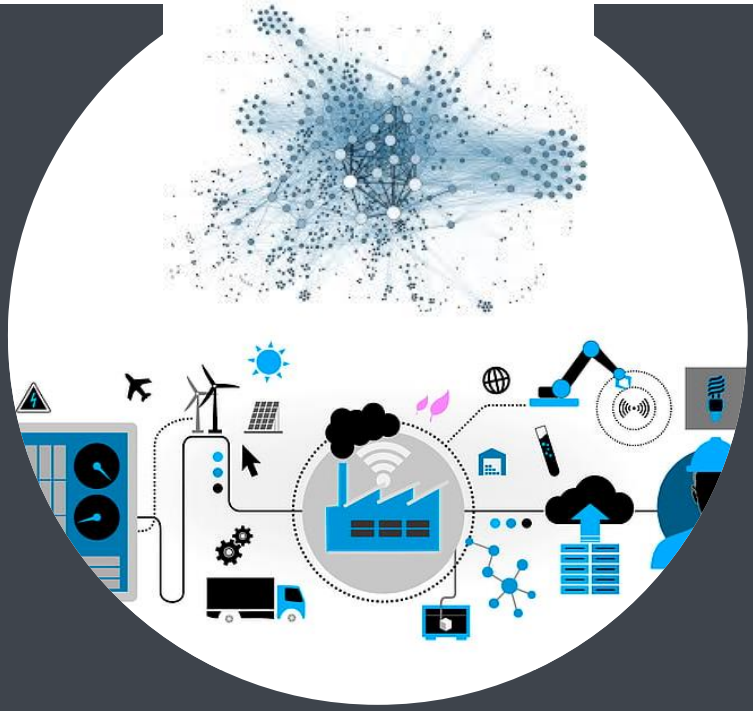
University of Stuttgart

Bayesian Model for Trustworthiness Analysis of Deep Learning Classifiers



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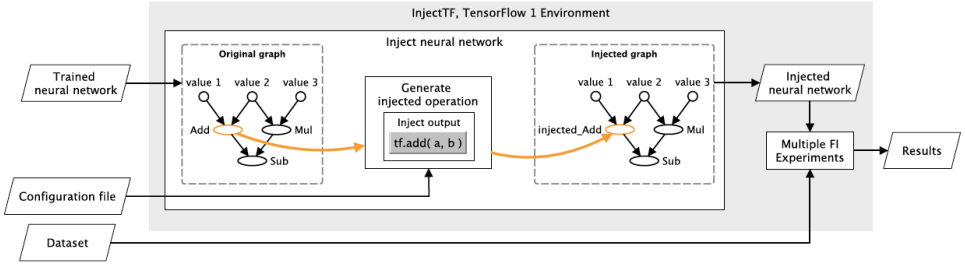
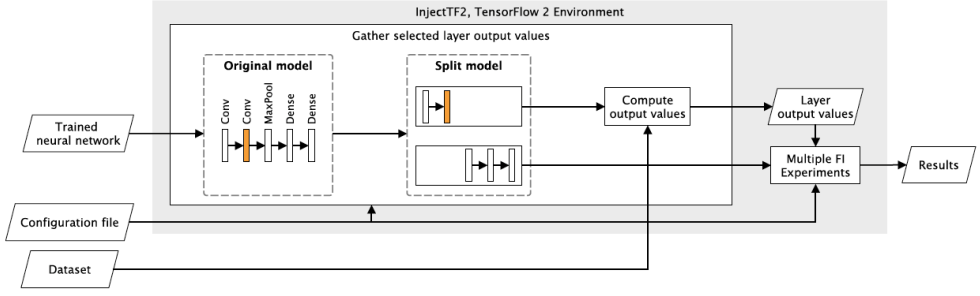
AI Safety Workshop, IJCAI 2020, Online

Impact of Random Hardware Faults on DNNs

- Deep Learning software is prone to random hardware faults e.g. bit flips.
- We developed two fault injection framework for TensorFlow 1 and 2.

