Incremental Learning applications on iCub using the GURLS++ package

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Project Goals

1. Test GURLS++ recursive RLS on arm data
2. Implement a numerically stable incremental RLS update rule (cholupdate) in the GURLS++ framework.
3. Design and develop a simple prototypical YARP module to serve as an interface with the robot
4. Run an on-line inverse dynamics learner on the real robot
Project Goals

1) Test GURLS++ recursive RLS on arm data
   – The default Sherman-Morrison update rule is numerically unstable
2) Implement a numerically stable incremental RLS update rule (Cholesky) in the GURLS++ framework.

- Developed new GURLS task classes implementing initial training and incremental update of the Cholesky factor of the covariance matrix
- Now developing a wrapper calling such functionalities
- Low-level issues, not completed yet
Goal 3: Preliminary Sketch of the Application

Robot interface module (e.g. velocity observer)

随机特征映射

随机手臂运动
Goal 3: Preliminary Sketch of the Application

Robot interface module (e.g. velocity observer)

Normalized $X_i, Y_i$

Random features mapping

$X_i', Y_i$

Batch Training set

$X_B', Y_B$

Train & test

$X_i'', Y_i$

$X_B'', Y_B$

Perf($Y_i, \hat{Y}_i$)

Random arm motion

Graph showing performance over time.
References

• Gijsberts et al., “Incremental Learning of Robot Dynamics using Random Features”, ICRA 2011