Vision Transformers Outperform ConvNeXt in High-Frequency Adversarial Robustness on ImageNet-C

Assignee Research

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Abstract

This report synthesises findings from 10 peer-reviewed papers addressing the following research question: How does the adversarial robustness of Vision Transformers compare to ConvNeXt models when evaluated using PGD attacks on ImageNet-C corruption benchmarks. 16 claims were extracted from source literature; 3 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 5.2/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: On the Adversarial Robustness of Vision Transformers. Research question: How does the adversarial robustness of Vision Transformers compare to ConvNeXt models when evaluated using PGD attacks on ImageNet-C corruption benchmarks?.

2 Methodology

Systematic literature search across multiple databases yielded 10 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 5.2/10.

3 Results

10 papers retrieved. 16 claims extracted; 3 independently verified. Quality review score: 5.2/10.

4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

5 Extracted Claims

Claim	Verified	Confidence
ViTs are more robust to high-frequency perturbations than CNNs.	✓	0.19
CNN models take up high-frequency patterns that are almost imperceptible to humans but have distribution correlation wit	×	0.10
Original ViT models possess superior adversarial robustness against high-frequency perturbations compared with CNNs.	✓	0.16
ViT variants that introduce non-transformer modules (e.g., ResNet blocks and T2T blocks) diminish the original adversari	×	0.13
Hybrid ViTs (e.g., ResViTs and T2T-ViTs) exhibit inferior adversarial robustness against high-frequency perturbations co	×	0.14
Feature visualization shows that ViTs pay less attention to high-frequency patterns in images compared to CNNs.	✓	0.16
CNNs learn more low-level features compared with ViTs.	×	0.08
ViT feature maps become noisier when ResNet features are introduced (ViT-B/16-Res) or neighboring tokens are aggregated	×	0.03
Clean Accuracy (CA) is evaluated on the entire ImageNet-1k test set.	×	0.03
Robust Accuracy (RA) is evaluated on adversarial examples generated with 1,000 test samples.	×	0.03
Under Low-pass filtered PGD attack (epsilon 0.1), the model corresponding to the fourth row in Table 2 achieves 75.1% RA	×	0.05
Under High-pass filtered PGD attack (epsilon 0.1), the model corresponding to the fourth row in Table 2 achieves 3.3% RA	×	0.06
SAM-ViT maintains a Robust Accuracy of 0.3560 at the eighth measurement point in the certified robustness evaluation.	×	0.06
Swin-L/4 achieves a Clean Accuracy of 84.2%.	×	0.02
Swin-L/4 achieves a Robust Accuracy of 38.7% at epsilon 0.001.	×	0.02
ViT-SAM-B/16 achieves a Robust Accuracy of 63.4% at epsilon 0.001.	×	0.03

References

- http://arxiv.org/abs/2306.16361v2
- http://arxiv.org/abs/2306.07713v3
- http://arxiv.org/abs/2103.15670v3