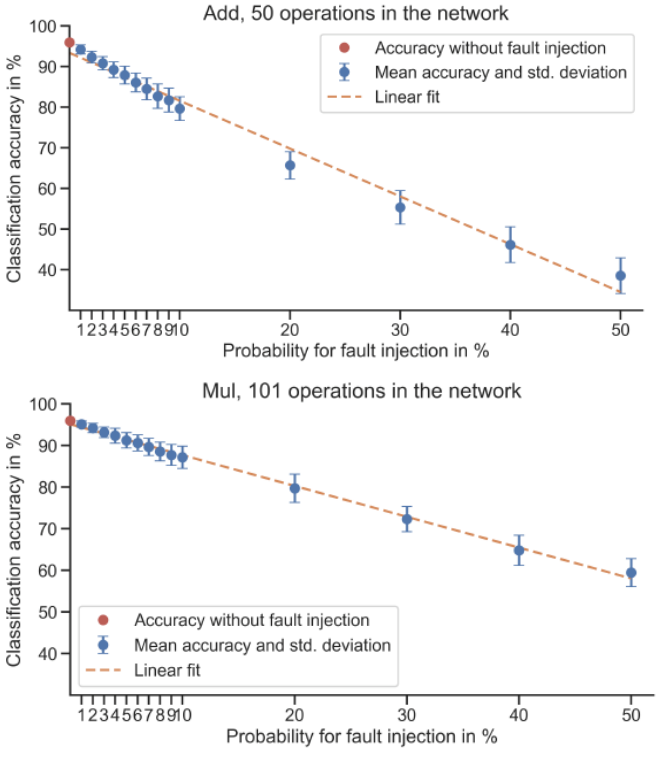


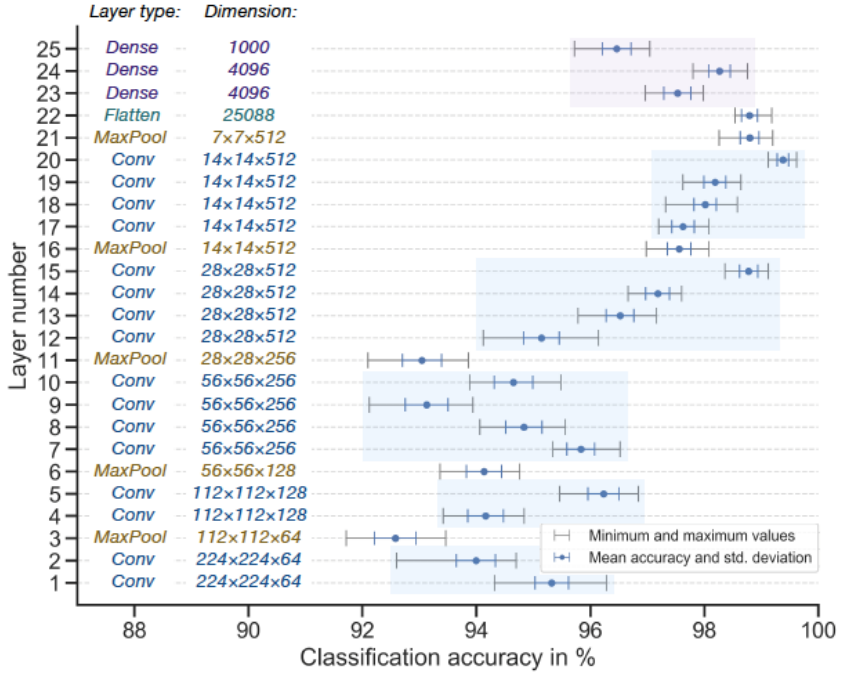
https://github.com/mbsa-tud/InjectTF



https://github.com/mbsa-tud/InjectTF2

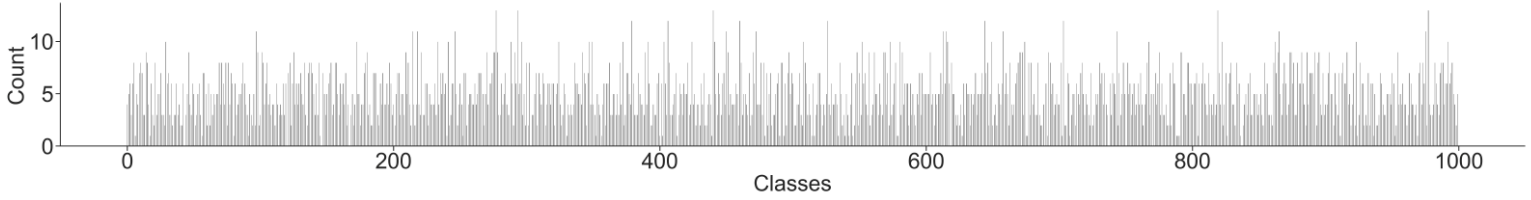
Impact of Random Hardware Faults on DNNs



