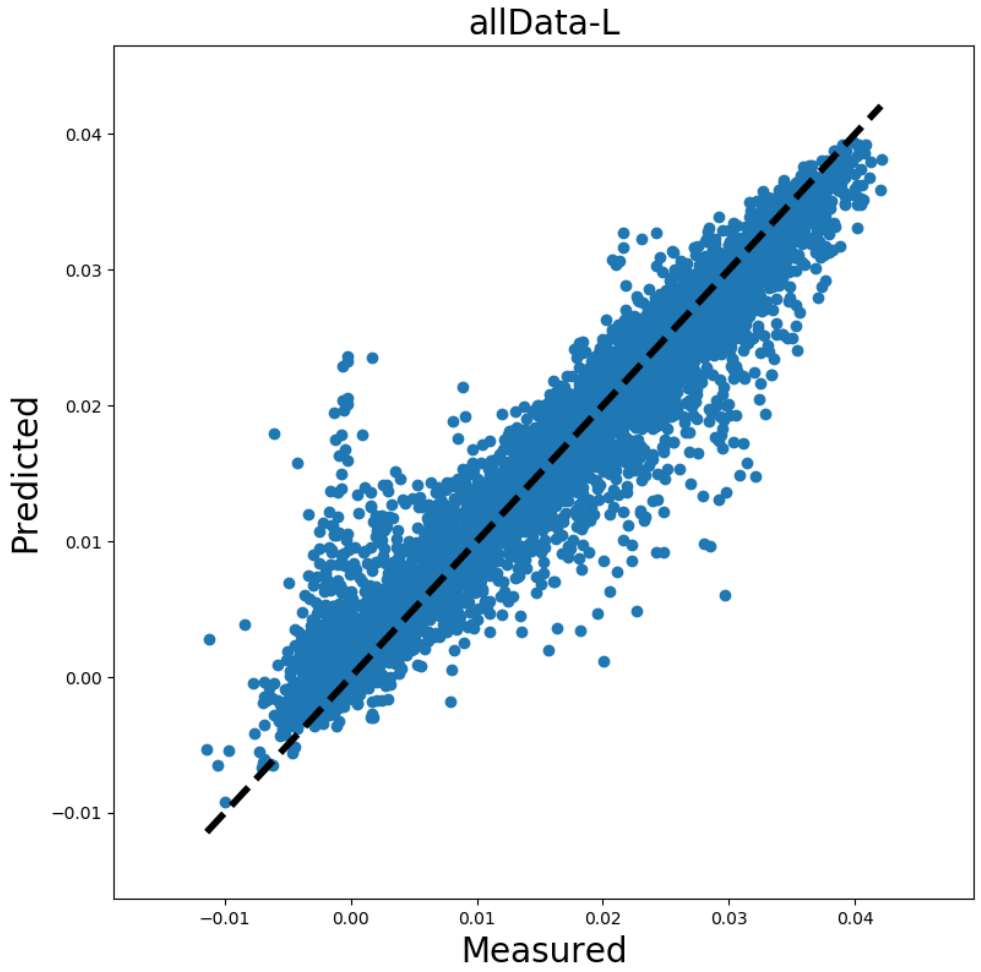
Data and features

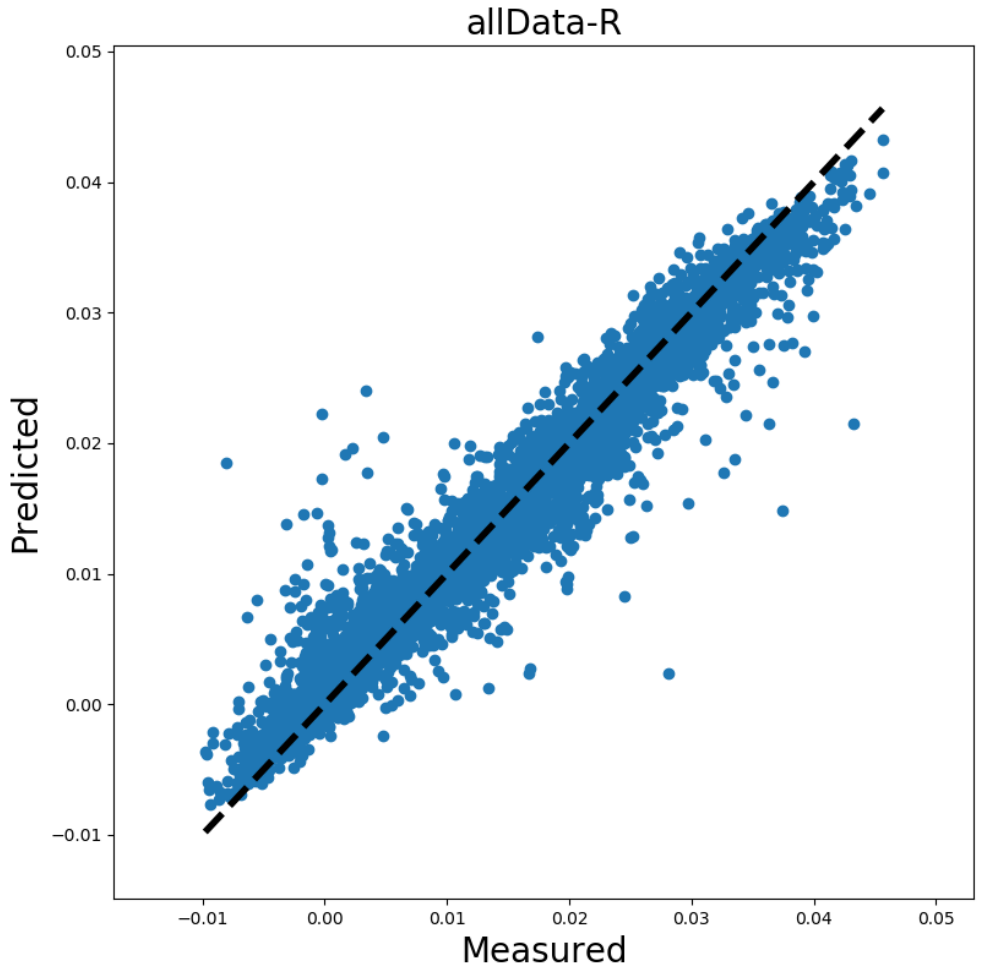
Dataset			
Dataset	**Subjects**	**Left foot**	**Right foot**
Noraxon	22	20940	20504
IoT	12	11163	12525

Features			
Features	**Abbreviation**	**Features**	**Abbreviation**
LLACx	Left lateral Accelerometer x	RLGYx	Right lateral Gyroscope x
LLACy	Left lateral Accelerometer y	RLGYy	Right lateral Gyroscope y
LLACz	Left lateral Accelerometer z	RLGYz	Right lateral Gyroscope z
LLGYx	Left lateral Gyroscope x	RMACx	Right medial Accelerometer x
LLGYy	Left lateral Gyroscope y	RMACy	Right medial Accelerometer y
LLGYz	Left lateral Gyroscope z	RMACz	Right medial Accelerometer z
LMACx	Left medial Accelerometer x	RMGYx	Right medial Gyroscope x
LMACy	Left medial Accelerometer y	RMGYy	Right medial Gyroscope y
LMACz	Left medial Accelerometer z	RMGYz	Right medial Gyroscope z
LMGYx	Left medial Gyroscope x	Lleglen	Left leg length
LMGYy	Left medial Gyroscope y	LkneeWid	Left knee width
LMGYz	Left medial Gyroscope z	Rleglen	Right leg length
RLACx	Right lateral Accelerometer x	LankleWid	Left ankle width
RLACy	Right lateral Accelerometer y	RkneeWid	Right knee width
RLACz	Right lateral Accelerometer z	RankleWid	Right ankle width
age	age	gender	gender
mass	mass	height	height

