



Pose Interpolation with Dual Quaternion Series

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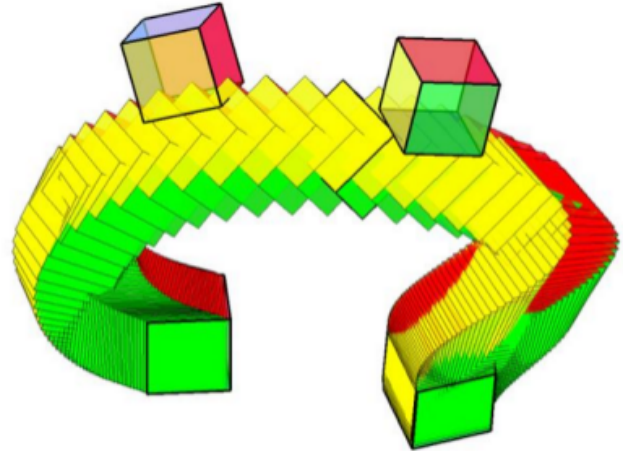
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Final Presentation
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Goal of the project

- Implement algorithm for smooth interpolation of pose (rotation and translation) using dual quaternions



Interpolation based on four measurements [1]

[1] Documentation – Kinematic toolbox, Daniel Klawitter, Technische Universität Dresden, March 29, 2010



Background and Motivation

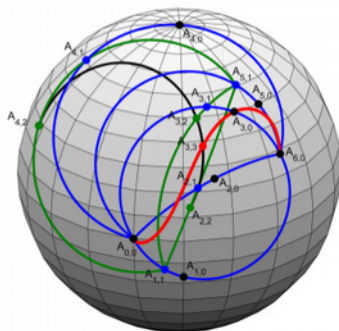
- Real-time tracking systems benefits from interpolation
 - animation
 - multi-modal sensor
- Quaternions
 - robust
 - fast
 - efficient
- Dual quaternion for rigid-body motions



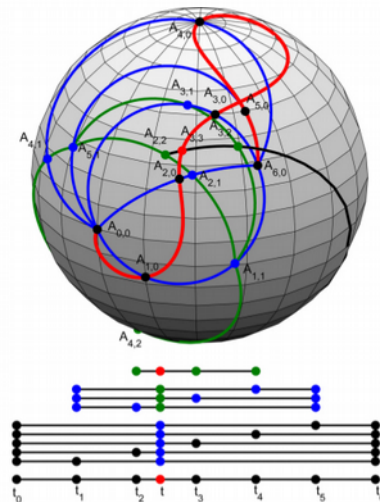
Methods and materials

- Cumulative basis [3]:
 - Bezier curve
 - Quadric Bezier curves (QB) [1]
 - Hermite curves
 - B-spline curves
- Aitken [1]

$$p(t) = \sum_{i=0}^n p_i B_i(t)$$



QB curve construction [1]



Extended Aitken algorithm [1]

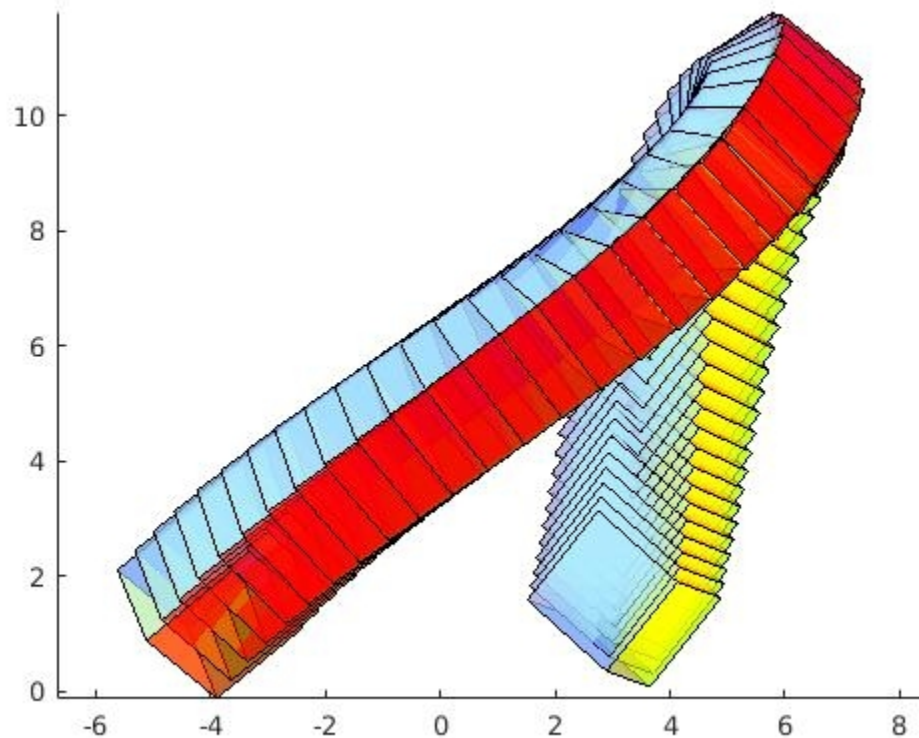
[3] A General Construction Scheme for Unit Quaternion Curves with Simple High Order Derivatives - Myoung-Jun Kim, Myung-Soo Kim, Sung Yong Shin (1995)

