

# Low Image-Dataset Quality strongly contributes to DCNN Texture-Bias

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## The origins of Texture-Bias

Deep Convolutional Neural Networks (DCNNs) trained on ImageNet have been shown to exhibit a texture-bias (Geirhos et al. 2018). The origin of this texture-bias has been debated widely (e.g., Hermann et al. 2020).

Here, we show that the same models trained on an **ultra-high-resolution dataset** exhibit a **more human-like shape-bias**.

Further, when tested on Cue-Conflict images created from ImageNet, the texture-bias drastically decreases.

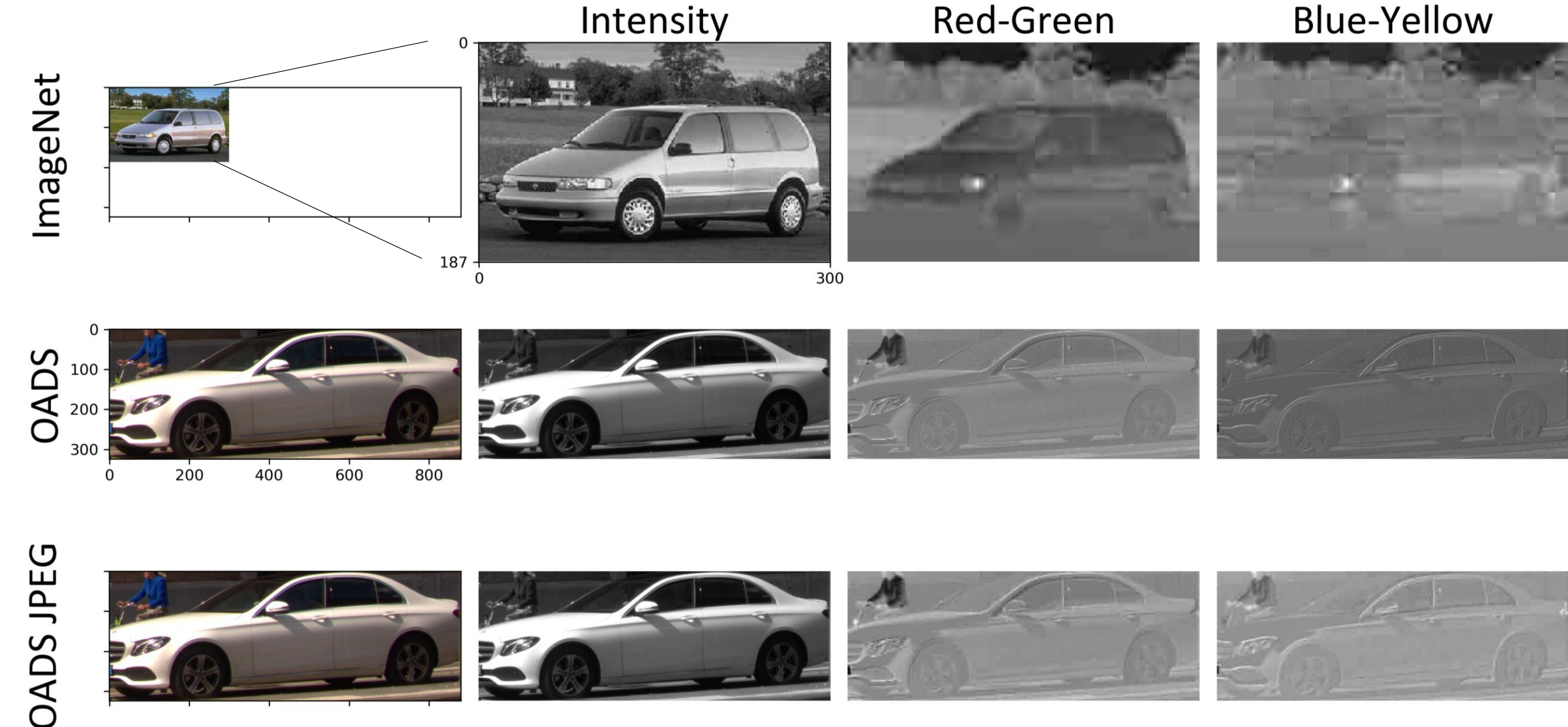
## Open Amsterdam Data Set (OADS)

