Title

A Programmatic and Semantic Approach to Explaining and Debugging Neural Network Based Object Detectors

Authors

Kim, Edward
Gopinath, Divya
Păsăreanu, Corina S
et al.

Publication Date

2020-06-13

DOI

10.1109/cvpr42600.2020.01114

Peer reviewed

A Programmatic and Semantic Approach to Explaining and Debugging Neural Network Based Object Detectors

Edward Kim, Divya Gopinath, Corina S. Pasareanu, and Sanjit A. Seshia. **A Programmatic and Semantic Approach to Explaining and Debugging Neural Network Based Object Detectors**. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, June 2020.

Download

[pdf]

Abstract

Even as deep neural networks have become very effective for tasks in vision and perception, it remains difficult to explain and debug their behavior. In this paper, we present a programmatic and semantic approach to explaining, understanding, and debugging the correct and incorrect behaviors of a neural network-based perception system. Our approach is semantic in that it employs a high-level representation of the distribution of environment scenarios that the detector is intended to work on. It is programmatic in that scenario representation is a program in a domain-specific probabilistic programming language which can be used to generate synthetic data to test a given perception module. Our framework assesses the performance of a perception module to identify correct and incorrect detections, extracts rules from those results that semantically characterizes the correct and incorrect scenarios, and then specializes the probabilistic program with those rules in order to more precisely characterize the scenarios in which the perception module operates correctly or not. We demonstrate our results using the Scenic probabilistic programming language and a neural network-based object detector. Our experiments show that it is possible to automatically generate compact rules that significantly increase the correct detection rate (or conversely the incorrect detection rate) of the network and can thus help with understanding and debugging its behavior.

BibTeX

```
@inproceedings{kim-cvpr20,
  author    = {Edward Kim and
               Divya Gopinath and
               Corina S. Pasareanu and
               Sanjit A. Seshia},
  title     = {A Programmatic and Semantic Approach to Explaining and Debugging Neural
               Network Based Object Detectors},
  booktitle = {IEEE Conference on Computer Vision and Pattern Recognition (CVPR)},
  month = {June},
  year = {2020},
  abstract = {Even as deep neural networks have become very effective for tasks in vision and perception, it remains difficult to explair
}
```