



Sharif University of Technology
Electrical Engineering Department

Machine Learning and Vision Lab Pre-Report 7

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HOG Normalization

1. Illumination Invariance:

- Normalization helps to make the HOG descriptor more robust to changes in illumination conditions. By standardizing the intensity values of the local image patches, the descriptor becomes less sensitive to variations in lighting, making it more effective across different lighting conditions.

2. Contrast Normalization:

- It enhances the ability of the HOG descriptor to capture local contrast information. Normalizing the histograms helps to highlight patterns related to the edges and textures in the image, making the descriptor more discriminative.

3. Normalization Across Blocks:

- In HOG, the image is divided into multiple cells, and each cell contributes to a histogram. These histograms are then grouped into larger blocks. Normalizing the histograms within each block helps in dealing with variations in contrast and lighting at different spatial scales, making the descriptor more adaptable to different object sizes.

4. Reduction of Sensitivity to Gradient Magnitude:

- Normalization reduces the sensitivity of the HOG descriptor to variations in gradient magnitude. This is important for achieving robustness in the presence of noise or small perturbations in the image.

5. Facilitating Learning:

- Normalization facilitates the learning process in machine learning algorithms. It helps maintain consistent scales and reduces the impact of outliers, making the training more stable and improving the overall performance of the system.

Pattern Uniform

Pattern Uniformity:

- After obtaining the binary pattern, the next step involves determining the uniformity of the pattern.
- A pattern is considered "uniform" if it contains at most one bitwise transition from 0 to 1 or vice versa.
- In other words, a pattern is uniform if it does not have more than one consecutive 0s-to-1s or 1s-to-0s transition when read in a circular or linear fashion.

Benefits of Pattern Uniformity:

- Uniform patterns are often more informative for texture analysis because they represent more regular and predictable local structures.
- By considering only uniform patterns, LBP can be more robust to variations caused by noise and small intensity fluctuations.

Histogram of Pattern Uniforms:

- In practical applications, the LBP operator is applied to each pixel in an image, and the resulting uniform patterns are used to construct a histogram.
- The histogram provides a concise representation of the distribution of different uniform patterns in the image, useful for texture classification and recognition.