EnKCF : Ensemble of Kernelized Correlation Filters for High Speed Object Tracking
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Proposed Method
➢ The Kernelized Correlation Filter tracker minimizes the ridge regression function in the frequency domain.

Ridge Regression ⇒ minimize \[ \sum (f(x_k) - y_k)^2 + \lambda |w|^2 \]
- Analytical Solution ⇒ \[ w = \left( X^T X + \lambda I \right)^{-1} X^T y \]
- Circulant Matrix ⇒ \[ X = F \text{diag}(k) F^T \]
- Solution in Frequency Domain (Primal) ⇒ \[ \hat{u} = \frac{y^H}{k^H + \lambda} \] requires \( O(n \log(n)) \)

EnKCF with Hand Crafted Features

EnKCF with Deep Convolutional Features

Experimental Results
➢ The proposed scale adaptive high speed tracker is tested on UAV123, UAV123-10fps, and OTB100 datasets. It is compared to the high-speed and low-speed tracking-by-detection algorithms such as KCF, DCF, MOSSE (>300fps), and DBST, ECC, CCAT, SAMF (<50fps).

Table: EnKCF with Deep Convolutional Features

<table>
<thead>
<tr>
<th>Tracker</th>
<th>ECC</th>
<th>CCAT</th>
<th>SAMF</th>
<th>MUSTER</th>
<th>DIST</th>
<th>EnKCF</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAV123</td>
<td>54.5</td>
<td>52.3</td>
<td>50.7</td>
<td>56.8</td>
<td>56.8</td>
<td>56.8</td>
</tr>
<tr>
<td>UAV123-10fps</td>
<td>40.2</td>
<td>49.6</td>
<td>46.1</td>
<td>39.5</td>
<td>36.1</td>
<td>56.8</td>
</tr>
</tbody>
</table>

Results on the UAV123 Dataset. Comparison is performed between high and low speed trackers.

Most of the correlation filter driven trackers estimate the scale by searching different size ROIs with the same centroid and use the one that provides largest confidence as the new scale.