License Plate Detection in Complex Scenes

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Presentation Link: https://drive.google.com/open?id=13Gc-ajM40S4Aj9BKtCOpTc16V7Jtq

Introduction
- License plate detection is a popular application for neural network object detection algorithms. In this project, we investigated fine-tuning with YOLO-V3 as baseline model and tried several strategies to improve its ability to detect small license plates & avoid false positives:
  1. Increase input image resolution;
  2. Re-tune anchors;
  3. Train on images with & without license plates;
  4. Train together with other seven object classes.

Data
- We used OpenImage dataset which contains images with multiple (0 or more) license plates that appears as part of complex scenes.
- We created 2 pairs of train & validation datasets by restricting to (1) images with license plates and (2) image with & without license plates.

<table>
<thead>
<tr>
<th># of Images</th>
<th>Train</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Images w/ LP</td>
<td>5,368</td>
<td>2,065</td>
</tr>
<tr>
<td>Images w/ w/o LP</td>
<td>35,368</td>
<td>24,153</td>
</tr>
</tbody>
</table>

Models
- The baseline model is YOLO-V3.
- Uses 9 anchor boxes based on COCO.
- Initialized with COCO weights & train on our dataset.
- High Res & Retuned Anchors has best mAP
- Precision Recall significantly better than baseline

Results
- The mAP on validation images with LP and validation image with & without LP improved significantly.

<table>
<thead>
<tr>
<th>mAP</th>
<th>Image with LP</th>
<th>Image with &amp; without LP</th>
</tr>
</thead>
<tbody>
<tr>
<td>YOLO V3 (Baseline)</td>
<td>85.85%</td>
<td>51.40%</td>
</tr>
<tr>
<td>YOLO V3 High Res</td>
<td>87.74%</td>
<td>54.46%</td>
</tr>
<tr>
<td>YOLO V3 High Res &amp; Re-tuned Anchors</td>
<td>88.39%</td>
<td>61.47%</td>
</tr>
<tr>
<td>YOLO V3 Trained on Image</td>
<td>87.17%</td>
<td>57.57%</td>
</tr>
</tbody>
</table>

- The image prediction results for different models.
- False positive decreased.