**Oriented Response Networks**

Yanzhao Zhou¹
Qixiang Ye¹
Qiang Qiu²
Jianbin Jiao¹

¹ University of Chinese Academy of Sciences
² Duke University

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**Motivation**

The ability of Deep Convolutional Neural Networks (DCNNs) in handling significant image rotations remains limited.

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**Our Goal**

- Enable DCNNs to better understand rotation
- Reduce network parameters
- Prevent over-fitting
- Boost generalization ability
- Improve performance

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**Introduce ORN**

We propose Active Rotating Filters (ARFs) that actively rotate during convolution and produce feature maps with location and orientation explicitly encoded. DCNNs using ARFs are referred to as Oriented Response Networks (ORNs).

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**Experiment Results**

ORN improves **performance while using significantly fewer parameters**.

<table>
<thead>
<tr>
<th>Method</th>
<th>CNN Time(s)</th>
<th>CNN Params(%)</th>
<th>CNN MNIST(%)</th>
<th>CNN MNIST-rot(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNN</td>
<td>16.4</td>
<td>100.0</td>
<td>0.73</td>
<td>2.82</td>
</tr>
<tr>
<td>ORN</td>
<td>17.8</td>
<td>31.4</td>
<td>0.59</td>
<td>1.42</td>
</tr>
</tbody>
</table>

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**Application**

ORN improves **performance while using significantly fewer parameters**.

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**Conclusion**

ORN has great potential for application.

- Upgrading to ORN is a simple yet effective strategy to boost the ability of DCNNs in handling image rotations.
- Modern architectures can be easily upgraded.

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Contact

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Yanzhao Zhou
zhouyanzhao215@mails.ucas.ac.cn
http://yzhou.work