

Supplementary Materials: Creating incremental models of indoor environments through omnidirectional imaging

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Table S1. General Parameters of the Global Appearance Descriptors

Parameter	Definition
N_x	Number of rows of the panoramic image.
N_y	Number of columns of the panoramic image.
D_x	Derivative of the image regarding axis x.
D_y	Derivative of the image regarding axis y.
G	Module of the gradient.
θ	Orientation of the gradient.

Table S2. Parameters that impact the size of the image descriptors

HOG	
Position descriptor	$b_{hp} \Rightarrow$ bins per histogram in the position descriptor.
	$k_{hp} \Rightarrow$ number of horizontal cells in the position descriptor.
Orientation descriptor	$b_{ho} \Rightarrow$ bins per histogram in the orientation descriptor.
	$k_{ho} \Rightarrow$ number of vertical cells in the orientation descriptor.
	$dist_{ho} \Rightarrow$ distance between consecutive vertical cells.
Gist	
Position descriptor	$m_{gp} \Rightarrow$ number of Gabor filters in the position descriptor.
	$k_{gp} \Rightarrow$ horizontal cells in the position descriptor.
	$r_{gp} \Rightarrow$ resolution models in the position descriptor.
Orientation descriptor	$m_{go} \Rightarrow$ Gabor filters in the orientation descriptor.
	$k_{go} \Rightarrow$ vertical cells in the orientation descriptor
	$r_{go} \Rightarrow$ resolution models in the orientation descriptor.
	$dist_{go} \Rightarrow$ distance between consecutive vertical cells.

Table S3. Symbols used in the hierarchical incremental mapping processes

Symbol	Definition
I_q	New acquired image.
\vec{d}_q	New image's descriptor.
N^C	Set of clusters currently contained in the map.
C	Current number of clusters.
Node Level Loop Closure	
N^*	Group of nodes that meet Node Level Loop Closure condition.
N_l	Node evaluated in the Node Level Loop Closure condition.
$\vec{\mu}^{N_l}$	Mean descriptor of N_l (Equation 3).
Σ^{N_l}	Covariance matrix of N_l (Equation 3).
$\Delta_{\vec{d}_q}^{N_l}$	Mahalanobis distance between \vec{d}_q and N_l (Equation 3).
$\mu_{ns}^{N_l}$	Mean deviation of Mahalanobis distances (Equation 4).
$\sigma_{ns}^{N_l}$	Standard deviation of Mahalanobis distances (Equation 4).
x	It modifies Equation 4. The value depends on the number of clusters.
Ω	<i>Tuned parameter.</i> It limits the minimum value of x .
Image Level Loop Closure	
I_i	Image detected as the most similar one to I_q after the Image Level Loop Closure process.
N_i	Node which I_i belongs to.
I^{N^*}	All the images that are included in the nodes N^* .
\vec{d}_k	Descriptors of the images I^{N^*} evaluated in the Image Level Loop Closure process.
$dist_{eucl}^{\vec{d}_k, \vec{d}_q}$	Euclidean distance between \vec{d}_q and \vec{d}_k (Equation 5).
$sim_{\vec{d}_k, \vec{d}_q}$	Similarity between descriptors \vec{d}_q and \vec{d}_k (Equation 6).
Prominence Condition	
P_{I_i}	The prominence value of the candidate image I_i (Equation 8).
$\mu(P_{I_k^*})$	The mean prominence of the candidate images contained in N^* (Equation 8).
γ	<i>Tuned parameter.</i> It limits the minimum difference in Equation 8.
Node Merging Process	
N_o	An existing node which is evaluated in the node merging condition.
N_q	Newly created node whose distance to previous nodes is evaluated in Equation 10.
$\Delta_{N_q}^{N_o}$	Mahalanobis distance between nodes N_q and N_o (Equation 10).
μ^{N_q}	Mean descriptor of N_q (Equation 10).
μ^{N_o}	Mean descriptor of N_o (Equation 10).
$\Sigma_d^{N_o}$	Covariance matrix of N_o (Equation 10).
y	<i>Tuned parameter.</i> It restricts the node merging condition (Equation 11)

Table S4. Parameters that need to be tuned

Parameter	Definition	Values
Ω	It limits the minimum value of x .	1.7, 1.85, 2, 2.15, 2.3
γ	It limits the minimum difference in Equation 8.	Tuned experimentally $\gamma = 5$
y	It restricts the node merging condition in Equation 11.	0.75, 1, 1.25, 1.5, 1.75, 2, 2.25

