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EVALUATION OF SPECIAL CHANGES AND WATERFRONT REGIONS

ABSTRACT

The purpose of this study was to evaluate the special changes as well as waterfront

12.200 - S. J. de Campos, C. F. Preato, (Comisario)
Comando Regional de Desenvolvimento Urbanístico e Recursos (CREDUR)
Instituto de Pesquisas Espaciais (IPE)
R. Xeure

FOR SEPARABILITY OF AGRICULTURAL COVER TANDS
Kumar and Silva (1977) have investigated the statistical separability of the spectral classes of the agricultural cover types. They found that in the subset of one to twelve bands, the correlation of the agricultural cover types with the four bands selected by the Bishop method was greatest. The overall statistical separability of the agricultural cover types, as measured by the Bishop method, was found to be greater than that of the data from the other methods. Therefore, a method similar to that of the Bishop method was used to evaluate the capabilities of the various spectral channels for the agricultural cover types. The results of this evaluation were used to select the spectral channels for the agricultural cover types.

**METHOD OF ANALYSIS**

Kumar and Silva (1977) used a multivariate statistical analysis to investigate the separability of the agricultural cover types in the spectral channels. They found that the separability of the agricultural cover types was greatest in the subset of one to twelve bands. The overall separability was found to be greater than that of the data from the other methods. Therefore, a method similar to that of the Bishop method was used to evaluate the capabilities of the various spectral channels for the agricultural cover types. The results of this evaluation were used to select the spectral channels for the agricultural cover types.

**MULTISENSIBLE SCANNER DATA**

The multiband scanner captured data in twelve spectral channels in the wavelength range 0.4 to 2.0 μm. The wavelength bands of these twelve spectral channels are shown in Table 1. The data were collected with an optical multichannel analyzer, and a combination of multipass and differential techniques was used to analyze the data. The overall statistical separability of the agricultural cover types, as measured by the Bishop method, was found to be greater than that of the data from the other methods. Therefore, a method similar to that of the Bishop method was used to evaluate the capabilities of the various spectral channels for the agricultural cover types. The results of this evaluation were used to select the spectral channels for the agricultural cover types.

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The research deals with the problem of feature selection in the context of pattern recognition.

In this study, a novel method for selecting features is proposed. The method is based on the concept of mutual information between features and the class labels. The mutual information is calculated using the formula:

$$I(X;Y) = \sum_x \sum_y p(x,y) \log \frac{p(x,y)}{p(x)p(y)}$$

where $I(X;Y)$ is the mutual information between features $X$ and class labels $Y$, $p(x,y)$ is the joint probability of feature $x$ and class label $y$, $p(x)$ is the marginal probability of feature $x$, and $p(y)$ is the marginal probability of class label $y$.

The selected features are those that maximize the mutual information with the class labels. This selection process is performed by evaluating the mutual information for each feature and selecting the features with the highest values.

The effectiveness of the proposed method is validated through experiments on two benchmark datasets, MNIST and CIFAR-10. The results show that the proposed method outperforms existing feature selection methods in terms of classification accuracy.

In conclusion, the proposed method provides a robust approach for feature selection in pattern recognition tasks, offering improved performance compared to existing methods.
REFERENCES


TABLE I. WAVELENGTH BANDS OF THE SPECTRAL CHANNELS

<table>
<thead>
<tr>
<th>Channel No</th>
<th>Wavelength Band (Micrometers)</th>
<th>Wavelength Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.46 - 0.49</td>
<td>visible</td>
</tr>
<tr>
<td>2</td>
<td>0.48 - 0.51</td>
<td>visible</td>
</tr>
<tr>
<td>3</td>
<td>0.50 - 0.54</td>
<td>visible</td>
</tr>
<tr>
<td>4</td>
<td>0.52 - 0.57</td>
<td>visible</td>
</tr>
<tr>
<td>5</td>
<td>0.54 - 0.60</td>
<td>visible</td>
</tr>
<tr>
<td>6</td>
<td>0.58 - 0.65</td>
<td>visible</td>
</tr>
<tr>
<td>7</td>
<td>0.61 - 0.70</td>
<td>near infrared</td>
</tr>
<tr>
<td>8</td>
<td>0.72 - 0.92</td>
<td>near infrared</td>
</tr>
<tr>
<td>9</td>
<td>1.00 - 1.40</td>
<td>middle infrared</td>
</tr>
<tr>
<td>10</td>
<td>1.50 - 1.80</td>
<td>middle infrared</td>
</tr>
<tr>
<td>11</td>
<td>2.00 - 2.60</td>
<td>middle infrared</td>
</tr>
<tr>
<td>12</td>
<td>9.30 - 11.70</td>
<td>thermal infrared</td>
</tr>
</tbody>
</table>
Table II. Effect of Detection of Each Channel on the Percentage Provability of Correct Classification

<table>
<thead>
<tr>
<th>Channel</th>
<th>Percentage Provability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69.2%</td>
</tr>
<tr>
<td>2</td>
<td>68.1%</td>
</tr>
<tr>
<td>3</td>
<td>63.2%</td>
</tr>
<tr>
<td>4</td>
<td>62.5%</td>
</tr>
<tr>
<td>5</td>
<td>60.7%</td>
</tr>
<tr>
<td>6</td>
<td>57.1%</td>
</tr>
<tr>
<td>7</td>
<td>54.9%</td>
</tr>
<tr>
<td>8</td>
<td>52.7%</td>
</tr>
<tr>
<td>9</td>
<td>50.7%</td>
</tr>
<tr>
<td>10</td>
<td>48.5%</td>
</tr>
<tr>
<td>11</td>
<td>46.9%</td>
</tr>
<tr>
<td>12</td>
<td>45.3%</td>
</tr>
</tbody>
</table>

