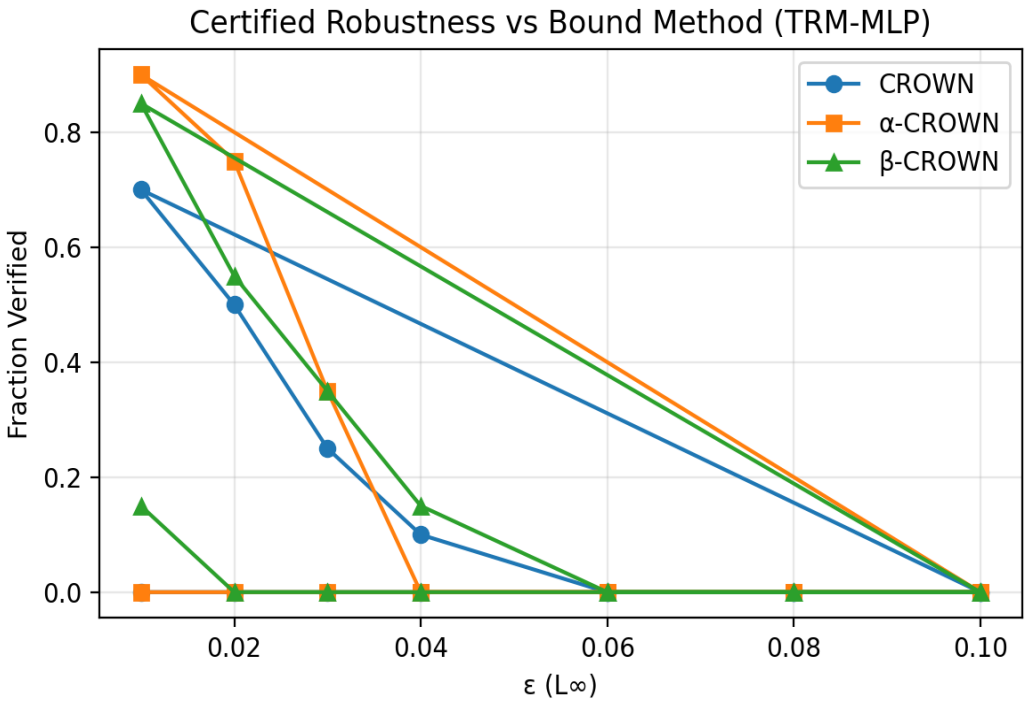
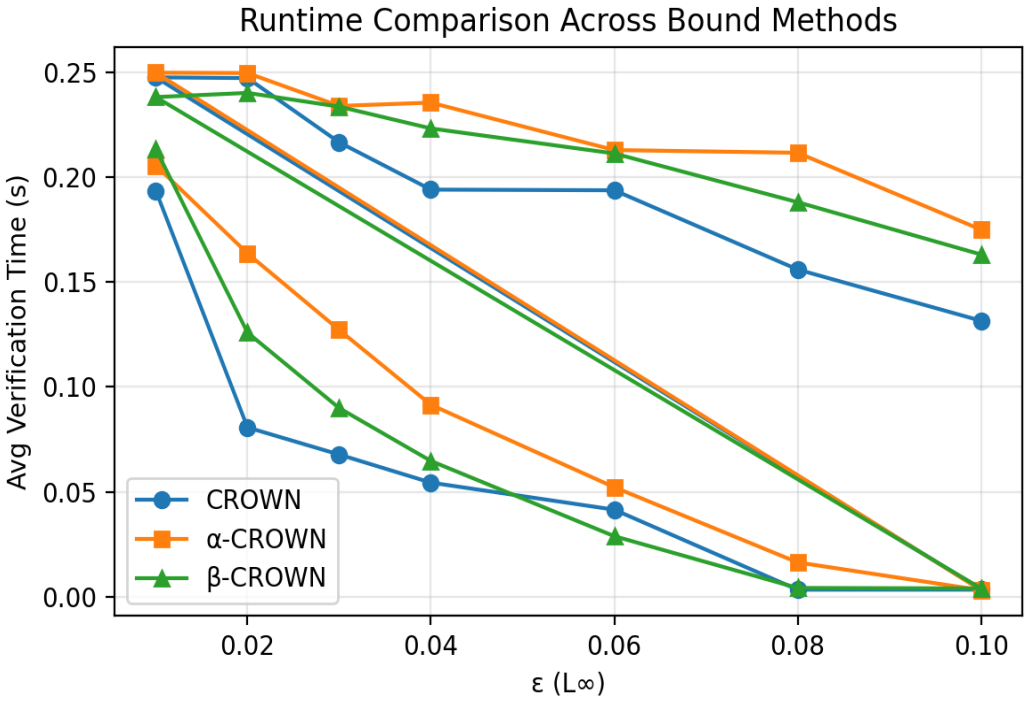
# TRM Bound-Method Comparison Report