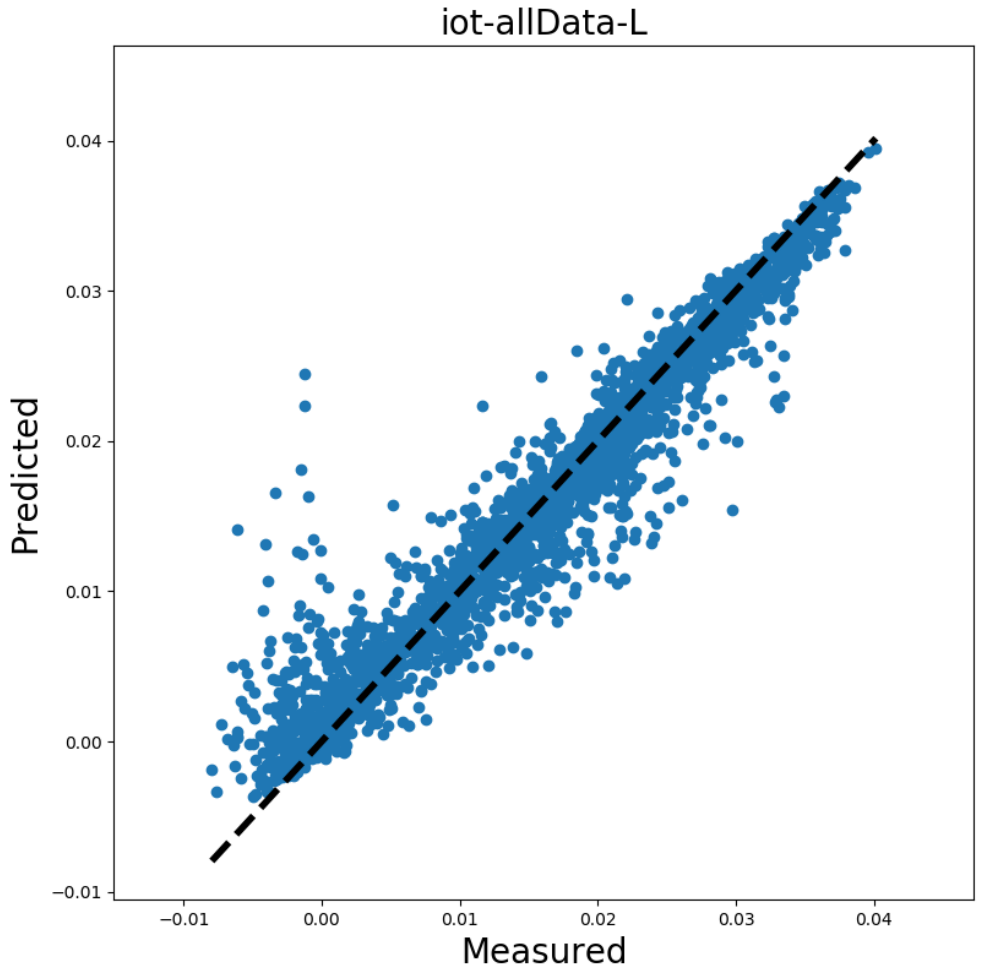
Random forest training
Training data: 70%
Testing data: 30%



