Negentropic Planar Symmetry Detector Supplementary Material

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1 Details of a Loy and Eklundh's Method Assessment

In this section we present the details of Loy and Eklundh's method [1] assessment. The pseudocode is given in Algorithm 1. The input parameters are an image I and a scaling factor $sf \in (0, 1]$. In our experiments we have set *dist_max* as 1/64 of the original image resolution, this parameter is used to determine the most centred rotation in an image.

[2] utilizes the right-handed coordinate system, while in our method we use the left-handed one. Therefore in line 6 of the algorithm we transform the results to the left-handed system and take modulo 180 to keep angles between 0° and 180°.

2 Details of a Shen-Ip Symmetry Detector Assessment

Shen-Ip Symmetry Detector [3] is based on generalized complex (GC) moments given by

$$GC_{p,q} = \frac{1}{2\pi} \int_0^{2\pi} \int_0^{\infty} I(r,\theta) \left(r^{p+1} \exp(iq\theta) \right) \, dr \, d\theta.$$

In our implementation of Shen-Ip method we map an image I onto a unit disc so that $r \in [0, 1]$ and $\theta \in [0, 2\pi]$ and utilize a discrete estimator of a GC moment,

$$\widehat{GC}_{p,q} = \frac{1}{2\pi} \sum_0^{2\pi} \sum_0^{1} I(r,\theta) \, r^{p+1} \exp(iq\theta).$$

In the method, the order p is usually fixed during the process of detecting the non-zero GC moments and it is recommended in the paper [3] that the selection of an order P is based on the ratio of the total alternating energy to the total energy. In the course of our experimental study we have determined that on our image set this selection can be arbitrary and that lower values yield more

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Algorithm 1 Execution of Loy and Eklundh's Algorithm

procedure LoyEklundh(I, sf)
  $loy\_refl \leftarrow$ [1] call for mirror symmetry detection in I scaled by sf
  $loy\_rot \leftarrow$ [1] call for rotational symmetry detection in I scaled by sf
  if NbOfRows(loy_refl) > 0 **then**
    $angle \leftarrow loy\_refl[1][2]$ ▷ the angle of a dominant symmetry
    $tilt\_angle \leftarrow (angle + 90) \mod 180$
    $order\_refl \leftarrow$ NbOfRows(loy_refl)
  else
    $tilt\_angle \leftarrow -1$
    $order\_refl \leftarrow 0$
  end if
  $rot\_idx \leftarrow$ an index of a row in loy_rot that contains rotational symmetry whose centre is the closest to the centre of an image and no further away than a predefined threshold $dist\_max$. If no such symmetry was found then 0.
  if $rot\_idx > 0$ **then**
    $order\_rot \leftarrow loy\_rot[rot\_idx][3]$
  else
    $order\_rot \leftarrow 1$
  end if
  return $order\_refl$, $angle$, $order\_rot$
end procedure

obvious non-zero values. We tested Shen-Ip method with p set to 1 in one experiment and to 3 in the other, and both experiments gave the same results. Thus, we report only on one of them, namely $p = 1$.

We have found, however, a certain problem with using GC moments. Moments with repetition q equal to a multiple of 4 reach significantly higher values than other moments. We have run our experiments including and excluding these moments, and the latter yielded higher detection rates.

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References

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