Note: The effect of detection on a channel in the subject of eye to examine channels on the percentage provability of correct classification is as follows:

1. Detection of channel 1 increases the percentage provability from 69.2% to 69.6%.
2. Detection of channel 2 increases the percentage provability from 68.1% to 68.0%.
3. Detection of channel 3 increases the percentage provability from 63.2% to 64.9%.
4. Detection of channel 4 increases the percentage provability from 62.5% to 65.4%.
5. Detection of channel 5 increases the percentage provability from 60.7% to 64.7%.
6. Detection of channel 6 increases the percentage provability from 57.1% to 59.3%.
7. Detection of channel 7 increases the percentage provability from 54.9% to 57.1%.
8. Detection of channel 8 increases the percentage provability from 52.7% to 55.3%.
9. Detection of channel 9 increases the percentage provability from 50.7% to 53.2%.
10. Detection of channel 10 increases the percentage provability from 48.5% to 50.8%.
11. Detection of channel 11 increases the percentage provability from 46.9% to 49.4%.
12. Detection of channel 12 increases the percentage provability from 45.3% to 47.8%.

The values of percentage provability can be found in the Table III. The values of P are estimated from the values of P风险管理 through the curve of benefit. The effect of detection on the percentage provability for each channel is as follows:

1. Detection of channel 1 increases the percentage provability from 69.6% to 70.2%.
2. Detection of channel 2 increases the percentage provability from 68.0% to 68.5%.
3. Detection of channel 3 increases the percentage provability from 64.9% to 65.4%.
4. Detection of channel 4 increases the percentage provability from 65.4% to 66.0%.
5. Detection of channel 5 increases the percentage provability from 64.7% to 65.3%.
6. Detection of channel 6 increases the percentage provability from 59.3% to 60.0%.
7. Detection of channel 7 increases the percentage provability from 57.1% to 57.6%.
8. Detection of channel 8 increases the percentage provability from 55.3% to 55.8%.
9. Detection of channel 9 increases the percentage provability from 53.2% to 53.8%.
10. Detection of channel 10 increases the percentage provability from 50.8% to 51.4%.
11. Detection of channel 11 increases the percentage provability from 49.4% to 50.0%.
12. Detection of channel 12 increases the percentage provability from 47.8% to 48.4%.

The values of P are estimated from the values of P风险管理 through the curve of benefit. The effect of detection on the percentage provability for each channel is as follows:

1. Detection of channel 1 increases the percentage provability from 70.2% to 70.5%.
2. Detection of channel 2 increases the percentage provability from 68.5% to 68.7%.
3. Detection of channel 3 increases the percentage provability from 65.4% to 65.7%.
4. Detection of channel 4 increases the percentage provability from 66.0% to 66.3%.
5. Detection of channel 5 increases the percentage provability from 65.3% to 65.6%.
6. Detection of channel 6 increases the percentage provability from 60.0% to 60.2%.
7. Detection of channel 7 increases the percentage provability from 57.6% to 57.8%.
8. Detection of channel 8 increases the percentage provability from 55.8% to 56.0%.
9. Detection of channel 9 increases the percentage provability from 53.8% to 54.0%.
10. Detection of channel 10 increases the percentage provability from 51.4% to 51.6%.
11. Detection of channel 11 increases the percentage provability from 50.0% to 50.2%.
12. Detection of channel 12 increases the percentage provability from 48.4% to 48.6%.
### Table III

**Effect of Dilation of Each Wavelength Region on the Percentage of Correct Classification**

<table>
<thead>
<tr>
<th>Number of Channels in Each Set</th>
<th>$\Delta_0$</th>
<th>$\Delta_1$</th>
<th>$\Delta_2$</th>
<th>$\Delta_3$</th>
<th>$\Delta_4$</th>
<th>$\Delta_5$</th>
<th>$\Delta_6$</th>
<th>$\Delta_7$</th>
<th>$\Delta_8$</th>
<th>$\Delta_9$</th>
<th>$\Delta_{10}$</th>
<th>$\Delta_{11}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>82.00</td>
<td>81.63</td>
<td>84.63</td>
<td>84.63</td>
<td>84.63</td>
<td>84.63</td>
<td>84.63</td>
<td>84.63</td>
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<td>84.63</td>
<td>84.63</td>
<td>84.63</td>
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<tr>
<td>Two</td>
<td>89.22</td>
<td>89.22</td>
<td>89.22</td>
<td>89.22</td>
<td>89.22</td>
<td>89.22</td>
<td>89.22</td>
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<td>89.22</td>
<td>89.22</td>
<td>89.22</td>
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<tr>
<td>Three</td>
<td>91.38</td>
<td>91.38</td>
<td>91.38</td>
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<tr>
<td>Four</td>
<td>92.11</td>
<td>92.11</td>
<td>92.11</td>
<td>92.11</td>
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<tr>
<td>Five</td>
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<td>Six</td>
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<tr>
<td>Seven</td>
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<tr>
<td>Eight</td>
<td>96.08</td>
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<td>96.08</td>
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<tr>
<td>Nine</td>
<td>96.20</td>
<td>96.20</td>
<td>96.20</td>
<td>96.20</td>
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<tr>
<td>Eleven</td>
<td>96.30</td>
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<td>96.30</td>
</tr>
</tbody>
</table>

Note: The values in the table represent the percentage of correct classification for different numbers of channels and wavelength regions. The values are calculated for each combination of $\Delta_i$ and $\Delta_j$, where $\Delta_i$ and $\Delta_j$ are different wavelength regions. The table includes results for one to twelve channels and different frequency combinations, demonstrating that an increase in the number of channels generally leads to an increase in the percentage of correct classification.