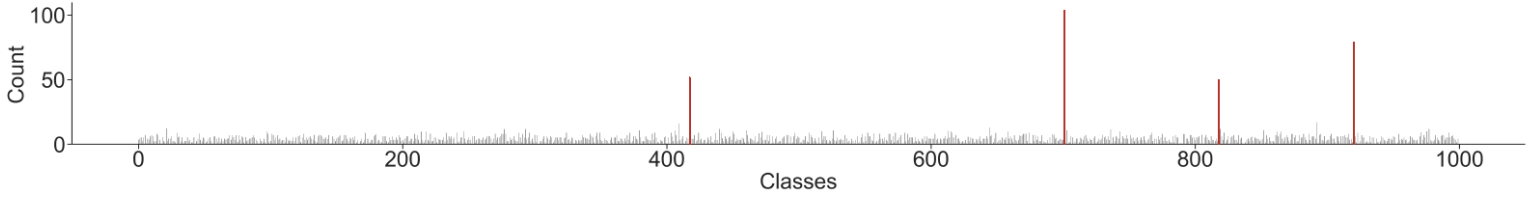


Resulting classification accuracies for the VGG19 CNN.

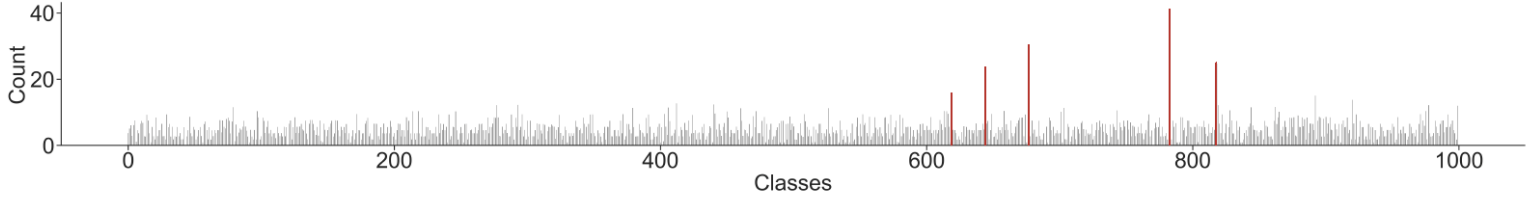
Sink Classes



(a) VGG19: Fault free run.



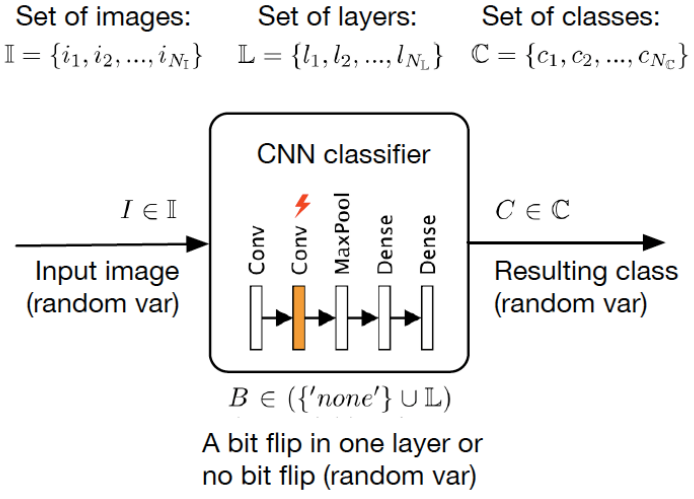
(b) VGG19: Fault injection in Layer 3. The sink classes are highlighted in red.

