**Feature extraction**

**Definition:**

Feature extraction is a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to quickly complete tasks such as image matching and retrieval. It is the process of collecting higher-level information of an image such as shape, texture, color, and contrast. In fact, texture analysis is an important parameter of human visual perception and machine learning system. It is used effectively to improve the accuracy of diagnosis system by selecting prominent features.

Feature Extraction plays a very important role in the area of image processing. Before getting features, various image preprocessing techniques like binarization, thresholding, resizing, normalization etc. are applied on the sampled image. After that, feature extraction techniques are applied to get features that will be useful in classifying and recognition of images. Feature extraction techniques are helpful in various image processing applications. As features define the behavior of an image, they show its place in terms of storage taken, efficiency in classification and obviously in time consumption also.

**Steps Involved in Feature Extraction:**

Feature extraction is defined as the first stage of intelligent (high level) image analysis. Therefore, the task of feature extraction is to emphasize image information on the particular level, where subsequent algorithms operate.

1. **Data Level**

Data-based features depend on the joint information of all pixels. Therefore, all transforms manipulating the whole matrix of an image at once can be regarded for data feature extraction. The most famous example of a data feature transform is the Fourier transform, which describes a 2D image in terms of frequencies, according to their amplitude and phase.

**2. Pixel Level**

Since pixel-based features depend on the values of individual pixels, all point operations can be regarded as feature extraction on the pixel level.

**3. Edge Level**

Edge-based features are defined as local contrast, i.e., a strong difference of (gray scale or color) values of adjacent pixels.

**4. Texture Level**

Textural features have been used in medicine for a long time. In textbooks on pathology one can read many metaphors to describe texture, such as a cobblestone-shaped mucosal relief, onion-like stratification of subintima, or honeycomb-structured lung tissue. As intuitive as these metaphors are for people, as difficult is their computational texture processing, and a variety of procedures and approaches have been developed. Texture analysis attempts to quantify objectively the homogeneity in a heterogeneous but at least subjectively periodic. In general, we can distinguish:

• structural approaches that are based on texture primitives (textone, texture element, texel) and their rules of combinations and

• statistical approaches that describe texture by a set of empirical parameters.

**5. Region Level**

Regional features are used primarily for object classification and identification. They are normally calculated for each segment after the segmentation process. The most important parameters to be mentioned here are:

• localization-descriptive measurements such as size, position, and orientation of the major axis and

• delineation-descriptive measures such as shape, convexity, and length of the border.

**References:**

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