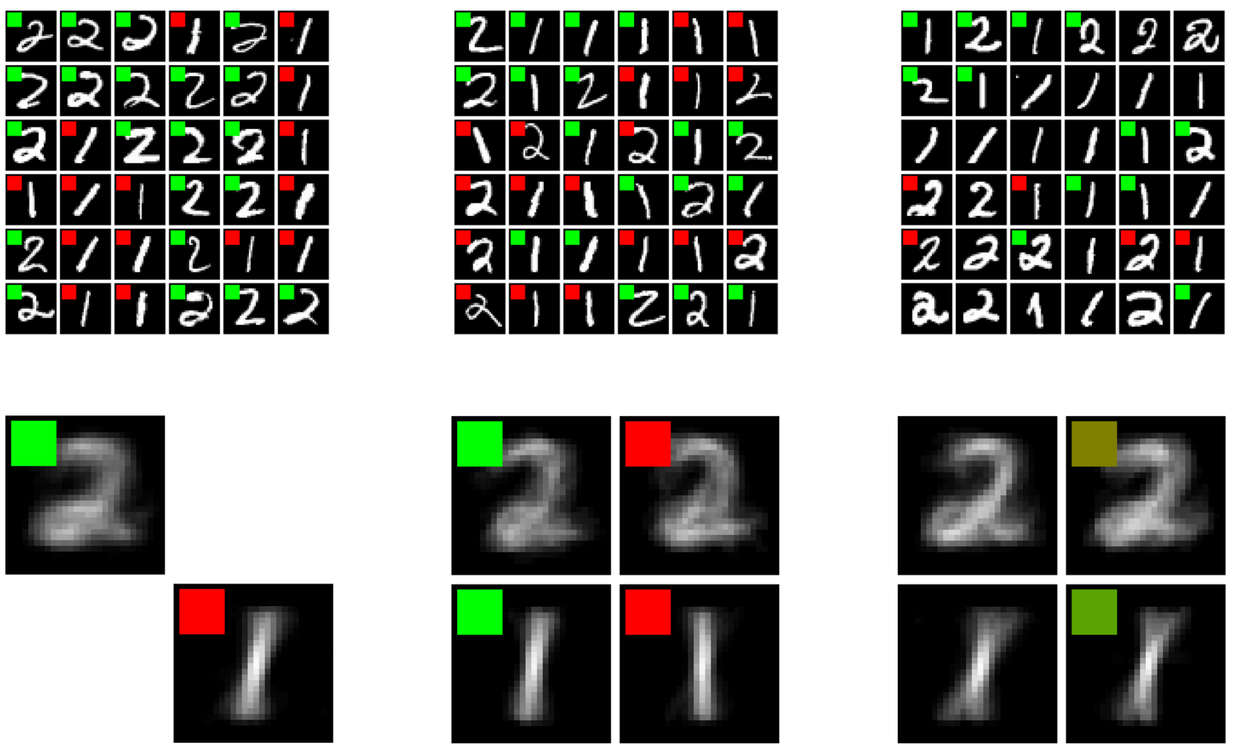
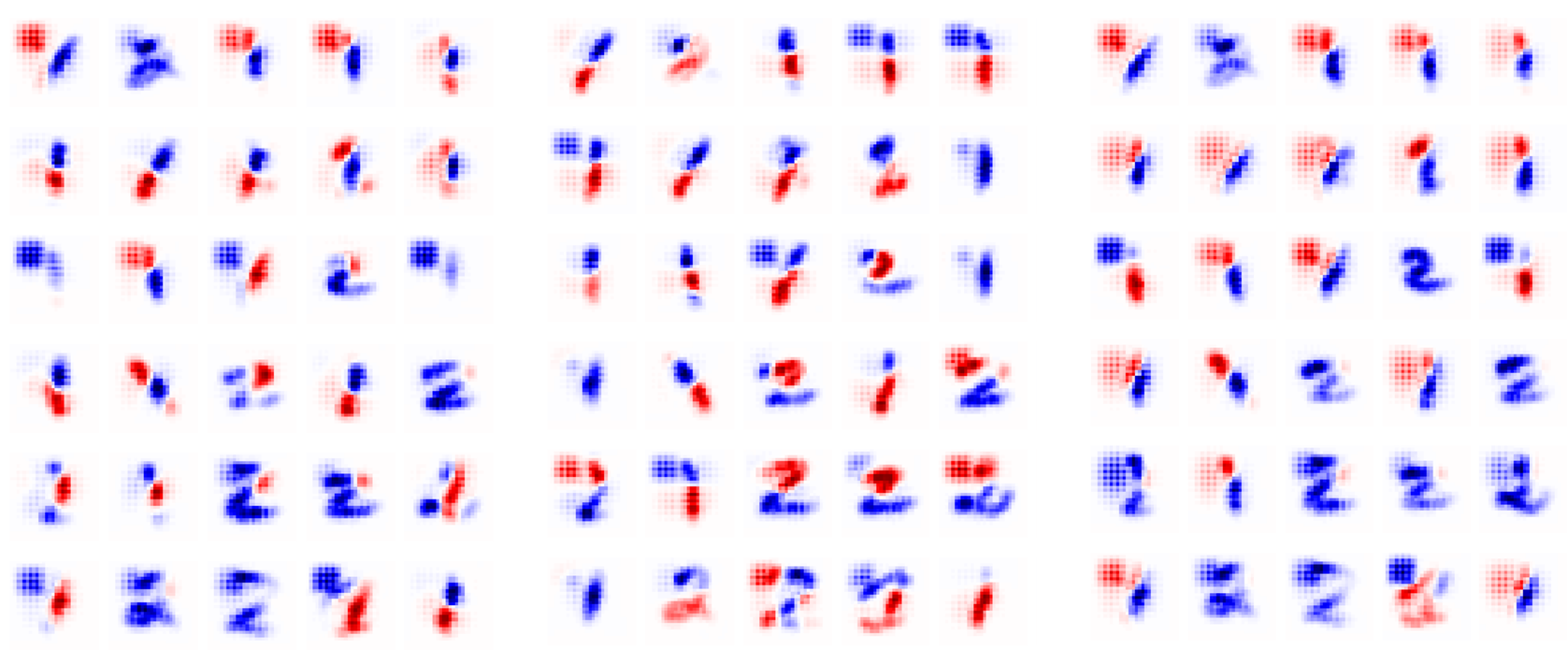
Motivation

