Use a Descriptive Title

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Version	*Date*	*Comments*
0.1	June 20, 2018	Initial writing

Abstract

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1 Definitions

Use what you need in the symbols and functions defined in Table 1, Table 2, and Table 3. Stay consistent with the lab's notation and your own symbols.

Table 1: General symbol definitions.

Symbol	*Explanation*
a	A scalar
$\boldsymbol{v}$	A vector of D dimensions, $\boldsymbol{v} = [v_1, v_2, \cdots, v_d]^T$
$\mathcal{S}$	A set of vectors with N elements in it, $\mathcal{S} = \{\boldsymbol{v}_1, \boldsymbol{v}_1, \cdots, \boldsymbol{v}_n\}$
$\boldsymbol{S}$	Matrix representation of a set $\mathcal{S}$ of size $D \times N$, $\boldsymbol{S} = [\boldsymbol{v}_1, \boldsymbol{v}_1, \cdots, \boldsymbol{v}_n]$
$\boldsymbol{a} \cdot \boldsymbol{b} = c$	Dot product of two vectors, also known as inner product
$\boldsymbol{a}^T \boldsymbol{b} = c$	Inner product of two vectors, also known as dot product
$\mathrm{f}(\cdot)$	A function, short version of function$(\cdot)$, same font as log, exp, arg min
$\lVert\boldsymbol{v}\rVert_2$	Euclidian distance or ℓ^2-distance, $\lVert\boldsymbol{v}\rVert_2 = \sqrt{\boldsymbol{v}^T\boldsymbol{v}}$

Table 2: Symbol definitions for point clouds and registration.

Symbol	*Explanation*
d	Indices used for the dimension of both the point clouds with $d = \{1, 2, \cdots, D\}$
i	Indices used for a point in the reading (moving) point cloud with $i = \{1, 2, \cdots, I\}$
$\boldsymbol{p}_i$	A point in the reading point cloud, $\boldsymbol{p} = [x, y, z]^T$ for a 3D point
$\mathcal{P}$	A set of discrete sample points representing the reading (moving) point cloud, $\mathcal{P} = \{\boldsymbol{p}_1, \boldsymbol{p}_1, \cdots, \boldsymbol{p}_i\}$
$\boldsymbol{P}$	Matrix version of $\mathcal{P}$ with a size of $D \times I$
$j, q_j, \mathcal{Q}, \boldsymbol{Q}$	Same definitions but for the reference (static) point cloud
k	Indices used when points are matched (points in $\boldsymbol{p}$ matched to $\boldsymbol{q}$) with $k = \{1, 2, \cdots, K\}$
$\boldsymbol{e}_k$	Matched error between two points, $\boldsymbol{e}_k = \boldsymbol{p}'_i - \boldsymbol{q}_j$
$\mathcal{E}, \boldsymbol{E}$	Set and its matrix version of size $D \times K$ containing all matched error
$\boldsymbol{x}$	States of the robot
$\boldsymbol{x}_k$	States of the robot at the same time as the point $\boldsymbol{p}_k$
$\boldsymbol{p}'_k$	Moved reading point cloud as $\boldsymbol{p}'_k = \mathrm{T}(\boldsymbol{x}, \boldsymbol{p})$
$\boldsymbol{R}$	Rotation matrix of size $D \times D$
$\boldsymbol{T}$	Rigid transformation matrix of size $(D+1) \times (D+1)$
$\boldsymbol{n}_{q_k}$	Normal vector representing a plane at $\boldsymbol{p}_k$
$\boldsymbol{W}_{\boldsymbol{q}_k}$	Covariance matrix of size $D \times D$ expressed in the reference frame of $\boldsymbol{q}_k$

Table 3: Function Definitions.

Function	*Explanation*
$\mathrm{T}(\boldsymbol{x}, \boldsymbol{p})$	Function transforming moving the reading point cloud
$\mathrm{T}(\boldsymbol{x}, \boldsymbol{p}_k)$	Rigid transformation with all points in the reading using the same states
$\mathrm{T}(\boldsymbol{x}_k, \boldsymbol{p}_k)$	Flexible transformation with each point moved by their own states
$\mathrm{R}(\boldsymbol{x})$	Function building a rotation matrix from the states
$\mathrm{J}(\boldsymbol{x}) = a$	Objective function also known as error function, loss function, cost function
$\mathrm{match}(\mathcal{P}, \mathcal{Q}) = \mathcal{E}$	Matching function generating a set of error vectors $\mathcal{E}$ with K elements in it

2 Your Technical Content 1

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References

[1] F. Pomerleau, F. Colas, R. Siegwart, and S. Magnenat, “Comparing ICP variants on real-world data sets,” *Autonomous Robots*, vol. 34, no. 3, pp. 133–148, 2013.

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