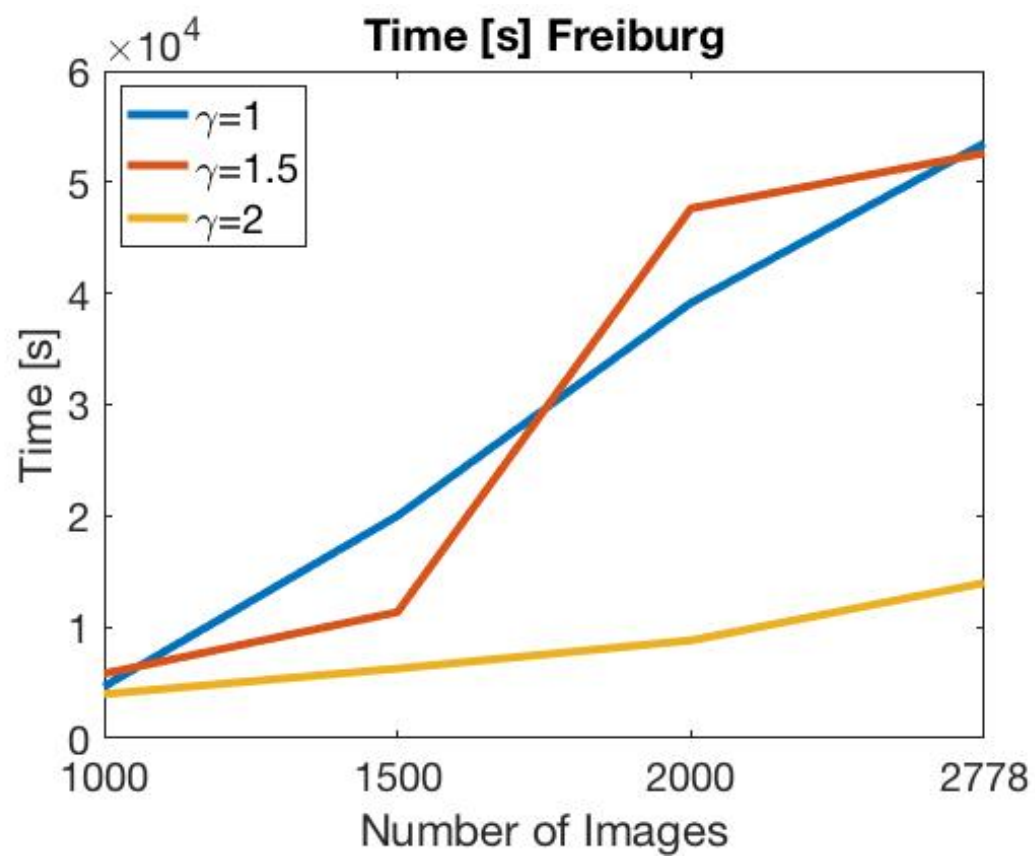


Figure S1. Time of the process [s] using HOG descriptor depending on the number of images that it contains and γ parameter.

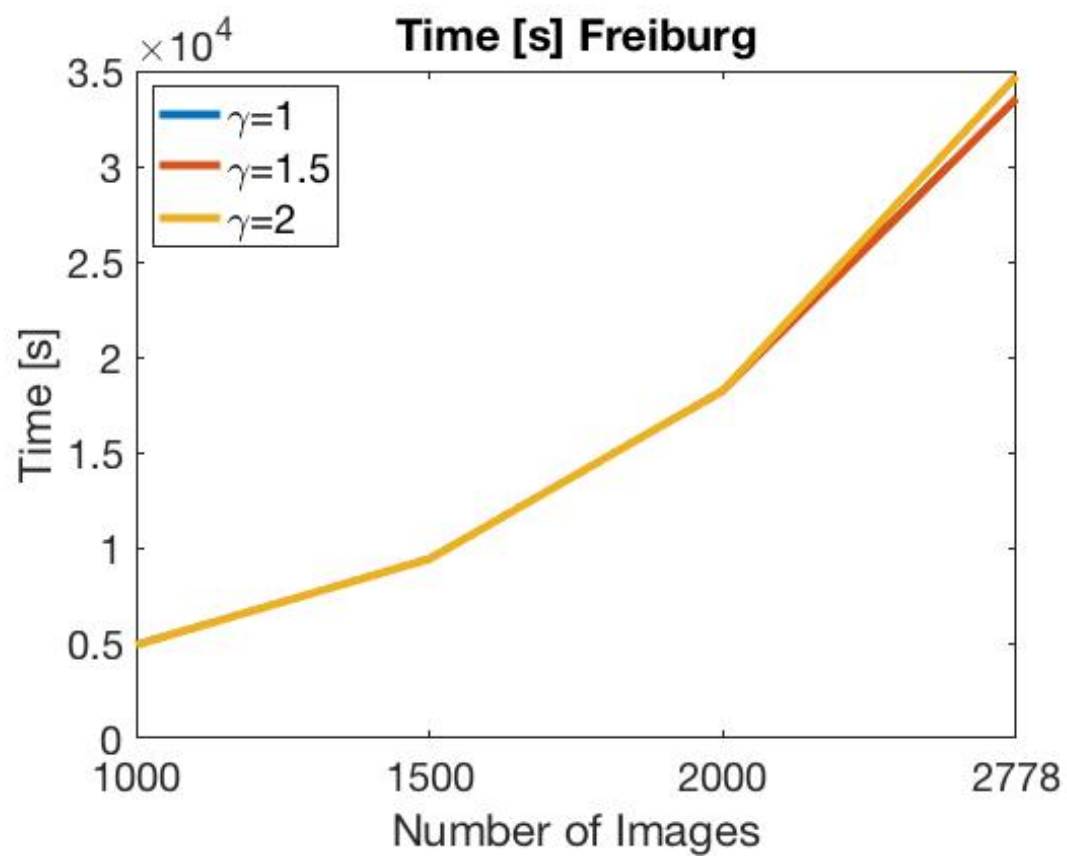


Figure S2. Time of the process [s] using gist descriptor depending on the number of images that it contains and γ parameter.

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