Predicting Failures of Vision Systems
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Motivation
Computer vision systems fail frequently, e.g. scene classification...

Goal
Can we build a system to reliably predict failures given the input instances?

Why feasible
Images predicted by Alert as best performing (left) and poor performing (right) for camera rotation matrix estimation...

Applications and datasets
<table>
<thead>
<tr>
<th>Application</th>
<th>Dataset</th>
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</thead>
<tbody>
<tr>
<td>Semantic segmentation \cite{munoz2010,carreira2010}</td>
<td>PASCAL dataset \cite{pascalvoc2012} Images collected by a Robot</td>
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<td>Vanishing point estimation \cite{lee2009}</td>
<td>Indoor scene images \cite{heduau2009}</td>
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<td>Camera matrix estimation \cite{lee2009}</td>
<td>Bedroom and living room images \cite{satkin2012}</td>
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<td>Image memorability prediction \cite{isola2011}</td>
<td>Image memorability data \cite{isola2011}</td>
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<tr>
<td>Attribute prediction</td>
<td>AWA \cite{lampert2009,Kumar2009}, PUBFIG \cite{kumar2009}, SUN \cite{patterson2012}, UIUC \cite{farhadi2009}</td>
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</tbody>
</table>

Evaluation: Failure predictions — Risk-Averse Metric
Points achieved by BaseSys when equipped with Alert at varying declaration rates (DR)

Evaluation: Benefit to a downstream application
- When using Alert, we ignore the attributes for which Alert raises a warning
- Baselines also ignore attributes as needed, but with different strategies

Conclusions
- We introduce Alert, a warning system that analyzes the input instance and predicts if a vision system is likely to produce an unreliable response.
- Alert does not need to run BaseSys, which maybe computationally expensive.
- Alert is a simple and general approach, and applicable to any vision system: semantic segmentation, vanishing point and camera parameter estimation, and image memorability prediction.
- The performance of a downstream application can be improved.
- We introduce the use of two metrics to evaluate failure predicting systems.
- We hope this work will promote development of self-evaluating and transparent machine perception systems.