3D Common Corruptions and Data Augmentation

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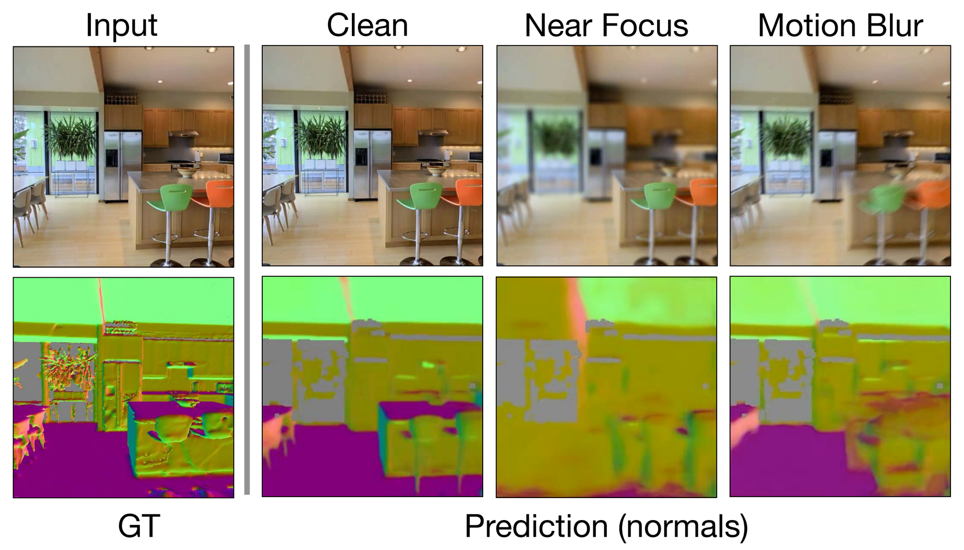
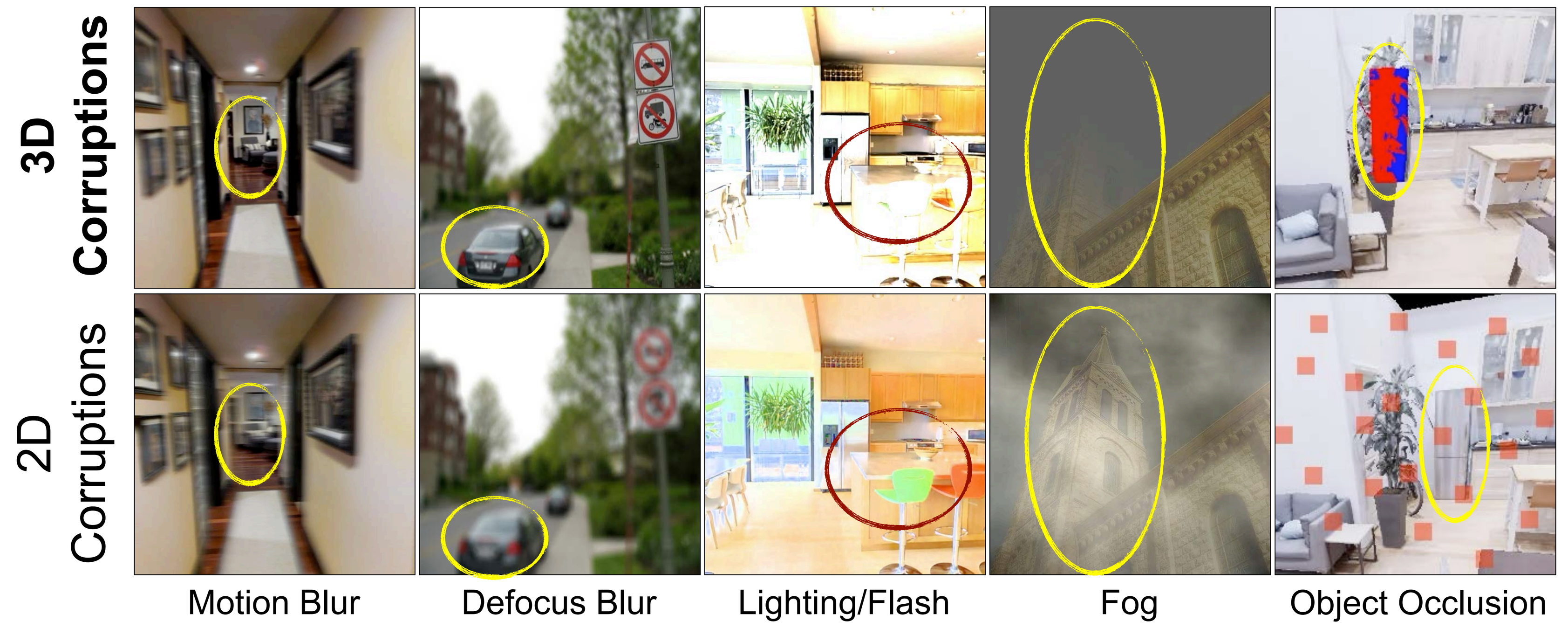
1. Problem

