Finding Optimal Parameter Setting for MLP and Check Classification Performance

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Background

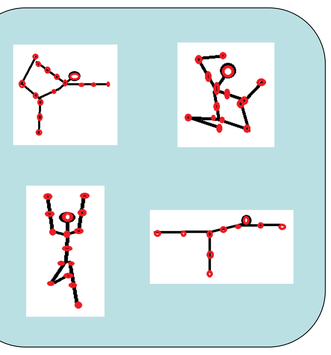
- MLP is Multilayer perceptron
- Kinect is a motion sensing input device by Microsoft for the Xbox 360 video game console
- ROS (Robot Operating System) provides libraries and tools to help software developers create robot applications
- Joint is a part of skeletal structure
- Weka is a popular suite of machine learning software written in Java
- arff is a data format to experiment for Weka

Research Questions

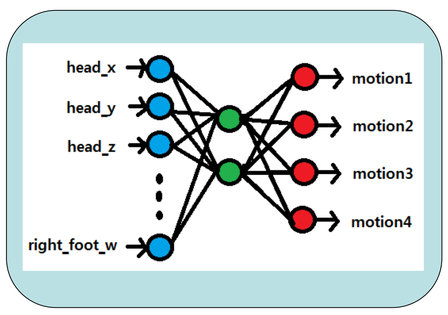
- What is optimal parameter setting for MLP?
- How is classification performance on that setting on all data sets?

Method

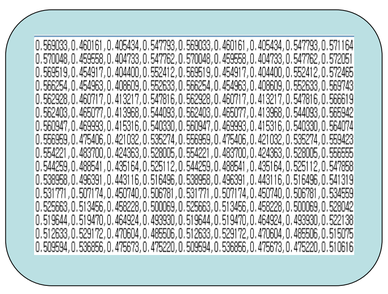
Getting Motion Data



Extracting Rotation Data per Frame



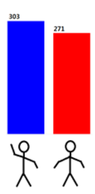
Experiment with MLP



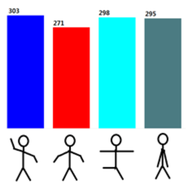
1. Define motion classes
2. Get motion data whose length is about 10 seconds with Kinect and ROS
3. Extract rotation data per frame
4. Construct data according to arff format for Weka
5. Experiment with MLP to find optimal parameter setting for Weka
6. Check the classification performance

Data

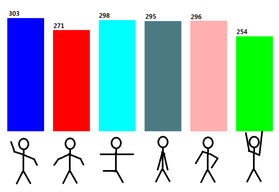
- Common Data Information
  - Joint types (head, neck, torso ,left_shoulder ,left_elbow ,left_hand ,right_shoulder, right_elbow,right_hand ,left_hip ,left_knee ,left_foot ,right_hip ,right_knee, right_foot)
  - Rotation data(x, y, z, w) represented as float data type per joint
  - 15 Joints per motion
- Data1
  - 574 motions
  - 2 motion types



- Data2
  - 1110 motions
  - 4 motion types



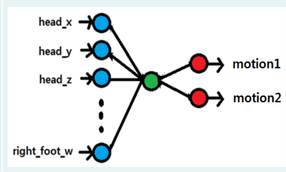
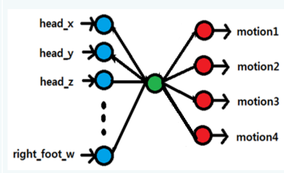
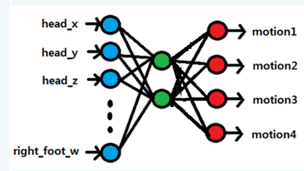
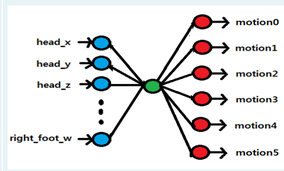
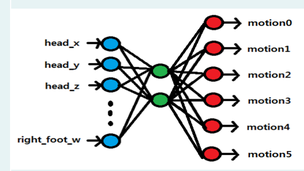
- Data3
  - 1,717 motions
  - 6 motion types



Results & Discussion

- Classification Success Rate

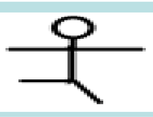
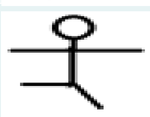
Const parameters : [learning Rate : 0.3] [momentum : 0.2] [training Time : 500]

	Hidden Layers : 1		Hidden Layers : 2	
Data1	100%		100%	
Data2	95.11 %		100%	
Data3	67.73 %		100%	

Optimal parameter setting was found. With this setting, It showed best classification performance. The data sets are classified with convex open or closed regions according to the hidden layer count. It seems to need to collect much more ambiguous motion data similar with other existing motions or make the various variation of motion when motion is recorded with Kinect camera device.

- Confusion matrix analysis (Data3)

Parameters : [hidden layers : 1] [learning Rate : 0.3] [momentum : 0.2] [training Time : 500]

						
	243 (303)	0	0	0	60	0
	0	**81 (271)**	54	0	109	27
	30	30	238 (298)	0	0	0
	0	0	0	**265 (295)**	30	0
	88	30	0	0	178 (296)	0
	0	51	0	0	50	153 (254)

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