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The authors are with the Department of Electrical and Computer Engineering, University of Queensland, Qld 4072, Australia.

Email: {paige, dl}@csse.qut.edu.au

Authors: Rupert Paige, Dennis Longstaff

Nonparametric Markov Random Field Model

Analysis of the MeasTex Test Suite

The University of Queensland, Qld 4072.
Dept. Electrical & Computer Engineering
Centre for Sensor Signal & Information Processing
Abstract

The advantages and disadvantages of such a scheme are discussed in this paper. Texture is deemed unknown. The advantages and disadvantages of statistics as that define a training set texture. If not, properties can be deemed to be from the same population. Texture is classified on the basis of whether or not its statistical scheme is based on a significance test. A texture is predefined classes. Instead of our texture classification scheme, one that does not require a complete set of been predefined. We look at a new texture classification classification, whereby all the classification classes have been predefined algorithms have been based on supervised algorithms can be compared. Typically, today's texture suite is a standard by which various texture classification classifying the MeasTex Test Suite. The MeasTex Test Random Field (MRF) model and its application in this paper looks at the nonparametric, multiplicative, Markovian...
Can easily model high dimensional statistics.

- Only requires a small amount of sample data.
- Imposes few underlying constraints on the texture.

**Advantages**

Field texture model.

Method

Use a nonparametric multiscale Markov random field texture model for "open-ended" classification.

Large portion of the unique characteristics of a texture

To find a model that is capable of capturing a skin, or the jumper someone is wearing.

**Figure 1**: Texture in images can represent different types of hair.

(a) Baboon

(b) Einstein
Problem 1: Determining the correct neighborhood size.

- Eighth order neighborhood.
- Second order neighborhood: (a) The first order of nearest-neighborhood
- Neighborhood: (b) Second order neighborhood; (c) Certain value given the values of its neighboring pixels.

Problem 2: Estimation of the LCPDF [3', 7].

LCPDF (Local Conditional Probability Density Function) which defines the probability of a pixel being a neighboring pixel. This dependence is then modeled by a local model on a local set of pixels in the texture must be dependent on a local set of pixels to be modeled as a MRF, the value of each pixel in the texture is the value of its MRF.

Markov Random Field Model
Figure 4: Histogram point is convolved with Gaussian kernel.

Figure 3: Smooth multi-dimensional histogram via nonparametric Parzen density estimation [8].

Step 3: Smooth multi-dimensional histogram via nonparametric Parzen density estimation [8].

Step 2: Build a multi-dimensional histogram with the neighbourhood from the texture. Example:

Step 1: Choose a neighbourhood size.

Estimation of nonparametric LCPDF.
Step 4: The simple estimate of the strong LCPDF is:

\[ \widehat{P} \approx \text{distribution LCPDF}. \]

Step 3: For each major clique, estimate the marginal that are not subsets of other cliques.

Step 2: Choose a set of major cliques \( \{ \mathcal{N} \} \) cliques.

**Figure 5**: Neighbourhoods and their cliques.

Step 1: Choose a neighbourhood \( \mathcal{N} \).

Non-neighbouring sites for any subset of the image lattice.

There is conditional independence between function of its marginal distributions by assuming that in [5] we showed that we can estimate the LCPDF as a

**Nonparametric MRF**
annealing in the relaxation process. Which can be regarded as an implementation of local
the use of our own novel pixel temperature function [6]
image [2]. We implemented constrained SR through
while constraining the SR with respect to the above

\[ f \]

same sampler [1].

\[ \text{Applying stochastic relaxation (SR)} \]
\[ \text{same resolution} \]
\[ \text{Estimation of the LPD}E \text{ from original texture at} \]
\[ \text{resolution} \]

works its way down performing the following at each
The multiscale synthesis algorithm starts from the top and