- Neural networks are not robust when deployed in the **real world**.
- They are vulnerable to **non-adversarial** image corruptions.



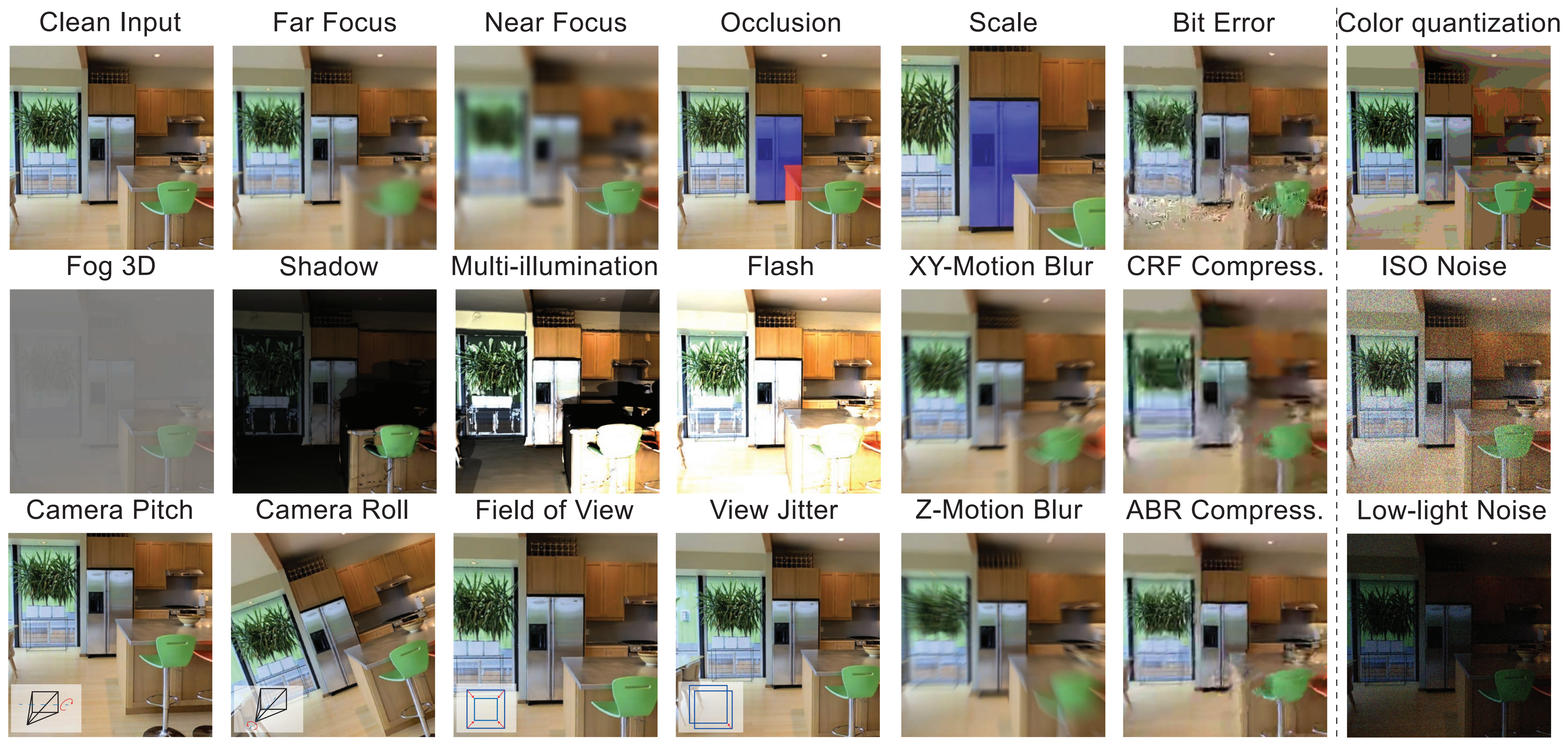
2. Realistic 3D Corruptions

- Common Corruptions [1] are **2D based** (applied uniformly). Hence, they could be **unrealistic**.
- We incorporate scene geometry and real world properties to generate **3D corruptions** that are more **realistic**.



