Yedrouj-Net: An efficient CNN for spatial steganalysis
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What is Steganalysis / Steganography?

Steganography

Source

message

Secret Key

EVE

Steganalysis

Destination

message

Secret Key

BOB

Proposed architecture

Yedrouj-Net comparison with two other steganalysis approaches based on deep learning (fair comparison).

Yedrouj-Net:
1. It has the advantage of using 30 SRM kernels which increases the diversity.
2. A shallow network compared to the Ye-Net equipped with a “value clipper” (hard tanh) activation function.
3. Thanks to batch normalization, Yedroudj-Net converges faster and is more robust with respect to hyperparameters.

Results

1. Clairvoyant protocol:
   - Resize the 1000 images of BOSSBase to 256*256.
   - Use the two algorithms WOW and S-UNIWARD to generate the stego.
   - Select 1000 pairs from the training set for validation.
   - Use the 5000 images of the test set to evaluate the obtained model.

2. Base augmentation protocol:
   - Add 10000 pairs of cover/stego of BOWS2Base to the training set (Clairvoyant protocol).
   - Rotate and flip the 14000 images of the training set.
   - Use the 5000 images of the test set to evaluate the obtained model.

Comparison of Yedrouj-Net and three state-of-the-art steganalysis methods in terms of steganalysis probability of error.

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>WOW</td>
<td>0.2 bpp</td>
<td>0.2 bpp</td>
</tr>
<tr>
<td>S-UNIWARD</td>
<td>0.4 bpp</td>
<td>0.4 bpp</td>
</tr>
<tr>
<td>SRM+EC [1], [2]</td>
<td>36.5 %</td>
<td>25.5 %</td>
</tr>
<tr>
<td>Yedrouj-Net</td>
<td>27.8 %</td>
<td>14.1 %</td>
</tr>
<tr>
<td>Xu-Net [3]</td>
<td>32.4 %</td>
<td>20.7 %</td>
</tr>
<tr>
<td>Ye-Net [4]</td>
<td>31.1 %</td>
<td>23.2 %</td>
</tr>
</tbody>
</table>

Comparison of Yedrouj-Net's and two state-of-the-art steganalysis's probability of error against a steganographic algorithm WOW at a payload of 0.2 bit per pixel (bpp).

<table>
<thead>
<tr>
<th>Method</th>
<th>WOW 0.2 bpp</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOSS</td>
<td></td>
</tr>
<tr>
<td>BOSS+BOWS2</td>
<td></td>
</tr>
<tr>
<td>BOSS+BOWS2+VA</td>
<td></td>
</tr>
<tr>
<td>Yedrouj-Net</td>
<td>27.8 %</td>
</tr>
<tr>
<td>Xu-Net</td>
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</tbody>
</table>

Conclusions

• An efficient approach based on deep learning (CNN) for steganalysis.
• Our method outperforms the state-of-the-art and others CNN-based models with and without taking extra measures (train set augmentation).
• Future work:
  1. Increase the size of the training set.
  2. Try other tricks such as transfer learning.
  3. Try an ensemble of Yedrouj-Nets.

Related Work[7]

For an efficient database augmentation 2 options:
• Produce new images using the same cameras and development than the original base.
• Eve has an access to the original RAW images to use them for producing new images with similar developments.

References