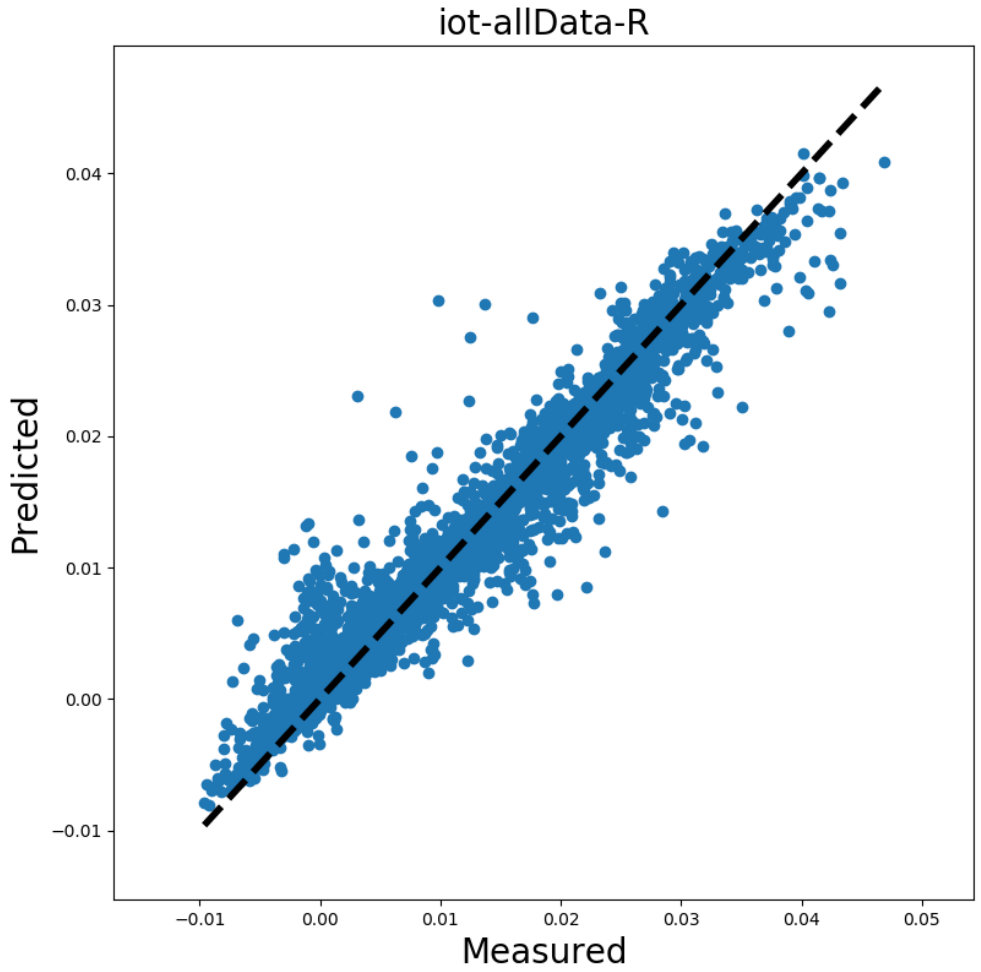
Noraxon left foot model



Noraxon right foot model



IoT left foot model



IoT right foot model

Model evaluation

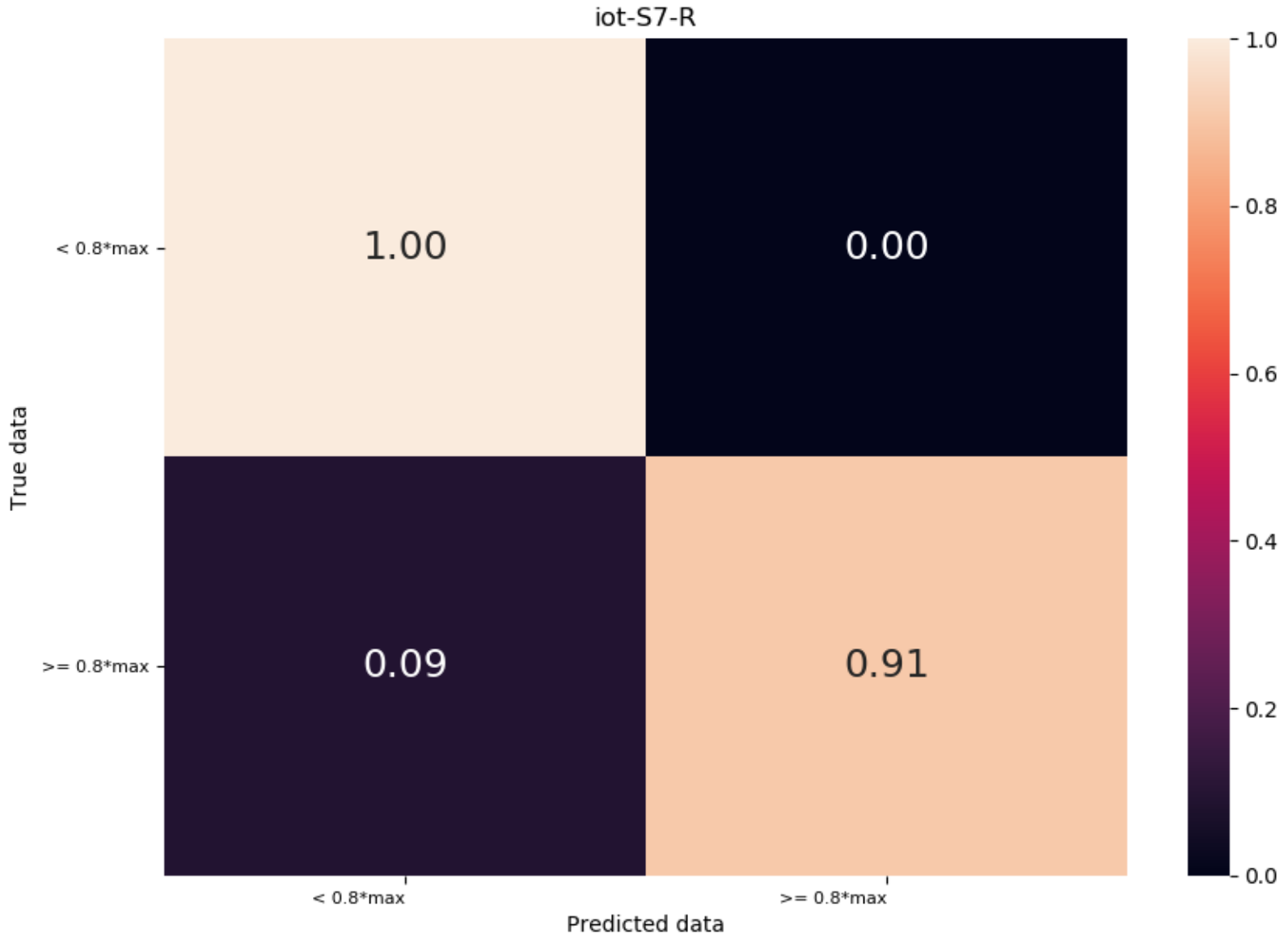
R2 = 1 indicates that the fitted model explains all variability in response variable.

R2 = 0 indicates no linear relationship between the response variable and predicted values.

