

Treball de Fi de Grau

Enginyeria en Tecnologies Industrials

SLAM Visual basat en l'ús de Bundle Adjustment

ANNEX

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Apèndix A

Paràmetres dels detectors i descriptors

A.1 Detectors

AGAST		
Parameter	Value	Description
threshold	10	threshold on difference between intensity of the central pixel and pixels of a circle around this pixel
nonmaxSuppression	true	if true, non-maximum suppression applied to keypoints
detection type	AGAST_5_8 = 0 AGAST_7_12d = 1 AGAST_7_12s = 2 OAST_7_12d = 3 THRESHOLD = 10000 NONMAX_SUPRES- SION=10001	

FAST		
Parameter	Value	Description
threshold	10	threshold on difference between intensity of the central pixel and pixels of a circle around this pixel
nonmaxSuppression	true	if true, non-maximum suppression applied to neighboring points with inferior scores
detection type	TYPE_9_16 = 0 TYPE_7_12 = 1 TYPE_5_8 = 2	Size of the circle and number of contiguous points required to consider the center a keypoint

GFTT (Shi-Tomasi corner detector)		
Parameter	Value	Description
maxCorners	1000	Maximum number of features to retain.
qualityLevel	0.01	The product of the largest lower eigenvalue and the qualityLevel gives the minimal acceptable lower eigenvalue for a point to be included. It shouldn't exceed 1.
minDistance	1.0	Minimum number of pixels between two keypoints to filter multiple keypoints in small regions.
blockSize	3	Region around a given pixel considered to compute the autocorrelation matrix of derivatives.
k	0.04	Weighting score used for Harris metric

HARRIS (GFTT using Harris score)		
Parameter	Value	Description
maxCorners	1000	Maximum number of features to retain.
qualityLevel	0.01	The product of the largest lower eigenvalue and the qualityLevel gives the minimal acceptable lower eigenvalue for a point to be included. It shouldn't exceed 1.
minDistance	1.0	Minimum number of pixels between two keypoints to filter multiple keypoints in small regions.
blockSize	3	Region around a given pixel considered to compute the autocorrelation matrix of derivatives.
k	0.04	Weighting score used for Harris metric.

MSER		
Parameter	Value	Description
delta	5	Compares (size _i - size _{i-delta}) divided by size _{i-delta}
min_area	60	Prune the area which smaller than minArea
max_area	14400	Prune the area which bigger than maxArea
max_variation	0.25	Prune the area with simliar size to its children
min_diversity	0.2	For color image, trace back to cut off mser with diversity less than min_diversity
max_evolution	200	For color image, the evolution steps
area_threshold	1.01	For color image, the area threshold to cause re-initialize
min_margin	0.003	For color image, ignore too small margin
edge_blur_size	5	For color image, the aperture size for edge blur

SBD (Simple Blob Detector)		
Parameter	Value	Description
thresholdStep	10.0	Step between thresholds.
minThreshold	50.0	First threshold to use.
maxThreshold	220.0	Highest threshold to use.
minRepeatability	2	Minimum consecutive threshold images to contain overlapping blob candidates to be combined into a blob.
minDistBetween-Blobs	10.0	If two blob candidates have centers within this distance (pixel units), they are combined into the same.
filterByColor	false	True to use color filter
blobColor	0	0 or 255. Retain either dark or light blobs.
filterByArea	true	True to use area filter
minArea	25.0	Min area to accept.
maxArea	5000.0	Max area to accept.
filterByCircularity	false	True to filter on circularity.
minCircularity	0.8	Min ratio to circle area.
maxCircularity	3.40282e+38	Max ratio to circle area.
filterByInertia	true	True to filter on inertia.
minInertiaRatio	0.1	Min eigenvalues ratio of the second moment matrix.
maxInertiaRatio	3.40282e+38	Max eigenvalues ratio of the second moment matrix.
filterByConvexity	true	True to filter on convexity.
minConvexity	0.95	Min ratio to hull area.
maxConvexity	3.40282e+38	Max ratio to hull area.

A.2 Detectors i Descriptors

SIFT		
Parameter	Value	Description
nfeatures	0	The number of best features to retain.
nOctaveLayers	3	The number of layers (different scales of Gaussian convolutions) in each octave (images in the image pyramid). The number computed is nOctaveLayers + 3. The number of octaves is computed automatically from the image resolution.
contrastThreshold	0.04	Used to filter out weak features in low-contrast regions. The larger, the less features are retained.
edgeThreshold	10	Used to filter out edge-like features with eigenvalues ratio. The larger, the more features are retained.
sigma	1.6	The sigma of the Gaussian applied to the input image at the octave 0. Typical values are the order of a pixel.

SURF		
Parameter	Value	Description
hessianThreshold	400	Threshold for hessian keypoint detector used in SURF. A typical reasonable value could be 1500.
nOctaves	4	Number of pyramid octaves.
nOctaveLayers	2	Number of octave layers (images) within each octave.
extended	true	Extended descriptor flag (true: 128-element descriptors; false: 64-element descriptors).
upright	false	If true, do not compute orientation of features.