Ultra-high-resolution, labelled image dataset  
5691 Images ⇔ **5496x3672** pixels  
98534 Object Label annotations

## Main Contribution

- Introduction of ultra-high-resolution labelled image dataset **OADS**
- Creation of high-resolution cue-conflict dataset
- Texture-bias arises as a function of image quality**

## High-Resolution Matters



Color-Opponent-Channel (COC) representation allows for a direct inspection of available **shape information**. The top row shows a representative image from ImageNet. The second row shows a representative image crop from the **Open Amsterdam Data Set (OADS)**. The last row shows the JPEG-compressed version of the OADS image crop. Original RGB version (first column), Intensity channel (second column), Red-Green channel (third column), and Blue-Yellow channel (last column) of the COC representation. Images in scale.

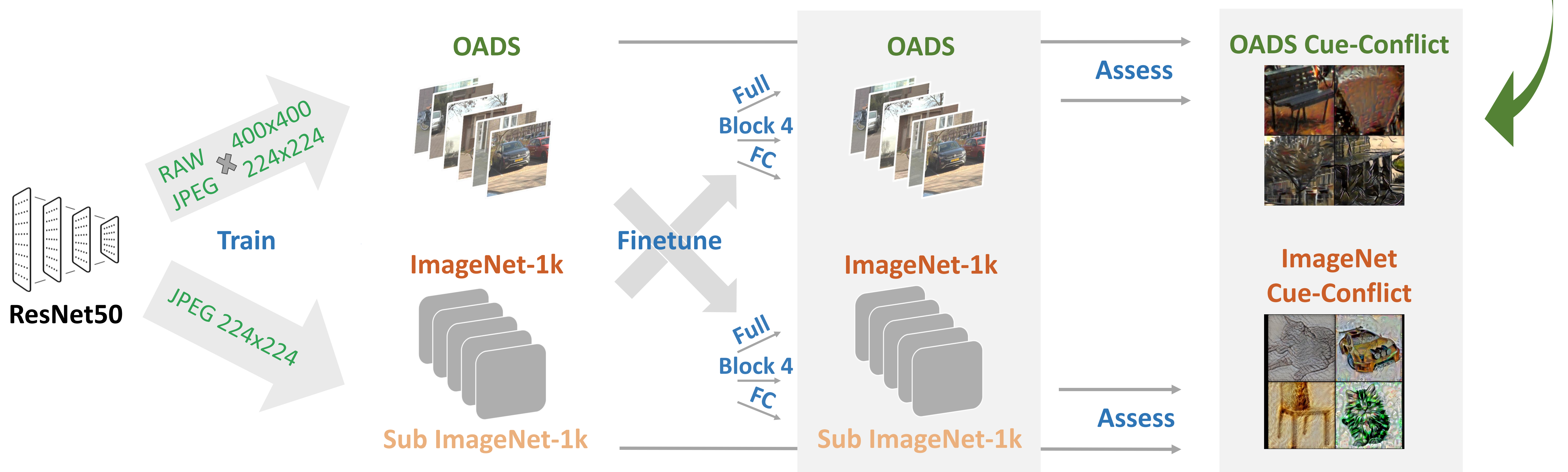
**ImageNet images are inherently missing shape information**

## DCNN Training & Assessment

We train ResNet50 models with controlled image resolution and quality on a low-quality and a high-quality dataset and assess DCNN texture-bias on a low-quality and a high-quality dataset.