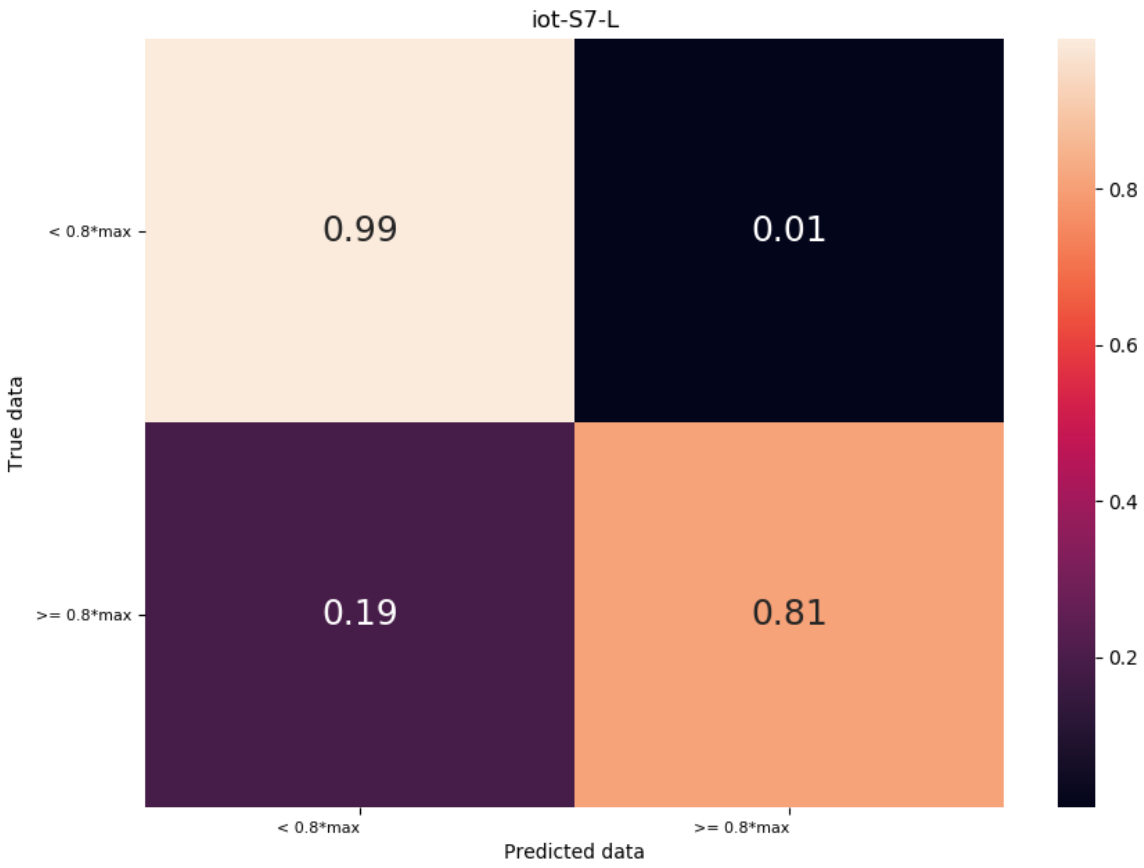
Model evaluation			
Dataset	**Model**	**R2**	**RMSE**
Noraxon	LASSO-left KAM	0.5186	0.007696
	LASSO -right KAM	0.3987	0.008625
	Random forest-left KAM	0.9349	0.002851
	Random forest-right KAM	0.9296	0.002956
IoT	LASSO -left KAM	0.4745	0.007616
	LASSO -right KAM	0.2355	0.009253
	Random forest-left KAM	0.9386	0.002628
	Random forest-right KAM	0.9385	0.002624

