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Rotation-Invariant Fast Features

Background. Image content description is used in a wide range of applications, including web-scale image search and real-time object recognition, but the effectiveness is constrained by a computational bottleneck. Augmented reality applications are further constrained because the mobile device's resources must be shared between camera pose tracking and image content recognition. Technologies capable of real-time tracking typically do not perform well at recognition from large-scale databases. Conversely, algorithms which excel at recognition are typically not fast enough for real-time tracking on mobile devices.

Invention. Stanford and Nokia researchers have developed an end-to-end feature extraction algorithm which is state-of-the-art in both speed and accuracy. Simultaneously computing image and filter scale spaces which enables real-time feature extraction with scale invariance. The Rotation Invariant Fast Feature (RIFF) allows for very low complexity description of local image patches. This allows for unified tracking and recognition as the complexity is low enough for real-time use on a mobile device. Accuracy is high enough for content detection.

The high speed of the algorithm is attributable to several factors:
• Box filtering - the filter response of the interest point detector is extremely low-complexity;
• Low scale-space overhead - the scale-space representation computes very few filter responses,
• while capturing the full space;
• Filter re-use - while computing a filter response scale-space, an image scale-space is obtained at no additional cost;
• No pixel interpolation – all computation is on the original image raster and at no time are pixels or gradients interpolated or rotated;
• Radial gradients - unlike (x, y)-gradients, radial gradients allow for placing gradients into oriented spatial bins without rotation.

Applications

- Real-time object recognition
- Web-scale image search
- Hand-held product recognition,
- Three dimensional reconstruction
- Panorama Stitching
- Robotic mapping
- Video tracking
- Augmented reality

Advantages

- Most accurate for the speed.

Patents

- Published Application: WO2011061709

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