BRISK		
Parameter	Value	Description
thresh	30	FAST/AGAST detection threshold score.
octaves	3	Number of octaves. Use 0 to do single scale. If set to N, it will compute 2N-1 levels.
patternScale	1.0f	Apply this scale to the pattern used for sampling the neighbourhood of a keypoint.

KAZE		
Parameter	Value	Description
extended	false	Set to enable extraction of extended (128-element) descriptor.
upright	false	Set to enable use of upright descriptors (non rotation-invariant).
threshold	0.001f	Detector response threshold to accept point
nOctaves	4	Maximum octave evolution of the image
nOctaveLayers	4	Default number of sublevels per scale level
diffusivity	DIFF_PM_G1 = 0 DIFF_PM_G2 = 1 DIFF_WEICKERT = 2 DIFF_CHARBONNIER = 3	Diffusivity type

AKAZE		
Parameter	Value	Description
descriptor_type	DESCRIPTOR_KAZE_UPRIGHT = 2 DESCRIPTOR_KAZE = 3 DESCRIPTOR_MLDB_UPRIGHT = 4 DESCRIPTOR_MLDB = 5	Type of the extracted descriptor.
descriptor_size	0	Size of the descriptor in bits. 0: Full size
descriptor_channels	3	Number of channels in the descriptor (1, 2, 3)
threshold	0.001f	Detector response threshold to accept point
nOctaves	4	Maximum octave evolution of the image
nOctaveLayers	4	Default number of sublevels per scale level
diffusivity	DIFF_PM_G1 = 0 DIFF_PM_G2 = 1 DIFF_WEICKERT = 2 DIFF_CHARBONNIER = 3	Diffusivity type

ORB		
Parameter	Value	Description
nfeatures	200	Maximum number of features to retain.
scale factor	1.2f	Pyramid decimation ratio, greater than 1. scaleFactor==2 is the classical pyramid (each level 4x less pixels), it will degrade feature matching. scaleFactor too close to 1 means more pyramid levels and the speed will suffer.
nlevels	8	The number of pyramid levels. The smallest level will have linear size equal to: $\text{input_image_linear_size} \setminus \text{pow}(\text{scaleFactor}, \text{nlevels})$.
edge threshold	16	Size of the border where the features are not detected. It should be equal to or greater than patchSize.
first level	0	It should be 0 in the current implementation.
WTA_K	2	The number of points that produce each element of the oriented BRIEF descriptor. Value 2 means we take a random point pair and compare their brightnesses, so we get 0/1 response. Value 3 means that we take 3 random points and output index of the winner (0, 1 or 2). Such output will occupy 2 bits. Value 4 means we take 4 random points to compute each bin (that will also occupy 2 bits with possible values 0, 1, 2 or 3).
scoreType	kBytes = 32 HARRIS_SCORE = 0 FAST_SCORE 1	The default HARRIS_SCORE means that Harris algorithm is used to retain best nfeatures. FAST_SCORE is alternative value that produces less stable keypoints, but it is faster.
patchSize	16	Size of the patch used by the oriented BRIEF descriptor. On smaller pyramid layers the perceived image area covered by a feature will be larger.

A.3 Descriptors

BRIEF		
Parameter	Value	Description
bytes	32	Length of the descriptor in bytes, can be: 16, 32 or 64.
use_orientation	false	If true, sample patterns using keypoints orientation.

DAISY		
Parameter	Value	Description
radius	15	Radius of the descriptor at the initial scale
q_radius	3	Amount of radial range division quantity
q_theta	8	Amount of angular range division quantity
q_hist	8	Amount of gradient orientations range division quantity
norm	NRM_NONE = 100 NRM_PARTIAL = 101 NRM_FULL = 102 NRM_SIFT = 103	Descriptors normalization type. NRM_NONE=100 will not do any normalization Histograms are normalized independently for L2 norm equal to 1.0 Descriptors are normalized for L2 norm equal to 1.0 Descriptors are normalized for L2 norm equal to 1.0 but no individual one is bigger than 0.154 as in SIFT.
interpolation	true	Switch to disable interpolation for speed improvement at minor quality loss
use_orientation	false	Sample patterns using keypoints orientation

FREAK		
Parameter	Value	Description
orientationNormalized	true	If true, it computes orientation.
scaleNormalized	true	If true, image patch around the keypoint rescaled by its size.
patternScale	22.0	Scaling of the description pattern.
nOctaves	4	Number of octaves covered by the detected keypoints.
selectedPairs	[]	(Optional) user defined selected pairs indexes.

LATCH		
Parameter	Value	Description
bytes	32	Size of the descriptor - can be 64, 32, 16, 8, 4, 2 or 1
rotationInvariance	true	Whether or not the descriptor should compensate for orientation changes
half_ssd_size	3	Size of half of the mini-patches size.

LUCID		
Parameter	Value	Description
lucid_kernel	1	Kernel for descriptor construction, where 1=3x3, 2=5x5, 3=7x7 and so forth.
blur_kernel	2	Kernel for blurring image prior to descriptor construction, where 1=3x3, 2=5x5, 3=7x7 and so forth.