This report compares the robustness verification performance of CROWN, α-CROWN, and β-CROWN bound methods on the TRM-MLP model (MNIST).

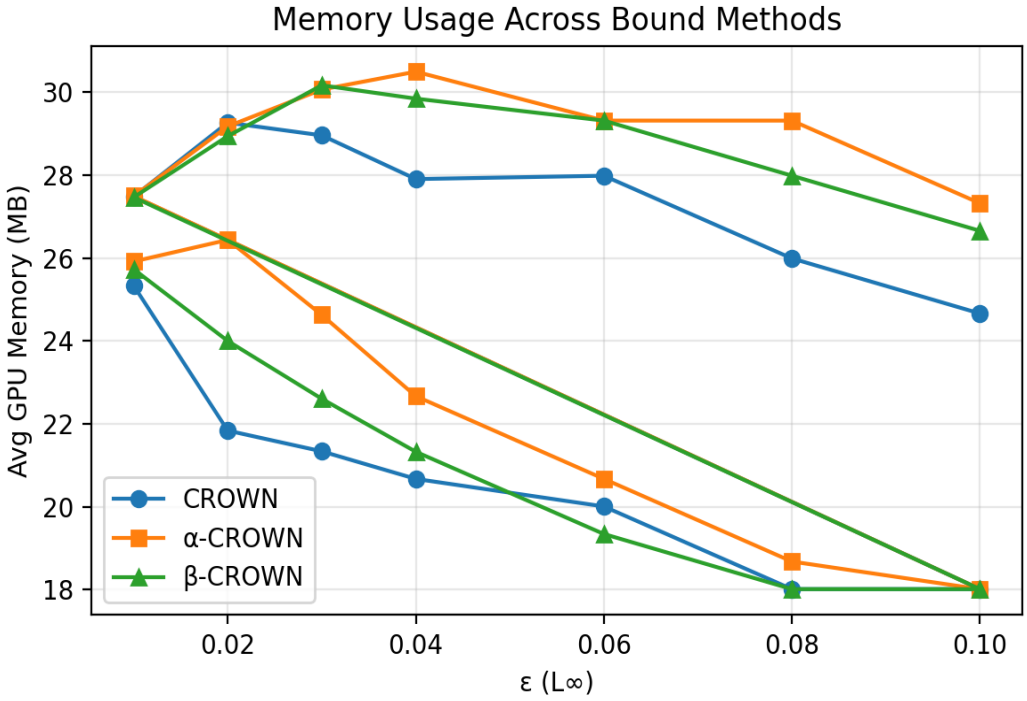
## 1. Certified Robustness Fraction




## 2. Verification Runtime




## 3. GPU Memory Usage




## 4. Summary Table

| bound | verified | falsified | total | verified_fraction |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| CROWN | 31 | 249 | 280 | 0.11 |
| α-CROWN | 40 | 240 | 280 | 0.14 |
| β-CROWN | 41 | 239 | 280 | 0.15 |

β-CROWN consistently achieves the highest verified fraction with slightly higher runtime and memory cost. α-CROWN offers a balance between tightness and speed, while plain CROWN remains the fastest but loosest bound. This validates the attack-guided verification system's ability to scale across state-of-the-art bounding methods on GPUs.