Modular Vehicle Control for Transferring Semantic Information Between Weather Conditions Using GANs

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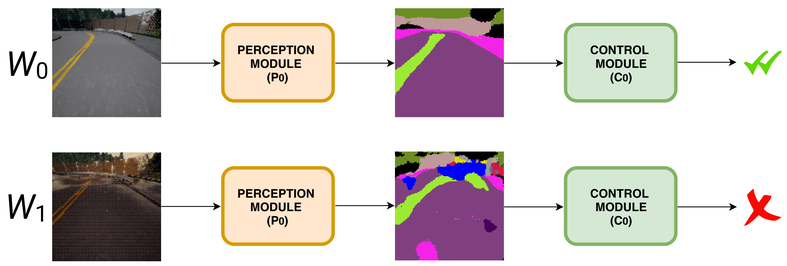
1. Motivation

Diverse weather conditions are challenging for end-to-end driving models.

Models trained on one weather condition may fail on different weather conditions.



Perception module P_0 and control module C_0 are trained on weather condition W_0.

P_0 fails to produce the correct semantic labels on a different weather condition W_1 and therefore C_0 cannot predict the correct steering angle.

2. Contribution

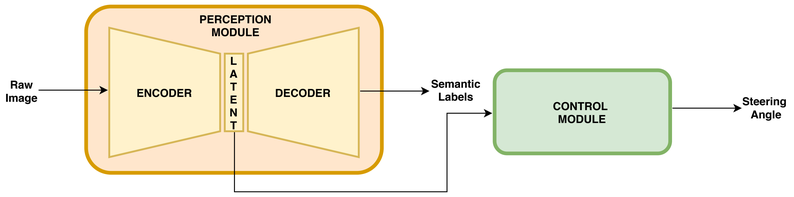
Transfer knowledge from a weather condition with semantic labels to other weather conditions for which no labels exist.

Ability to control the vehicle in different weather conditions without having the need to collect additional data for steering commands and without requiring to retrain the control module.

3. Method

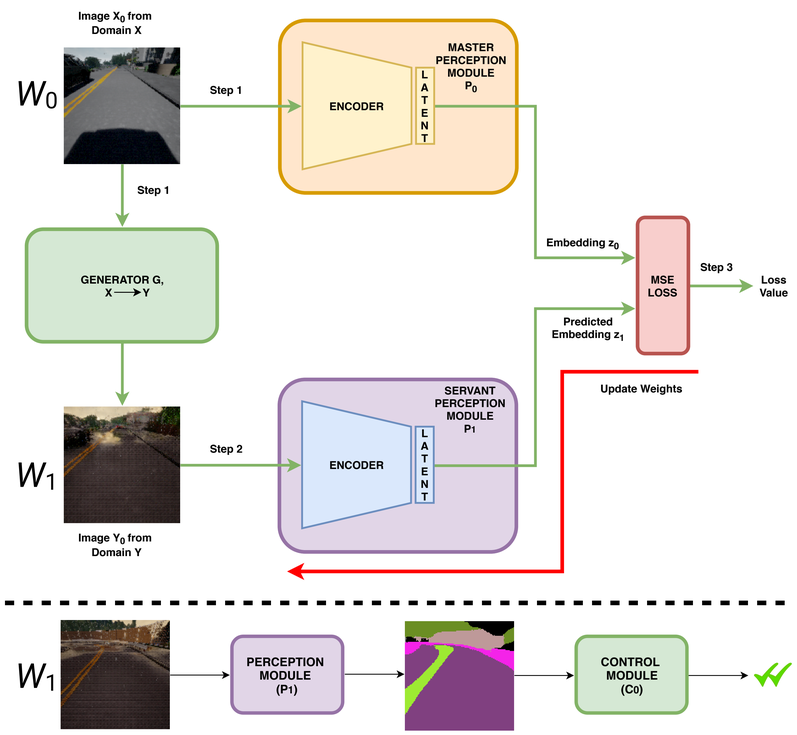
Modular control

- *Perception module*
  Input: raw image, Output: semantic label map
- *Control module*
  Input: latent embedding, Output: steering angle



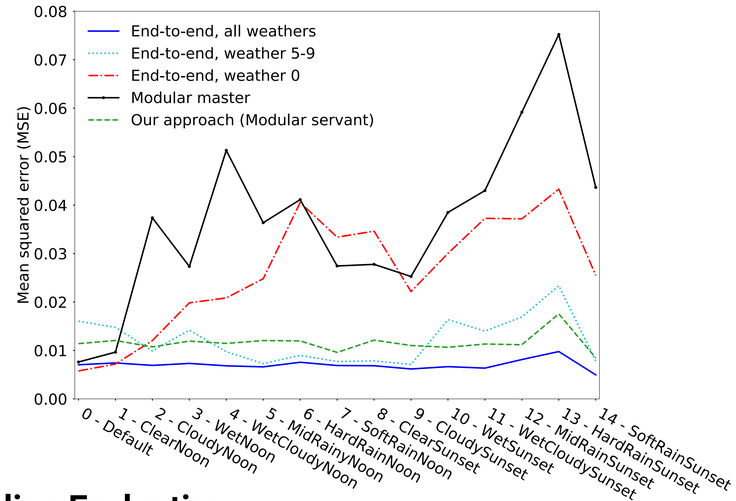
Master-servant architecture

- Generator G translates images from domain X to domain Y while preserving semantics.
- Train servant module P_1 from master module P_0.



4. Results

Offline Evaluation



Online Evaluation

Model	Avg. percentage of successful turns
End-to-end, all weathers	96
End-to-end, weather 5-9	85
End-to-end, weather 0	22
Modular master	56
Our approach (Modular servant)	**96**

5. Conclusion

Vehicle control generalizes across different weather conditions without additional semantic labels and steering commands.

Master-servant architecture successfully transfers semantic knowledge among diverse weathers.

This transfer is possible due to the modularity of the approach.

Conference on Robot Learning (CoRL), Zurich, Switzerland, 2018.

Project page: https://pmwenzel.github.io/carla-domain-adaptation