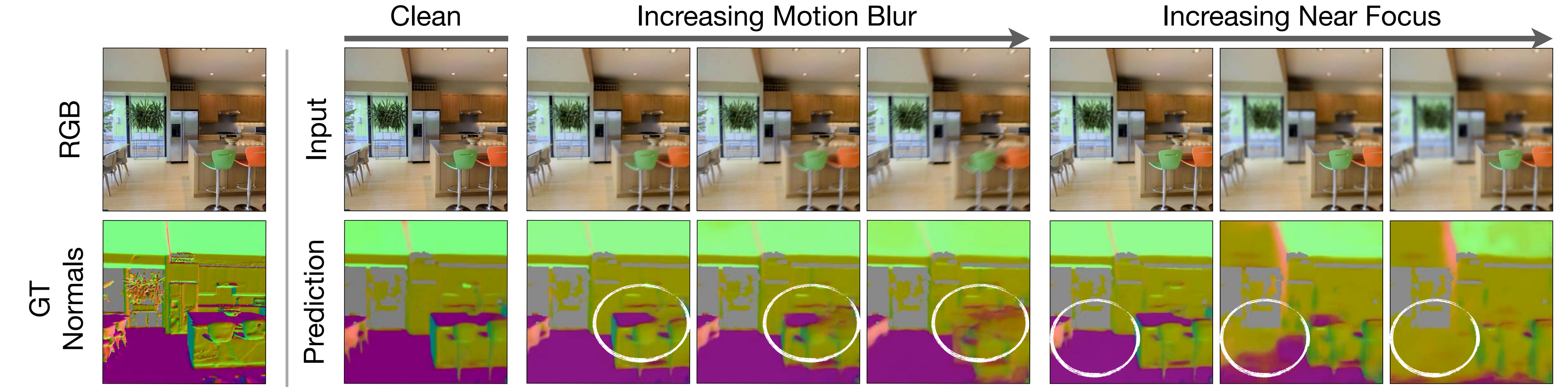
3. All 3D Common Corruptions (3DCC)

- 3DCC has a **diverse set of corruptions** which:
  1. can be used for **benchmarking** to test robustness
  2. or as **data augmentation** to improve robustness.
- They are **extendable** to datasets without 3D labels, e.g. ImageNet & COCO.
- They can also be **generated efficiently**.

