Project work
Team 4

FLAGS

The Problem

- Input: images of flags and training set

- Try to identify given flags with distortion.

The Problem

- Input: images of flags and training set

- Try to identify flags given that they will be distorted.

Team members

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Problem analyzing

- There is a finite number of different national flags in the world. There are 192 members of the United Nations.
- Flags have rectangular shape
- Flags mostly have horizontal, vertical or occasionally diagonal stripes
- Flags contain only certain colors

Problem solution steps

Preprocessing

- Flag segmentation from a given image
- Reshape to rectangular

Processing

- **Comparing** with the flags in database

Comparing flags

We compare two flags *A* and *B* by determining the

- **Color** similarity, $c \in [0,1]$

- **Correlation** factor, $r \in [0,1]$

Similarity function,

$$\Psi(A,B) = \frac{\omega_c}{\sigma} \bullet c + \frac{\omega_r}{\sigma} \bullet r$$

where ω_c, ω_r are the appropriate weights
and $\sigma = \omega_c + \omega_r$.

Color similarity

- We define 6 diffrerent colours and its appropriate intervals in HSV color space
- Calculate the number of pixels for each 6 colors in the given flags and form its color vector representations

$$[white, black, red, yellow, green, cyan, blue]$$

- Calculate the absolute distance between color vector representations of two flags,

$$DC = |white_1 - white_2| + |black_1 - black_2| + ... + |blue_1 - blue_2|$$

- Calculate the color similarity factor *c* by

$$c = (1 - \frac{DC}{2 * res})$$

Correlation factor

We calculate the correlation factor of two grey-valued flags A and B by the formula:

$$r^* = \frac{\sum_m \sum_n (A_{mn} - \overline{A})(B_{mn} - \overline{B})}{\sqrt{\sum_m \sum_n (A_{mn} - \overline{A})^2 \sum_m \sum_n (B_{mn} - \overline{B})^2}}, \quad r = \frac{1 + r^*}{2}$$

where:
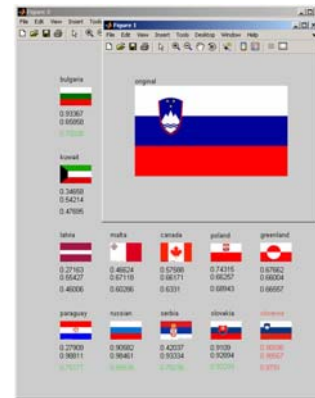
A_{mn} - Pixel value at point (m,n) in image A

$\overline{A}$ - Mean value of the image A

B_{mn} - Pixel value at point (m,n) in image B

$\overline{B}$ - Mean value of the image B

Example 1

Example 2

Conclusion

- Flags with rectangular shapes and relatively high saturation are recognized with high probability (>95% ☺)

- Flags with distortion, pale colors, small dissimilarity (e.g. only different coat of arms) can be recognized with lower probability

Thank you!