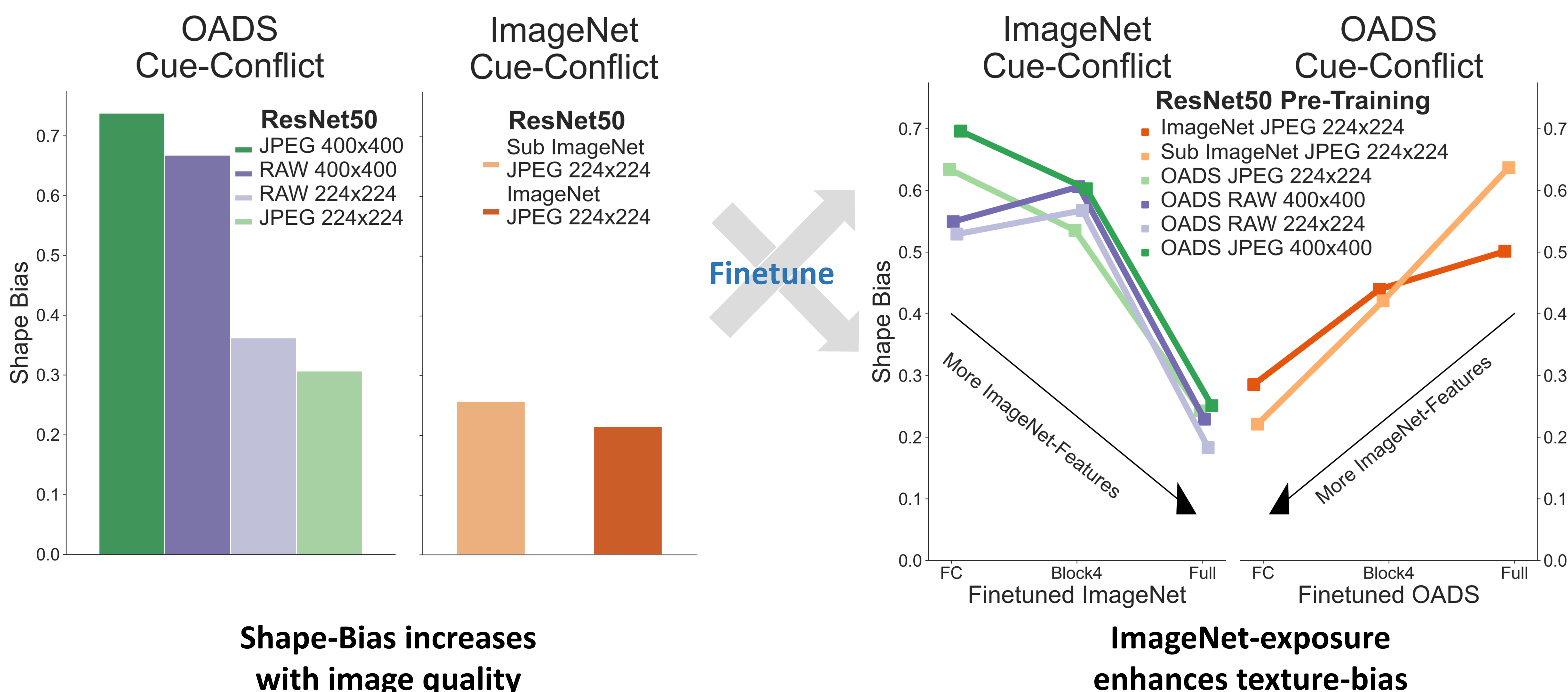
We created a **OADS** Cue-Conflict dataset using Neural Style Transfer<sup>3</sup> offering an alternative, high-resolution assessment of texture-bias in DCNNs

## Schematic representation of model training, cross-finetuning and texture-bias assessment



## Image Quality vs. Texture-Bias

## Conclusion



- Dataset and image quality contribute to DCNN texture-bias
- COC representation yields intuition about texture-bias
- Low-quality (ImageNet) yields high texture-bias**
- High-quality (OADS) yields low texture-bias**

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**References** | <sup>1</sup>Geirhos et al., *CVPR*, 2018; <sup>2</sup> Hermann et al., *NeurIPS*, 2020; <sup>3</sup> Gatys et al., *IEEE*, 2016