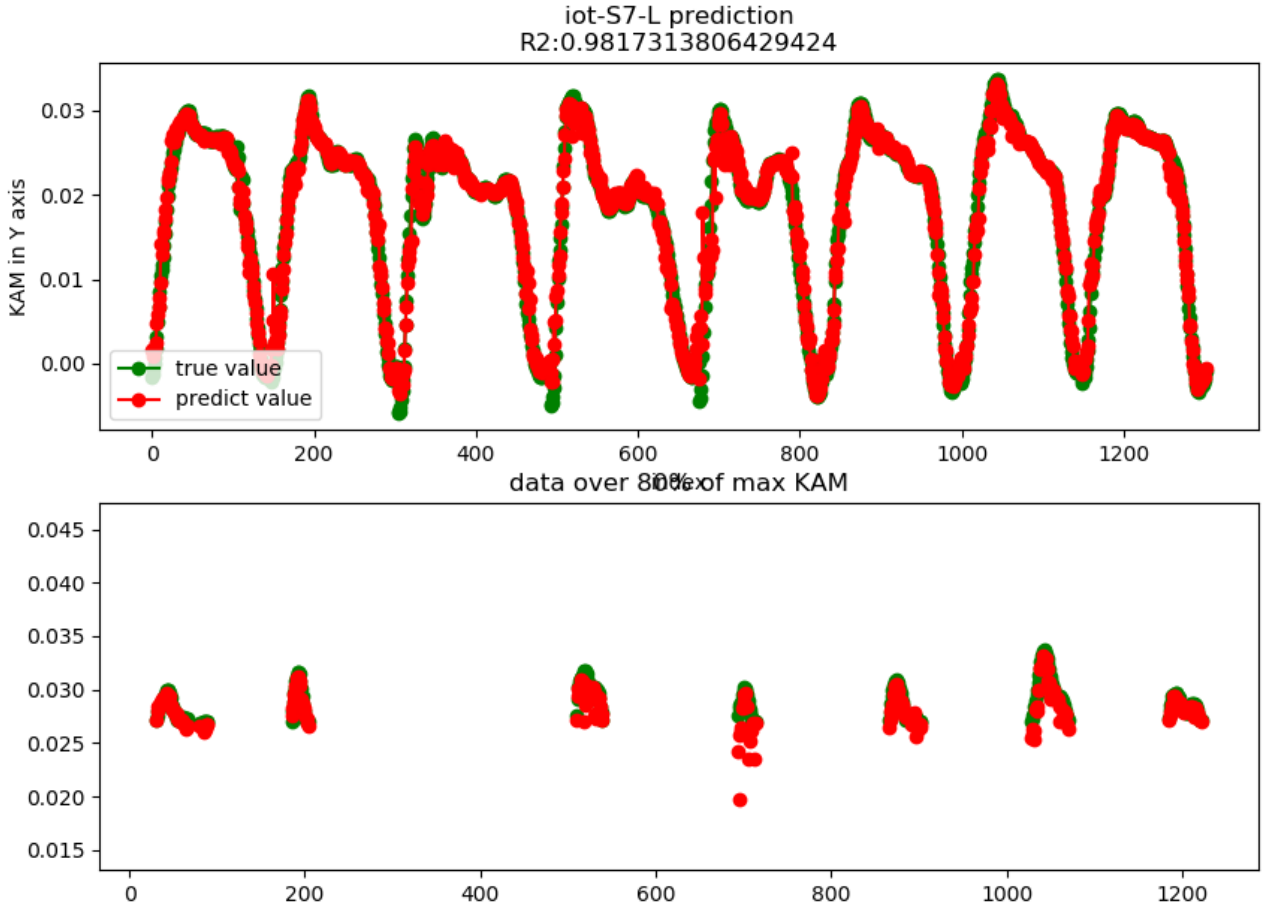
Confusion matrix

Threshold = 80% * max KAM	
KAM>= Threshold	TRUE
KAM< Threshold	FALSE