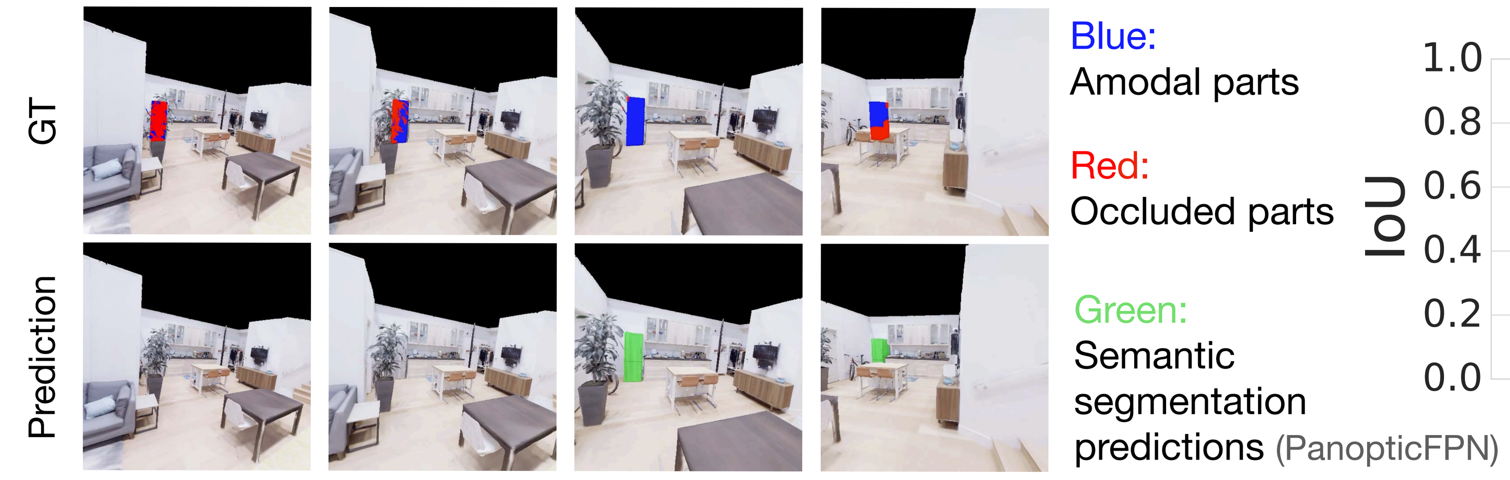


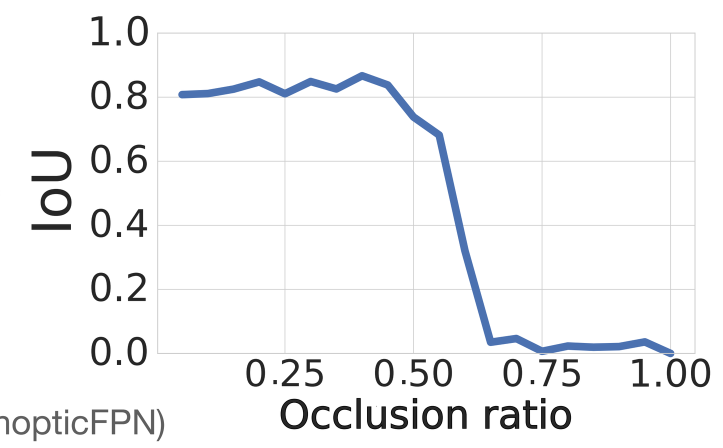
4. Benchmarking with 3D Common Corruptions

- 3DCC provides a **challenging testbed** to identify model failures:

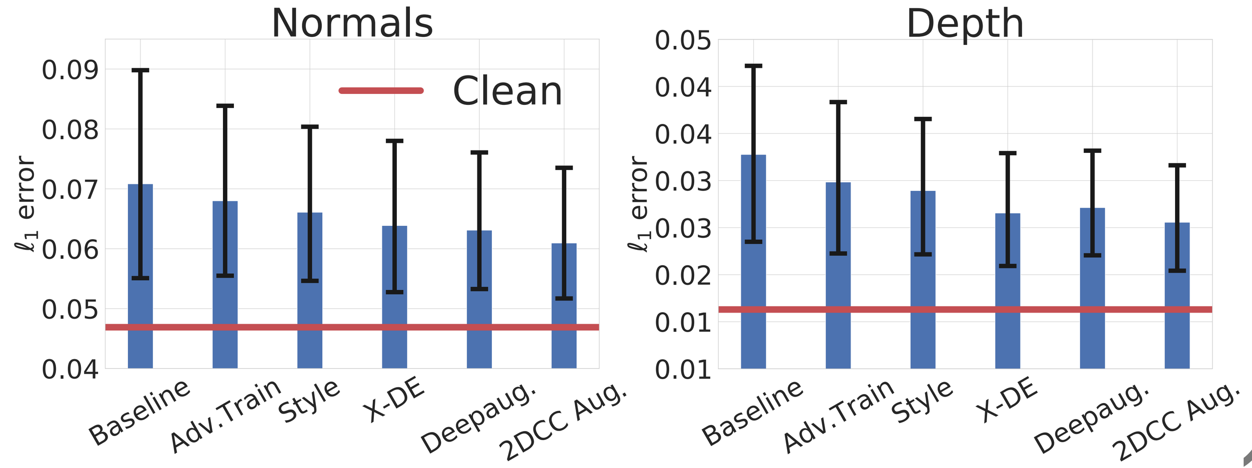


- This includes a new set of **semantic** based corruptions, e.g. occlusions.



