CARE: Class Attention to Regions of Lesion for Classification on Imbalanced Data

Jiaxin Zhuang*
Jiabin Cai*
Ruixuan Wang
Jianguo Zhang
Weishi Zheng
To date, it is still an open and challenging problem for intelligent diagnosis systems to effectively learn from imbalanced data, especially with large samples of common diseases and much smaller samples of rare ones.
Framework
Attention Loss

Embed attention into the machine learning process
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Attention loss: \( L_a = L_{in} + \lambda L_{out} \), where

\[
L_{in} = -\min\left( \frac{\sum_{i,j} M_{in}(i,j) \cdot F(i,j)}{\sum_{i,j} M_{in}(i,j)}, \tau \right)
\]

\[
L_{out} = \frac{\sum_{i,j} M_{out}(i,j) \cdot F(i,j)}{\sum_{i,j} M_{out}(i,j)}
\]
The inner loss $L_{in}$ helps the classifier learn to attend to lesion regions.

The outer loss $L_{out}$ helps the classifier learn to decrease the attention outside lesion regions.
CARE outperforms widely-used methods for handling data imbalance

<table>
<thead>
<tr>
<th>Model</th>
<th>Pneumonia Dataset recall(%)</th>
<th>MCA(%)</th>
<th>Skin Dataset recall</th>
<th>MCA(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>baseline</td>
<td>7.41</td>
<td>56.77</td>
<td>47.83</td>
<td>75.75</td>
</tr>
<tr>
<td>CARE (ours)</td>
<td><strong>31.12</strong></td>
<td><strong>63.29</strong></td>
<td><strong>52.17</strong></td>
<td><strong>76.16</strong></td>
</tr>
<tr>
<td>CSL</td>
<td>11.11</td>
<td>57.88</td>
<td>61.91</td>
<td>80.21</td>
</tr>
<tr>
<td>CARE+CSL (ours)</td>
<td>45.04</td>
<td>65.23</td>
<td><strong>65.22</strong></td>
<td><strong>81</strong></td>
</tr>
<tr>
<td>FL</td>
<td>11.14</td>
<td>58.41</td>
<td>38.3</td>
<td>72.72</td>
</tr>
<tr>
<td>CARE+FL (ours)</td>
<td><strong>49.44</strong></td>
<td><strong>66.72</strong></td>
<td><strong>40.28</strong></td>
<td><strong>74.06</strong></td>
</tr>
<tr>
<td>DA</td>
<td>20.06</td>
<td>59.64</td>
<td>56.62</td>
<td>54.41</td>
</tr>
<tr>
<td>CARE+DA (ours)</td>
<td><strong>45.18</strong></td>
<td><strong>65.97</strong></td>
<td><strong>60.32</strong></td>
<td><strong>56.22</strong></td>
</tr>
</tbody>
</table>

CARE model can learn to focus on lesion regions

images with bounding box

without CARE

with CARE
Thank you!

Poster: F-T-7