FIRE: THE FIRST-YEAR
INNOVATION & RESEARCH EXPERIENCE
CAPITAL ONE MACHINE LEARNING

Survey of Rotational Representations for Improving Vehicle Rotation Estimation with Deep Learning

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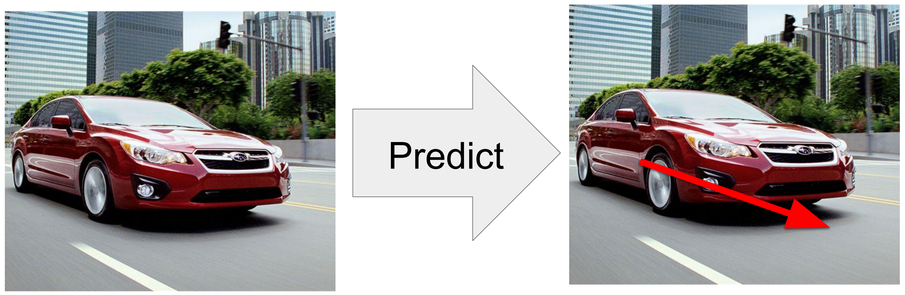
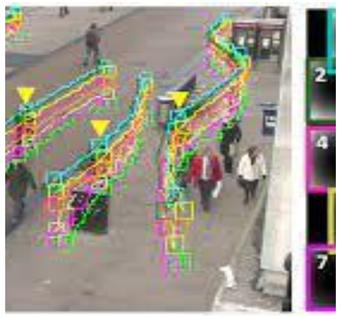
Research Question

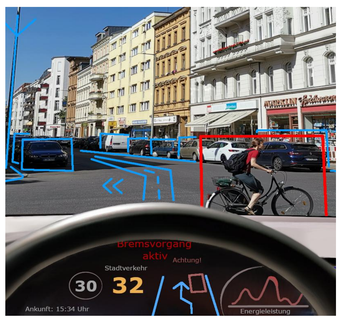
How to represent vehicle angles such that it improves deep learning prediction accuracy?



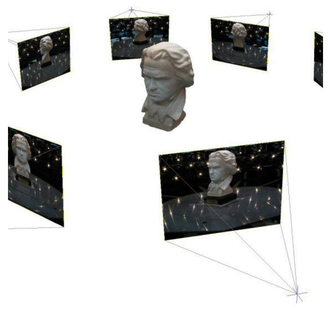
Potential Applications


Robotic Navigation

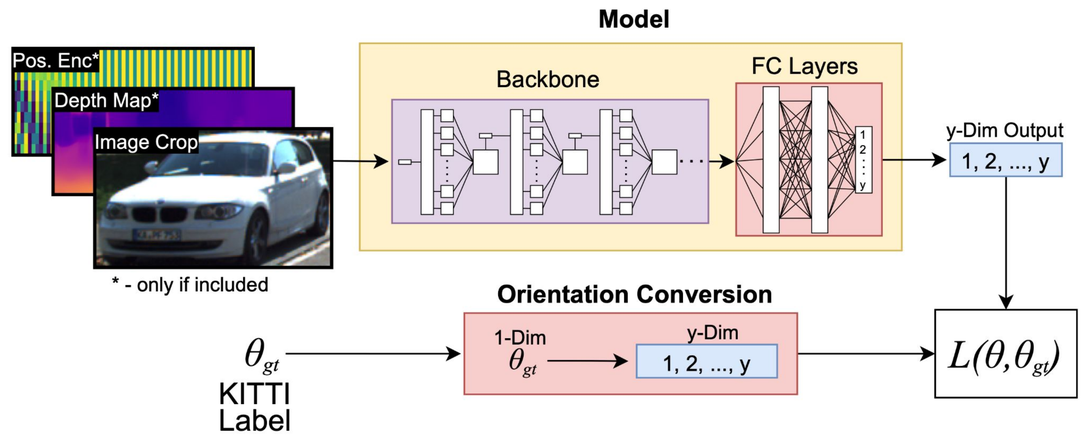

Movement Tracking



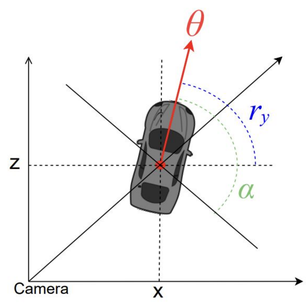
Autonomous Driving


3D Reconstruction

Model Architecture

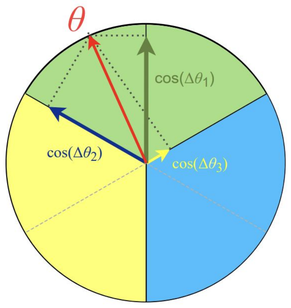


Experiment Results



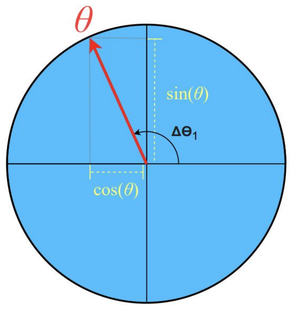
Radians
Represent the vehicle rotation angle in radians.

Validation Accuracy: 90.49%



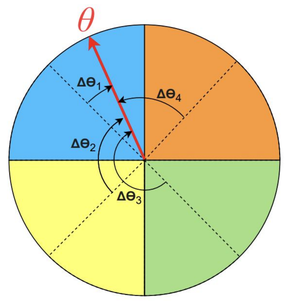
Tri-Cosine
Represent the angle as the cosine distances to three bin centers.

Validation Acc: 94.25%(↑4.15%)



Cartesian
Represent angle as a pair of horizontal and vertical coordinates.

Validation Accuracy: 94.82% (↑4.33%)



Multi-Bin
Represent the angle from multiple bin centers where each is represented with Cartesian.

Validation Acc: 83.30%(↓7.94%)