Figure 6: Grid organisation for multiscale modelling of an MRF.
Neighborhood textures were synthesized from a nonparametric MRF model with a $7 \times 7$ neighborhood. The synthesized textures were compared to the visual similarities between the synthesized textures and the original textures. To test whether a texture model has captured all the unique characteristics, use the model to synthesize synthetic textures.
value [5] probabilty of recording a larger chi-squared-distributed test returned was the one degree of freedom, the probability we returned was the test returned a value that was chi-squared-distributed with the classification. As the Kruskal-Wallis hypothesis MeasTex Test Suite [9] required a probability associated with directly from the Kruskal-Wallis hypothesis test, the hypothesis would be of the same class. Although we were able to make a yes/no classification characteristics would be of the same class. Any texture with similar unique statistic texture class. Any texture with similar unique statistic features involved in the classification were unique to the training texture. This ensured that the statistics, or was able to reproduce synthetic textures similar to the was involved in collecting the probabilities. This classification process was deemed possible non-parametric Kruskal-Wallis test [4] to test this null were from the same population. We used the significance test on whether the two sets of probabilities training texture. The classification was made by using a collect probabilities from the unknown texture and the collect probabilities from the training texture. This LCPDF was then used to from the MeasTex Test Suite [9], we first built an LCPDF To perform open-ended texture classification for a texture.
Strong MRF model. It is the multilingual heigh index. The maximum statistical order (clique size) used in the table is the distance from the centre pixel. c: indexes referring

**MRF model key:** n: is the neighbourhood index, referring

<table>
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<th>Test Series</th>
<th>Grass</th>
<th>Material</th>
<th>Object</th>
<th>Vtest</th>
<th>All</th>
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<td>All</td>
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<td>0.69710</td>
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Table 1: MeasTex test suite summary scores
Known techniques when the all the required texture classes are
outperformed by the standard supervised classification
our method of open-ended texture classification is
computationally more efficient. What this shows is that
then the best nonparametric MRF model (the fractal model) does better
performing standard model (the fractal model) does better
structure of these models are given in [9]. Even the worst
fractal, Gabor, GLCM, and Gaussian MRF models. The
can be directly compared to the results in Table 2 for the
The results in Table 1 for the nonparametric MRF models

<table>
<thead>
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<th>Rank</th>
<th>Grass</th>
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<th>VisTex</th>
<th>Qandubu</th>
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Table 2: MeasTex test suite summary scores
as no functional framework was imposed on the model. The optimization result is also fairly general, as independent. The optimization result is also fairly general.

We can therefore surmise that these variables are relatively optimal MRF model as the one identified in Table 1. We operational MRF model's specifications. Give an expected of the tables (which show the general effect of varying one

<table>
<thead>
<tr>
<th>Mutigrid Height</th>
<th>All models</th>
<th>Except clique models</th>
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<td>8.25</td>
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<tr>
<td>10.00</td>
<td>7.67</td>
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Table 5: Average rank for various mutigrid heights

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<tr>
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</tr>
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<td>1.90</td>
<td>2.50</td>
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</table>

Table 4: Average rank for various clique sizes

<table>
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<th>All models</th>
<th>Except clique models</th>
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<td>15.00</td>
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<td>5 x 5</td>
</tr>
<tr>
<td>11.17</td>
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<tr>
<td>6.50</td>
<td>6.50</td>
<td>nearest 4</td>
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</tbody>
</table>

Table 3: Average rank for various neighbourhoods

Analysis of Performance
The myometrium.

Figure 8: Probability maps of medical images: (a) lymphoid follicle.

(a.1) (a.2) (a.3) (b.1) (b.2) (b.3) (c.1) (c.2) (c.3)
Figure 9: Airborne SAR image of Cultura.

Figure 10: Probabilty maps of the trees and grass superimposed on to Cultura image.

Practical Application
Application of terrain mapping of SAR images. This technique is considered potentially valuable in the practical performance open-ended texture classification. Thus, with respect to its unique statistical characteristics, thereby unknown texture was similar to a training texture with an unknown model was used to determine the probability that an unknown image containing multiple unknown textures. The model is become feasible to recognize other similar textures with such a nonparametric MRF model captured all the unique with this evidence that we concluded that the synthesis realistic realisations of a training texture. It was

Summary and Conclusion
References