FUZZY CLUSTERING OF BRAND PRODUCT CUSTOMER LOYALTY DATA

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Brand product examples

<table>
<thead>
<tr>
<th>Meal</th>
<th>Alcohol &amp; Cigarette</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coca-Cola</td>
<td>SMIRNOFF</td>
</tr>
<tr>
<td>22. PEPSI</td>
<td>10. Marlboro</td>
</tr>
<tr>
<td>23. NESCAFÉ</td>
<td>86. SMIRNOFF</td>
</tr>
<tr>
<td>36. Kellogg's</td>
<td>42. Heinz</td>
</tr>
<tr>
<td>62. Nestle</td>
<td>63. Danone</td>
</tr>
<tr>
<td>10. Marlboro</td>
<td>24. Budweiser Budvar</td>
</tr>
<tr>
<td>52. Wrigley's</td>
<td>89. Moët &amp; Chandon</td>
</tr>
<tr>
<td>67. Kraft</td>
<td>83. Hennessy</td>
</tr>
<tr>
<td>83. Hennessy</td>
<td>99. Hennessy</td>
</tr>
</tbody>
</table>

The numbers equal positions in Top 100 List of Most Expensive Brand by Business Week, 2004.
Problem statement

How to partition the brand product markets into several groups with similar properties?

Why?

It allows a brand manager to extend his (her) knowledge from one brand product sale strategy to the whole group, and do good branding.
Experimental Data Sets
(from “Russian food & drinks market magazine” http://www.foodmarket.spb.ru )

Tea, Ukraine, 2004
Tea, Russia, 2004
Tea, Moscow, 2004

Instant Coffee, 2005
Natural Coffee, 2005
Ice Cream, 2004
Vodka, 2004
3 Steps for Data Clustering

I. Approximate the experimental data by a parametrical functions.

II. Combine the function parameters and RMSEs into feature vectors (clustering attributes).

III. Divide the feature vectors into fuzzy clusters.
Approximating Function

Sigmoid curve

\[ y = \frac{k}{1 + e^{-a(x-c)}} \]
Approximation by Sigmoid Curve
Attributes (Feature Vectors)

<table>
<thead>
<tr>
<th>Product</th>
<th>k</th>
<th>a</th>
<th>c</th>
<th>RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tea, Ukraine, 2004</td>
<td>(94.7, 0.0506, 72.2, 3.11)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Tea, Ukraine, 2003</td>
<td>(90.9, 0.0529, 67, 2.44)</td>
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<td></td>
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<tr>
<td>Tea, Russia, 2004</td>
<td>(76.7, 0.0632, 64.9, 1.38)</td>
<td></td>
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<tr>
<td>Tea, Moscow, 2004</td>
<td>(86.7, 0.0474, 74, 3.89)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instant Coffee, 2005</td>
<td>(88.3, 0.0693, 67, 2.98)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Coffee, 2005</td>
<td>(48.7, 0.0581, 51.1, 3.29)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ice Cream, 2004</td>
<td>(48.7, 0.0632, 51.2, 3.06)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vodka, 2004</td>
<td>(82.1, 0.0371, 63.8, 1.81)</td>
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</tbody>
</table>
Fuzzy Clustering

Main difference

*each object may assign to all the clusters but with various membership degrees*

Example: how to partition the symmetric butterfly on 2 symmetric clusters?
Butterfly Clustering
Fuzzy C-means Clustering

\[ \sum_{i=1}^{c} \sum_{k=1}^{M} (\mu_{ki})^m \cdot \left\| V_i - X_k \right\|^2 \rightarrow \min \]

\[ V_i = \frac{\sum_{k=1}^{M} (\mu_{ki})^m \cdot X_k}{\sum_{k=1}^{M} (\mu_{ki})^m} \] – center of fuzzy cluster

\[ m \in [1, \infty) \] – exponential weight
Fuzzy Clustering of Brand Product Markets

Tea, Ukraine, 2004
Tea, Ukraine, 2003
Tea, Russia, 2004
Tea, Moscow, 2004
Instant Coffee, 2005
Natural Coffee, 2005
Ice Cream, 2004
Vodka, 2004

- membership to cluster #1
- membership to cluster #2
Fuzzy Clustering of Brands

- cluster center
- marker size is proportionate to cluster membership grade
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