**TMW**

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**An Object Oriented Image Modelling Framework**

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We present **TMW**

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a completely modular, object oriented framework for image modelling. The framework allows the creation of arbitrarily complex models from relatively simple, self contained building blocks. If such a model is used for compression, the framework allows for model parameters to be optimized with respect to the compressed file size. This is achieved by propagating, through the whole model, accurate derivatives of the compressed image size with respect to the blocks' outputs.

The object oriented nature of **TMW** allows users to easily extend the set of available building blocks while still maintaining full use of the existing blocks. Thus **TMW** provides an ideal environment to quickly try out new ideas without the need to reimplement all stages of an image model.

Image compression is the prime application for such a framework. The table below shows that **TMW** results significantly better the results previously obtained by **LOCO**\(^1\), **CALIC**\(^2\), **P2AR**\(^3\), **TMW**\(^4\) and **Glicbawls**.\(^5\)

The work has application far beyond the area of image compression. The constructed models have been used for image processing tasks such as noise removal, in terpolation and JPEG artifact removal.\(^6\)

<table>
<thead>
<tr>
<th></th>
<th>balloon</th>
<th>barb</th>
<th>barb2</th>
<th>board</th>
<th>boats</th>
<th>girl</th>
<th>gold</th>
<th>hotel</th>
<th>zelda</th>
<th>lenna</th>
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<td>4.66</td>
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<td>3.87</td>
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</tr>
<tr>
<td><strong>TMW</strong></td>
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<td>3.61</td>
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<td>4.27</td>
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<tr>
<td><strong>Glicbawls</strong></td>
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</tr>
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</table>

Compressing images to a size 7.4% smaller on average than the size achieved by **CALIC** is especially remarkable as that size was once thought to be close to the theoretical minimum.

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\(^1\)LEGO is a trademark of the LEGO group of companies

\(^2\)Proceedings IEEE Data Compression Conference, Snowbird, Utah, March-April 1996

\(^3\)As available from ftp://ftp.csd.uwo.ca/pub/fromju/


\(^5\)As estimated from available results.

\(^6\)International Picture Coding Symposium PCS97 conference proceedings, September 1997

\(^7\)Proceedings IEEE Data Compression Conference, Snowbird, Utah, March 2001

\(^8\)See http://byron.csse.monash.edu.au/dic/ibin/jpg/cleanup.html