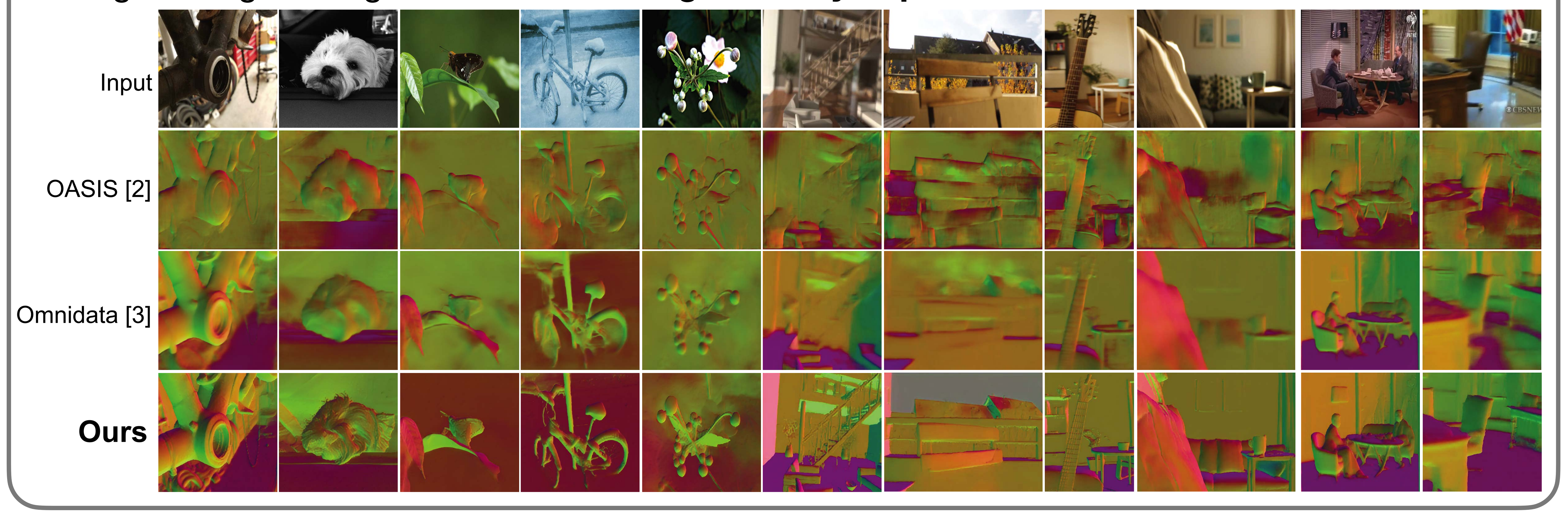


- Existing robustness mechanisms are insufficient for addressing 3DCC.



