Introduction

Class-distinct and class-mutual image generation
- **Given:** Class-overlapping data
- **Goal:** To construct a generator that can generate class-distinct and class-mutual images selectively

Class-separate distribution is learned. Class-overlapping distribution is learned.

Challenges

**AC-GAN (Previous) [Odena+2017]**
Optimized conditioned on discrete labels

Limited to generate data of each class separately

Expected states

<table>
<thead>
<tr>
<th>baseline</th>
<th>image generation</th>
<th>FID</th>
<th>DMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC-GAN</td>
<td>[Odena+2017]</td>
<td>13.7</td>
<td>36.6</td>
</tr>
<tr>
<td>cGAN</td>
<td>[Miyato+2018]</td>
<td>16.9</td>
<td>32.3</td>
</tr>
<tr>
<td>CFGAN</td>
<td>[Kaneko+2017]</td>
<td>15.8</td>
<td>50.9</td>
</tr>
<tr>
<td>CP-GAN</td>
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<td>12.5</td>
<td>95.0</td>
</tr>
</tbody>
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FID (Fréchet Inception distance), DMA (Class-distinct and class-mutual accuracy)

Achieves the best FID
Generates class-distinct and class-mutual images selectively

Contributions

**CP-GAN (Proposed)**
Represents between-class relationships using CP

Able to generate data on the basis of class specificity

Proposed Method: Classifier’s Posterior Generative Adversarial Networks (CP-GAN)
- **Key idea:** We redesign the generator input and the objective function of AC-GAN. (G: Generator, D: Discriminator, C: Classifier)

Baseline: AC-GAN

Proposal: CP-GAN

Experiment I: Controlled class-overlapping data

**CIFAR-10to5:** Class overlaps are made synthetically

We divide the original ten classes (0, ..., 9) [Krizhevsky2009] into five classes (A, ..., E).

Clothing1M [Xiao+2015]: Includes real-world class-overlapping data

The data are collected from shopping web sites (the annotation accuracy: 61.54%).

Experimental results

<table>
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<tr>
<td>AC-GAN</td>
<td>[Odena+2017]</td>
<td>9.3</td>
<td>54.7</td>
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<tr>
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<td>[Miyato+2018]</td>
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<td>6.8</td>
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FID (Fréchet Inception distance), DMA (Class-distinct and class-mutual accuracy)

Achieves the best FID
Generates class-distinct images selectively

Contributions

CP-GAN (Proposed)
Represents between-class relationships using CP

Able to generate data on the basis of class specificity