Praktikum 2

Tamura-Maß: Granularität

Tamura et al. beschreiben in [Tamura78] das von ihnen verwendete Feature zur Charakterisierung der in einer Textur vorherrschenden Granularität wie folgt:

> Rosenfeld and his colleagues have proposed and examined a variety of coarseness measures since the early days. Considering several problems in coarseness such as the undesirable dependence on contrast (in the narrow sense) or the presence of microtexture, they developed a new method by using various sized operators. The essence of this method is to pick a large size as best when coarse texture is present even though microtexture is also present but to pick a small size when only fine texture is present. This procedure can be summarized in the following steps.
>
> *Step 1:* Take averages at every point over neighborhoods whose sizes are powers of two, e.g., 1×1, 2×2, $\cdots$, 32×32. The average over the neighborhood of size $2^k \times 2^k$ at the point (x, y) is
>
> $$A_k(x,y) = \sum_{i=x-2^{k-1}}^{x+2^{k-1}-1} \sum_{j=y-2^{k-1}}^{y+2^{k-1}-1} \frac{f(i,j)}{2^{2k}}$$
>
> where $f(i, j)$ is the gray-level at (i, j).
>
> *Step 2:* For each point, at each point, take differences between pairs of averages corresponding to pairs of nonoverlapping neighborhoods just on opposite sides of the point in both horizontal and vertical orientations. For example, the difference in the horizontal case is
>
> $$E_{k,\mathrm{h}}(x,y) = \left| A_k(x + 2^{k-1}, y) - A_k(x - 2^{k-1}, y) \right|.$$
>
> *Step 3*: At each point, pick the best size which gives the highest output value:
>
> $$S_{\mathrm{best}}(x,y) = 2^k$$
>
> where k maximizes E in either direction, i.e.,
>
> $$E_k = E_{\max} = \max\{E_1, E_2, \cdots, E_L\}.$$
>
> *Step 4:* Finally, take the average of S_{best} over the picture to be a coarseness measure F_{crs}:
>
> $$F_{\mathrm{crs}} = \frac{1}{w \times h} \sum_{i=0}^{w-1} \sum_{j=0}^{h-1} S_{\mathrm{best}}(i,j)$$
>
> where w and h are the effective width and height of the picture, respectively. In effect, it should be noticed that boundary strips of a picture within the width of the largest operator size 2^L cannot be processed properly.

Implementieren Sie die Granularitätsberechnung in einer Programmierumgebung Ihrer Wahl und berechnen Sie F_{crs} für die Beispielbilder auf der MDB-Seite. Geben Sie für jedes Bild zusätzlich noch ein Histogramm für die Verteilung der S_{best}-Werte aus.

Hinweise

- Behandeln Sie die Bilder als Grauwert-Bilder mit 256 Werten (z.B. durch Umwandeln in HSV – der V-Kanal repräsentiert dann den Grauwert).
- Überlegen Sie sich, wie die Fenstergröße 1x1 (k=0) sinnvoll behandelt wird;
- Treffen Sie weiterhin eine sinnvolle Annahme für den Fall, dass zwei verschiedene k-Werte zur gleichen maximalen Differenz führen.
- Die zu untersuchenden Texturen finden Sie hier auf meiner Seite: http://www.hs-niederrhein.de/fileadmin/dateien/fb03/nutzer/weidenhaupt/mdb-ss11/Textures.zip

Referenzen

[Tamura78] Tamura, H., Mori, S., Yamawaki, T.: Textural features corresponding to visual perception. IEEE Transactions on Systems, Man, and Cybernetics, 8(6):460-473, 1978.