[1] Documentation – Kinematic toolbox, Daniel Klawitter, Technische Universität Dresden, March 29, 2010



Experiments

- Aitken interpolation:
 - 51 poses,
 - based on 3 measurements
 - 0,028 sec
- QB interpolation:
 - 51 poses,
 - based on 3 measurements
 - 0,006 sec

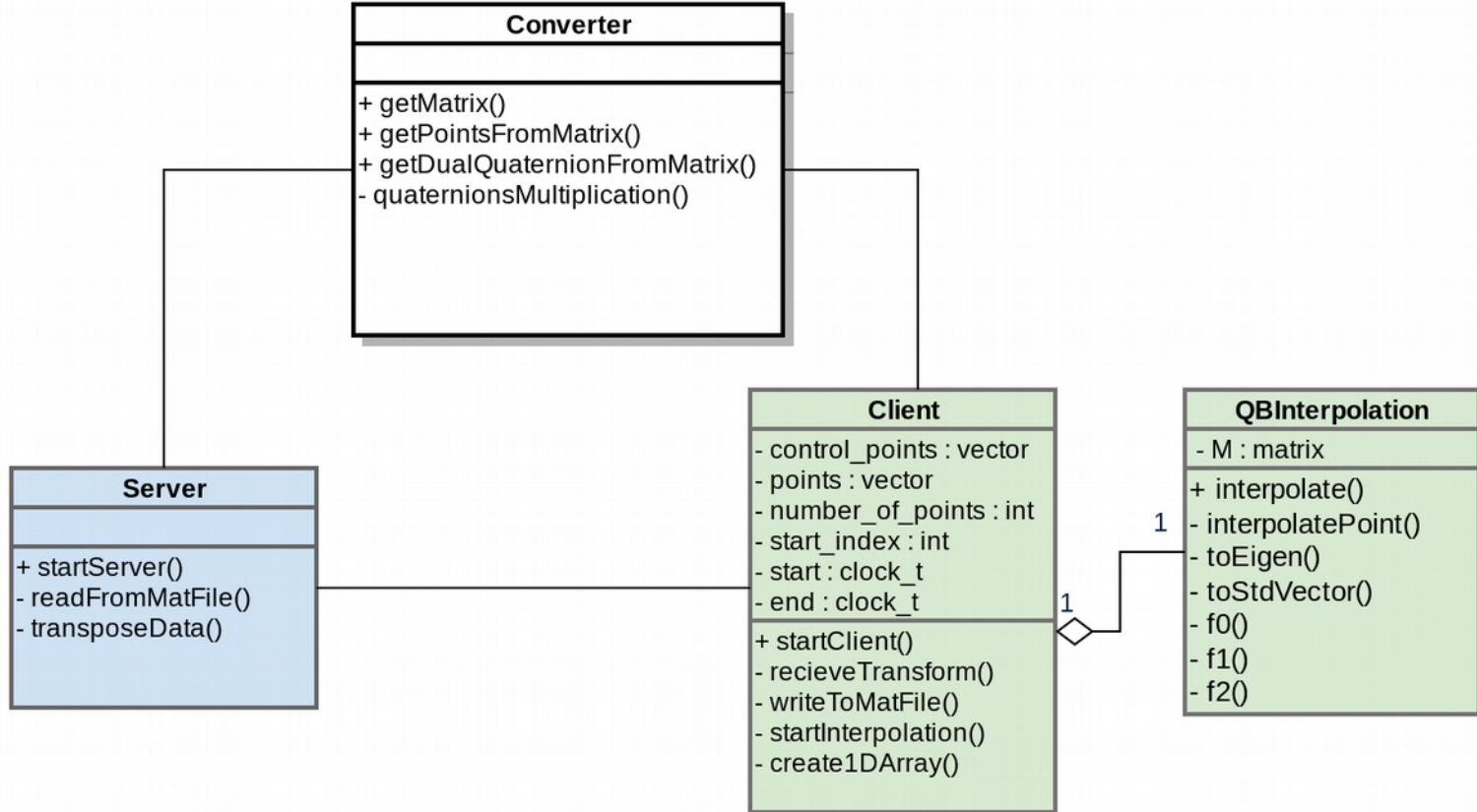


Technical outline