- Convolutional neural networks (CNNs) often learn harmful biases (concepts), leading to potential unfair treatment of protected groups
- We aim to determine whether unlearning harmful concepts can enhance model fairness
- Bias mitigation is critical for development of both trustworthy and ethically responsible AI systems

Methods

- $h_{ClArC}(a) = (I - vv^T)a + vv^T \mu_{\mathbf{A}_{non-artifact}}$
- $h_{\text{mass-mean}}(a) = a - (\mu_{\mathbf{A}_{artifact}} - \mu_{\mathbf{A}_{non-artifact}})$





Results discussion

- The threshold optimizer targeting Equalized Odds collapses, while targeting Demographic Parity shows slight improvement in the metric
- Layer-Wise Relevance Propagation (LRP) visualizations reveal bias and the impact of debiasing
- Debiasing techniques enhance fairness by targeting prediction construction issues
- P-ClArC significantly boosts both performance and fairness metrics
- Mass-mean probing, despite its simplicity, yields promising results

	Macro Accuracy ( )	Demographic Parity ( )	Equalized Odds ( )	Equality of Opportunity ( )
Base CNN	51.11	0.99	0.98	0.99
Threshold Optimizer (DP)	51.02 (-0.09)	0.97 (-0.02)	0.98 (+0.00)	0.99 (+0.00)
Threshold Optimizer (EO)	50.00* (-1.11)	0.00* (-0.99)	0.00* (-0.99)	0.00* (-0.99)
P-ClArC	96.51 (+45.40)	0.07 (-0.92)	0.06 (-0.92)	0.05 (-0.94)
Mass-mean	68.25 (+17.14)	0.98 (-0.01)	0.54 (-0.44)	0.98 (-0.01)

References

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