Anticipating Traffic Accidents with Adaptive Loss and Large-scale Incident DB
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**Motivation**
- Self-driving car MUST avoid a traffic accident
- Request for (i) accidental videos in DB (ii) earlier anticipation

**Contributions**
- Adalea (Adaptive Loss for Early Anticipation) which allows to gradually learn an earlier anticipation
- QRNN (Quasi-Recurrence Neural Net) in video recognition task
- NIDB (Near-miss Incident DataBase) to understand and anticipate traffic accidents/incidents

**Technical Contribution**
- Adalea (Adaptive Loss for Early Anticipation) which allows to gradually learn an earlier anticipation
- QRNN (Quasi-Recurrence Neural Net) in video recognition task
- NIDB (Near-miss Incident DataBase) to understand and anticipate traffic accidents/incidents

**Database Contribution**
- NIDB (Near-miss Incident DataBase) to understand and anticipate traffic accidents/incidents

**System**

1. Global feature
   - Use NIDB pretrain model
2. Local feature
   - Detect candidates of risk-factors
   - Use DSA [4]
3. Time-sequential analysis
   - Use QRNN
4. Output the risk rate $r_t$
5. If $r_t > \theta$, Decide the presence of a future accident
   - 7.7 × larger positives than the conventional
   - Detail annotations
     - Risk-factors (bicycle, pedestrian, vehicle)
     - Near-miss duration (start and end frame)

**Results**

**Qualitative Results**
- Encourages a model to anticipate earlier gradually

**Quantitative Results**
- Effectiveness of Adalea and QRRN in both metric

<table>
<thead>
<tr>
<th>Method</th>
<th>mAP [%]</th>
<th>ATTC [s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSTM</td>
<td>52.1</td>
<td>2.45</td>
</tr>
<tr>
<td>QRNN</td>
<td>53.2</td>
<td>4.62</td>
</tr>
<tr>
<td>Adalea</td>
<td>57.8</td>
<td>3.44</td>
</tr>
<tr>
<td>Ours 1</td>
<td>61.2</td>
<td>2.71</td>
</tr>
<tr>
<td>Ours 2</td>
<td>62.3</td>
<td>3.22</td>
</tr>
<tr>
<td>Ours 3</td>
<td>64.1</td>
<td>2.94</td>
</tr>
</tbody>
</table>

**Adaptive Loss for Early Anticipation (Adalea, ours)**

\[
\text{for positive: } L_{\text{EL}}(r_t) = \sum_{i=1}^{T} \alpha \log (r_i)
\]

\[
\alpha = \exp (\text{max}(0, d - F \cdot \Phi (e - 1) - \gamma))
\]

\[
\text{for negative: } L_{\text{EL}}(r_i) = \sum_{i=1}^{T} \gamma - \log (1 - r_i)
\]

\[
\gamma = \gamma (t, r, \text{risk rate}, F, \text{frame rate}, r \text{ training epoch,} \Phi \text{ hyper parameter}) \text{ function which returns ATTC}
\]

Always encourages an earlier anticipation than previous epoch

Depending on “how early the model can anticipate a traffic accident at each epoch”, referring Average Time-To-Collision (ATTC)

Ranges from easy (not early) anticipation to difficult (earlier) one according to training progress, like Curricular Leaning

**Loss function**

\[ L_{\text{EL}}(r_t) = \sum_{i=1}^{T} \alpha \log (r_i) \]

\[ \alpha = \exp (\text{max}(0, d - \lambda \cdot (e - 1))) \]

\[ L_{\text{EL}}(r_i) = \sum_{i=1}^{T} \gamma - \log (1 - r_i) \]

\[ \gamma = \gamma (t, r, \text{risk rate}, F, \text{frame rate}, r \text{ training epoch,} \Phi \text{ hyper parameter}) \text{ function which returns ATTC} \]