Augmented Reality & Video Service Emerging Technologies

AR Technology

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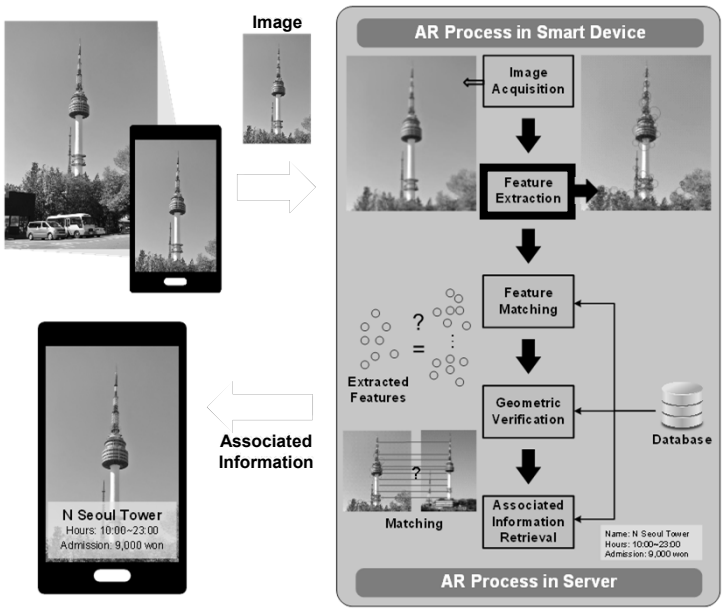
AR Technology

AR Feature Extraction

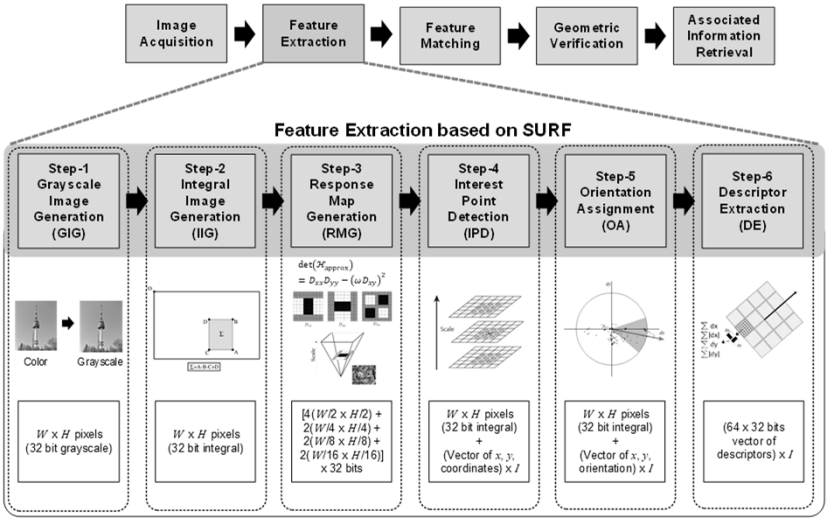
AR System Process



AR Feature Extraction

❖ AR Feature Extraction Process

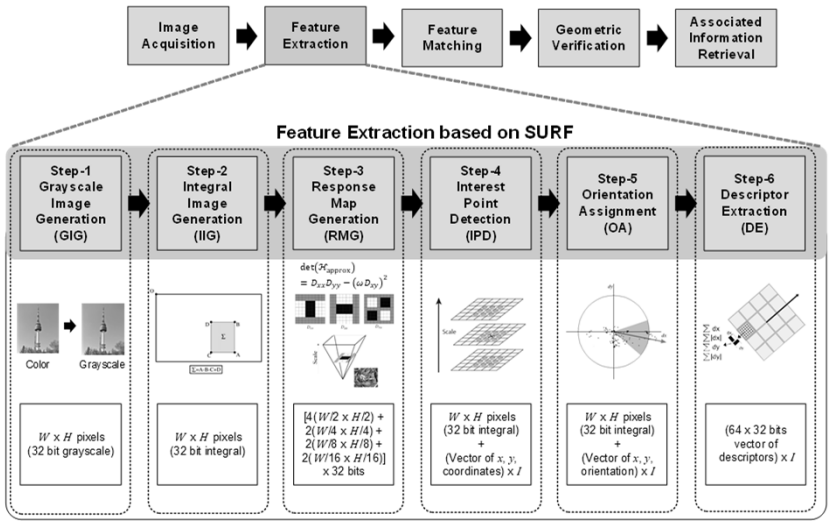
1. GIG: Grayscale Image Generation
2. IIG: Integral Image Generation
3. RMG: Response Map Generation



AR Feature Extraction

❖ AR Feature Extraction Process

4. IPD: Interest Point Detection
5. OA: Orientation Assignment
6. DE: Descriptor Extraction



AR Feature Extraction

❖ Feature Extraction Procedures

1. GIG (Grayscale Image Generation)
   - Original image captured by the AR device is changed into a grayscale valued image in order to make it robust to color modifications
2. IIG (Integral Image Generation)
   - Process of building an integral image from the grayscale image
   - This procedure enables fast calculation of summations over image sub-regions

AR Feature Extraction

❖ Feature Extraction Procedures

3. RMG (Response Map Generation)
   - In order to detect IPs (Interest Points) using the determinant of the image's Hessian matrix, the RMG process constructs the scale-space of the image

4. IPD (Interest Point Detection)
   - Based on the generated scale response maps, the maxima and minima (i.e., extrema) are detected and used as the IPs

AR Feature Extraction

❖ Feature Extraction Procedures

5. OA (Orientation Assignment)
   - Each detected IP is assigned a reproducible orientation to provides rotation invariance (i.e., invariance to image rotation)

6. DE (Descriptor Extraction)
   - Process of uniquely identifying an IP, such that it is distinguished from other IPs

AR Feature Extraction

❖ Feature Extraction

- Finding the Interest Points from the image/video
- Detecting the Descriptors from Interest Points and compare the descriptors with data in the database

Original Image Gray Scale Interest Point Descriptors

AR Feature Extraction

❖ Feature Extraction

- Qualification for Descriptors
  - Invariability from Noise, Scale, Rotation, etc.
- Kinds of Descriptors
  - Corner
  - Blob
  - Region

AR Feature Extraction

❖ Blob Detection

- LoG (Laplacian of Gaussian)
- Hessian Matrix (H): 2nd order derivative
  - Hessian (determinant of H)
  - Laplacian (trace of H)
- Blob Detection Example

AR Feature Extraction

❖ Blob Detection

- Blob Detection
  - Process of detecting blobs in an image
- Blob
  - Region of an image that has constant (or approximately constant) image properties
    ➔ All the points in a blob are considered to be similar to each other
  - These image properties (i.e., brightness, color, etc.) are used in the comparison process to surrounding regions

AR Feature Extraction

❖ **Typical Feature Extraction Techniques**

- Haar feature
  - P. Viola, et al., 2001
- SIFT (Scale Invariant Feature Transform)
  - D. G. Lowe, 2004
- HOG (Histogram of Oriented Gradient)
  - N. Dalal, et al., 2005
- SURF (Speeded Up Robust Features)
  - H. Bay, et al., 2006
- ORB (Oriented FAST and Rotated BRIEF)
  - E. Rublee, et al., 2011

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