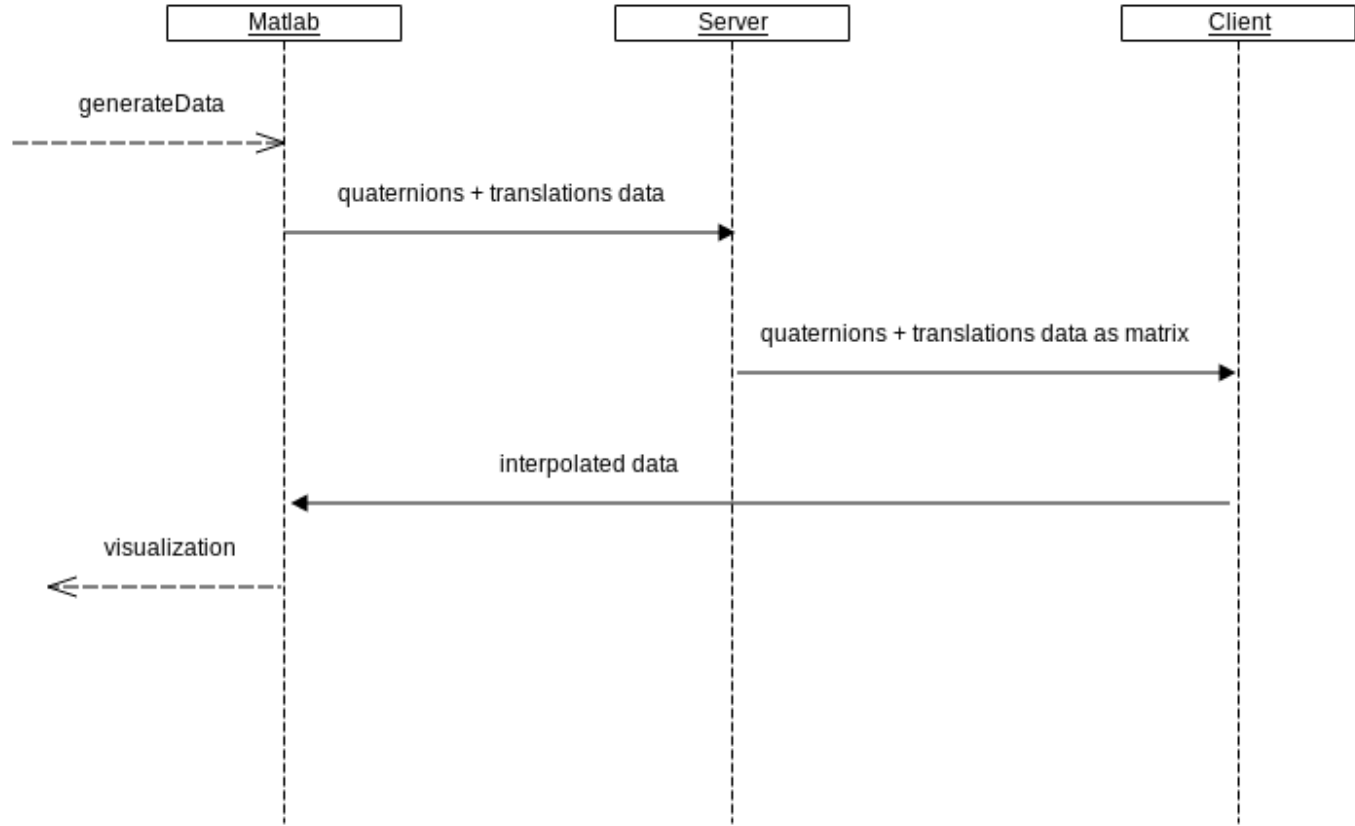
- Programming languages
 - C++
 - Matlab
- Libraries
 - OpenIGTLink
 - Matio
 - Eigen



Class diagram



Sequence diagram



Project risks and problems

- Schedule problems
 - incorrect time management
 - lack of time
- Technical problems
 - integration with matlab
 - integration of all components



