Albert-Ludwigs-Universität Freiburg, Institut für Informatik
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Lecture: Robot Mapping
Winter term 2013

Sheet 5

Topic: The Unscented Transform

Submission deadline: Nov. 25

Submit to: `robotmappingtutors@informatik.uni-freiburg.de`

Exercise: The Unscented Transform

Implement the Unscented Transform (using *Octave*). The implementation should consist of two parts, computing the sigma points and recovering the transformed Gaussian:

(a) Implement the function in `compute_sigma_points.m`, which samples the $2n+1$ sigma points given the mean vector and covariance matrix. You should also compute the corresponding point weights $w_m^{[i]}$ and $w_c^{[i]}$ for $i = 0, \ldots, 2n$.

(b) Implement the function in `recover_gaussian.m` to compute the mean and covariance of the resulting distribution given the transformed sigma points and their weights.

To support this task, we provide a small *Octave* framework (see course website). The above-mentioned tasks should be implemented inside the framework in the directory `octave` by completing the stubs. After implementing the missing parts, you can test your solution by running the main script. The program will produce a plot containing both the original and transformed distributions and save it in the `plots` directory.

The code provides three different functions describing transformations applied to the distribution. Test your implementation on each of them by uncommenting the corresponding parts in `transform.m`.

After completing the exercise, try other transformations by implementing them in `transform.m`. Moreover, you can change the parameters (α and κ) in `main.m` for computing λ and inspect how this affects the sampled sigma points.

Hint: To compute the square root of the covariance matrix in *Octave*, you can use the function `sqrtm`. Alternatively, you can compute the Cholesky decomposition using `chol`.