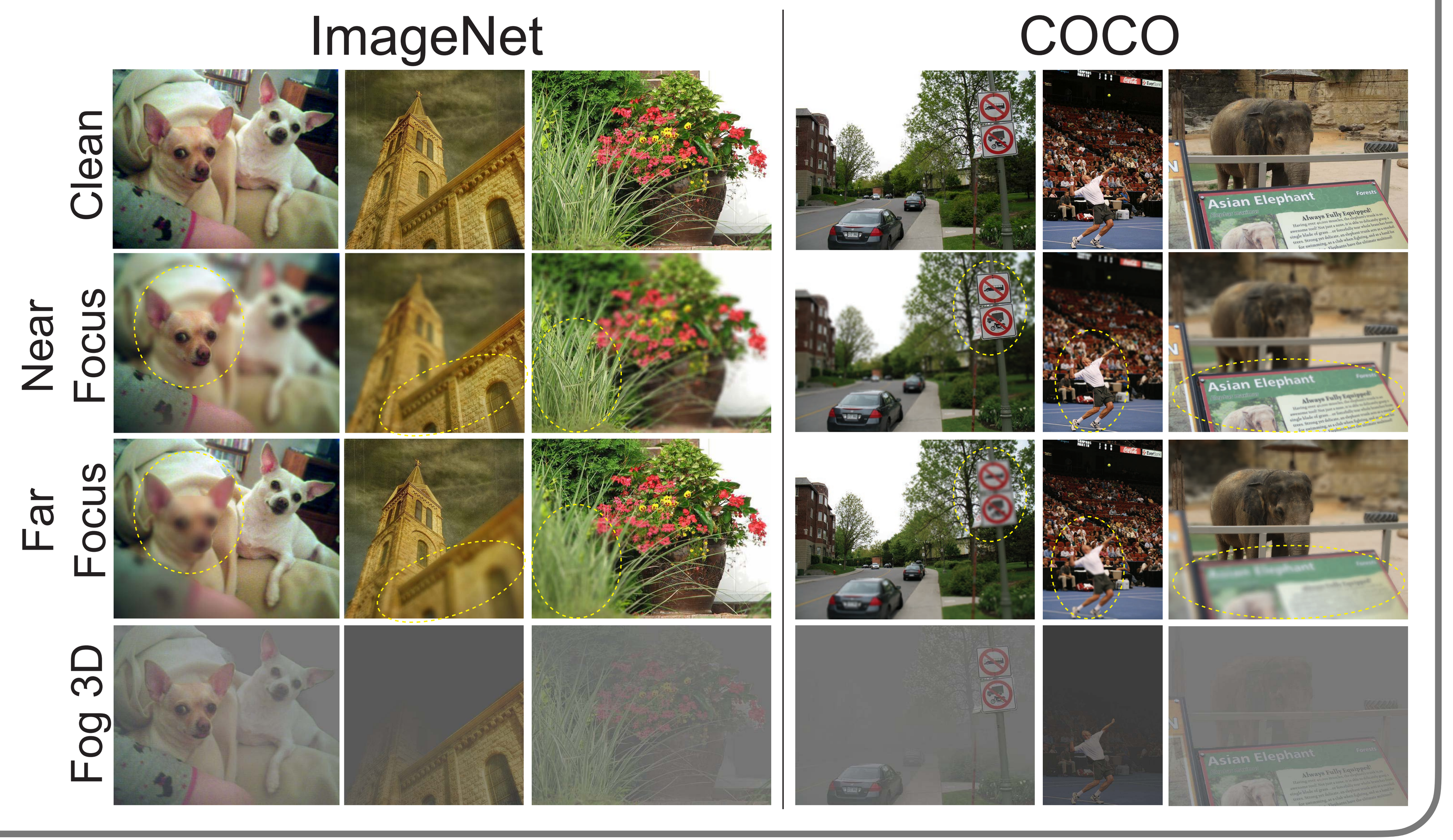
5. Data Augmentation with 3D Common Corruptions

- Augmenting training data with 3DCC **significantly improves robustness**.



6. Applying 3DCC to Standard Vision Datasets

- **3DCC can also be applied to standard datasets** without 3D information.
- We introduce the **ImageNet-3DCC** (now also in RobustBench [4]).
- To do this, we used the depth predictions from a SOTA depth estimator [3].
  - This gives a good approximation to generate realistic corruptions.



- *Project page*
- *Code*
- *Data/Models*
- *Live demo*

3dcommoncorruptions.epfl.ch

References:

[1] Benchmarking neural network robustness to common corruptions and perturbations. *Hendrycks et al.* ICLR 2019

[2] OASIS: A large-scale dataset for single image 3D in the wild. *Chen et al.* CVPR 2020

[3] Omnidata: A scalable pipeline for making multi-task mid-level vision datasets from 3d scans. *Eftekhar et al.* ICCV 2021

[4] RobustBench: a standardized adversarial robustness benchmark. *Croce et al.* NeurIPS Datasets and Benchmarks 2021