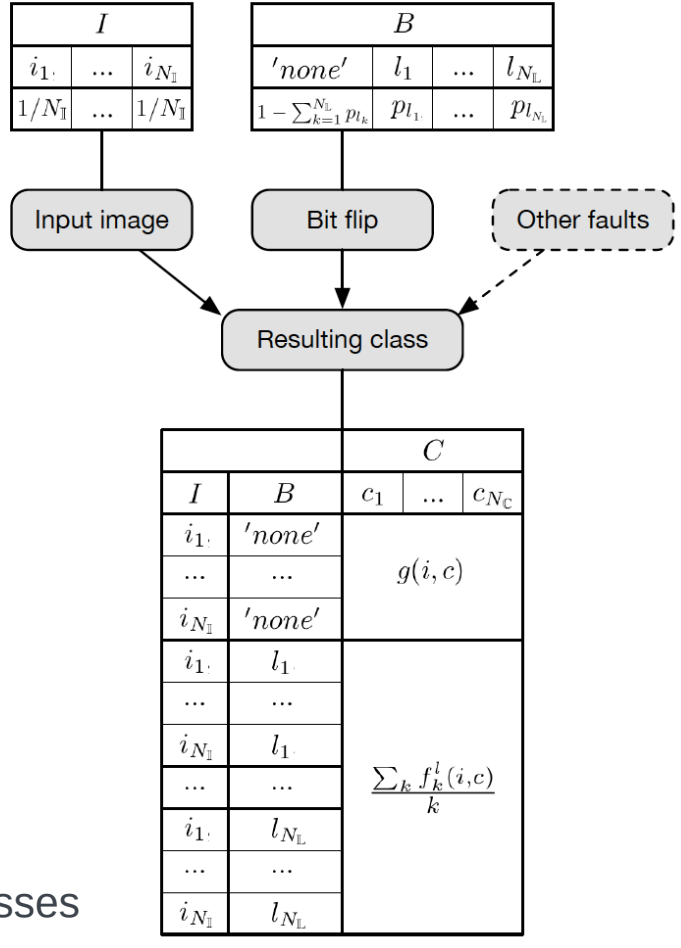


(c) VGG19: Fault injection in Layer 10. The sink classes are highlighted in red.

Results of the fault injection experiments on VGG19 for the ImageNet dataset (1000 classes).

Trustworthiness Bayesian Model

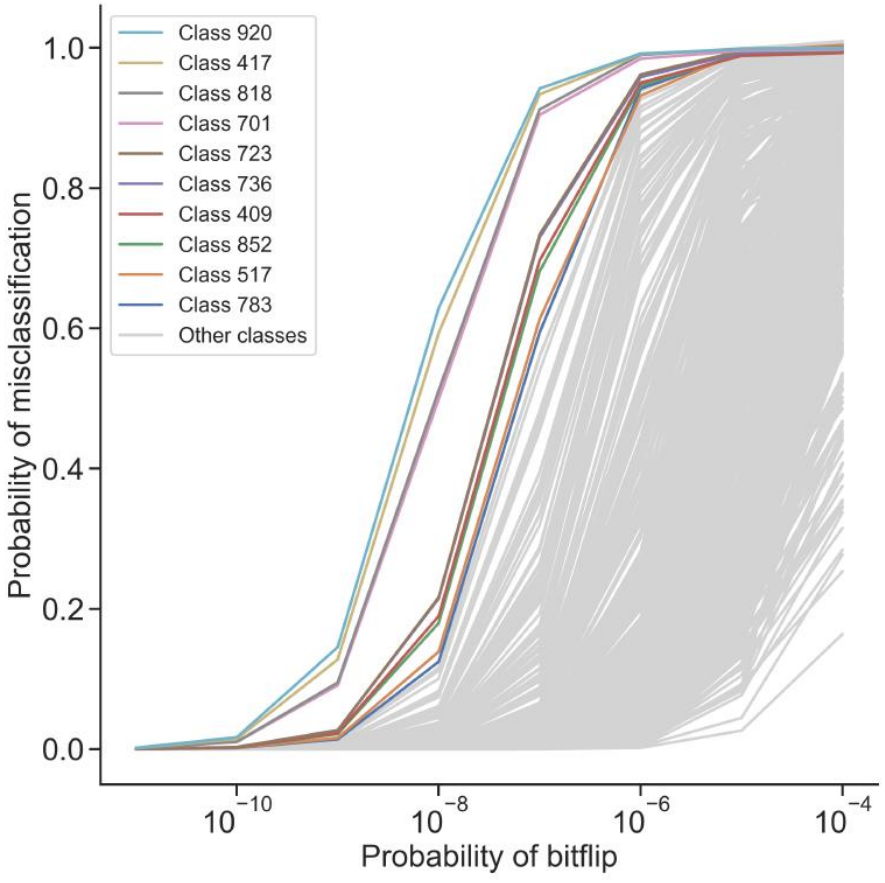




- BN stores the results of fault injection experiments
- Analysis of various reliability-related properties
- Quantification of the trustworthiness for resulting classes

Results and Conclusion

- Two fault injection frameworks
- Experiments on several CNN models
- Observation to distinctive sink classes for each layer
- BN that stores the results of the experiments and support multiple types of probablistic analysis of relaibility related properties



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Thank you!

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