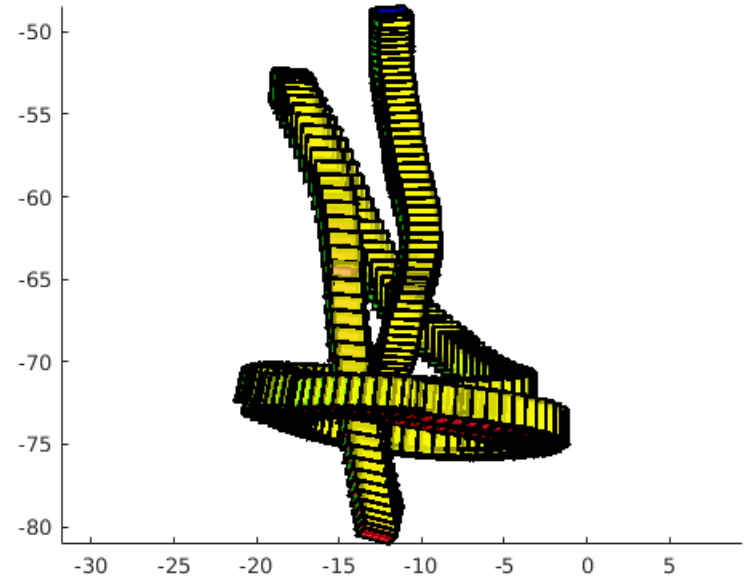
Results

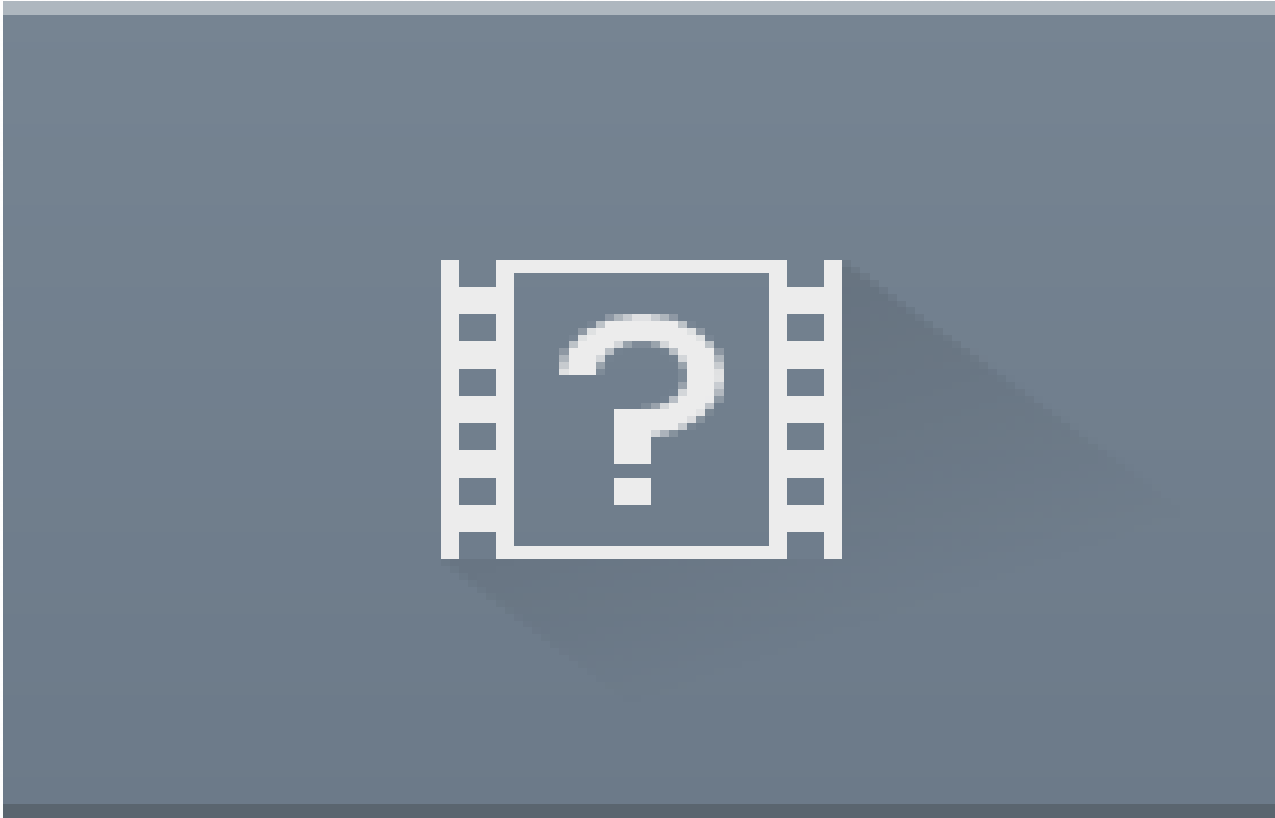
- Design a prototype
 - ✓ choose appropriate mathematical model for pose interpolation
 - ✓ implement algorithm
 - ✓ integrate with FRAMOS OTS
 - ✓ test system
- Adaptation for medical application
 - discuss with partners medical applications and choose one
 - adapt system to specific application
 - ✓ compare results before and after interpolation
- Documentation/Report



Experiments and measurements

- Data from Famos OTS (287 poses)
- Maximum tracker speed 20 Hz max (new poses every 50 ms)
- Delay from image acquisition to sending is 50 ms.
- Time measurements:
 - 0.1 ms between control points





Learning outcome

- Dual quaternions
- OpenIGTLink interface
- Client-Server architecture