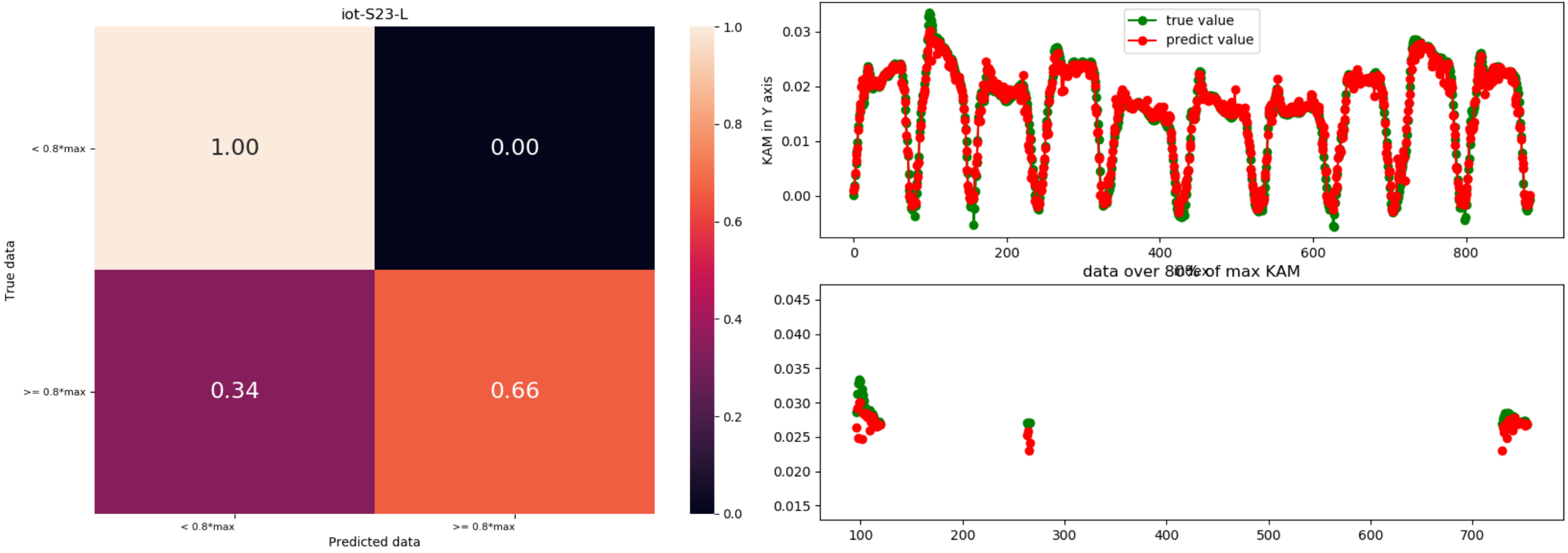


IoT-subject7-left foot

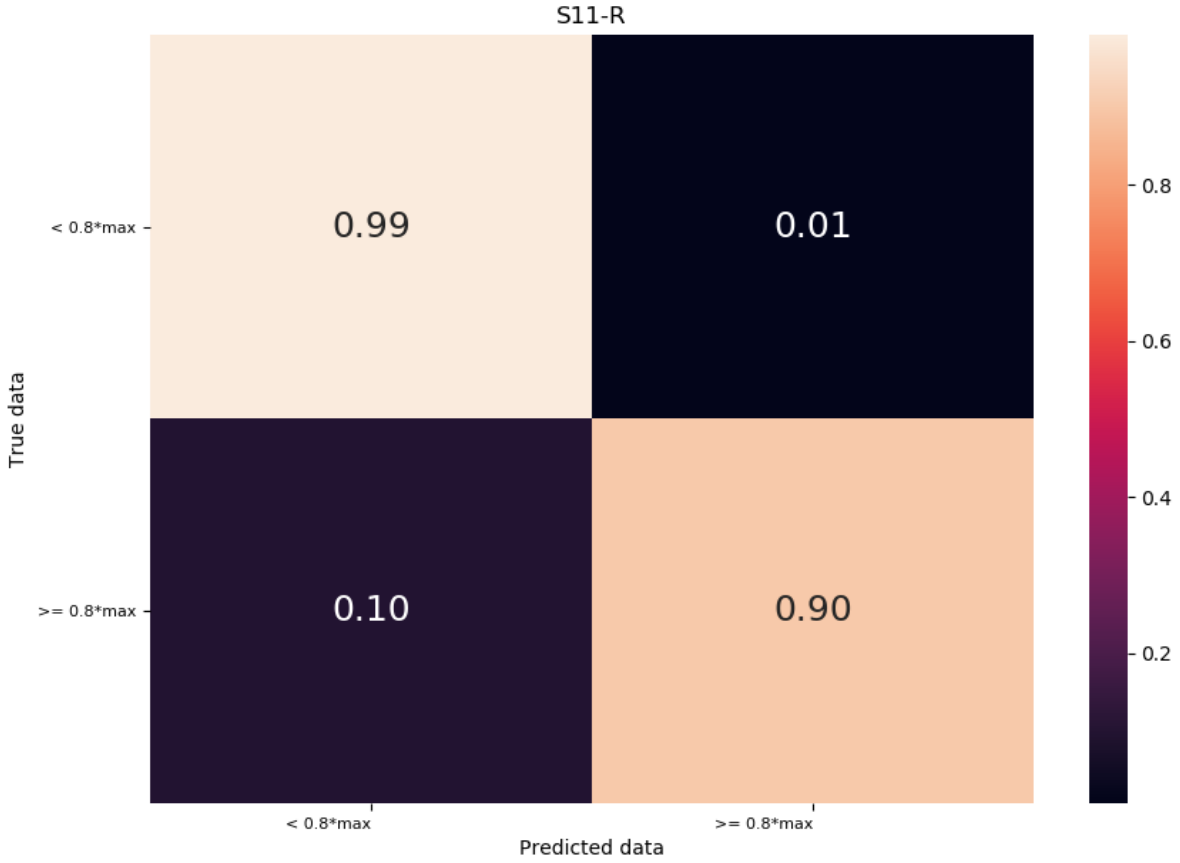


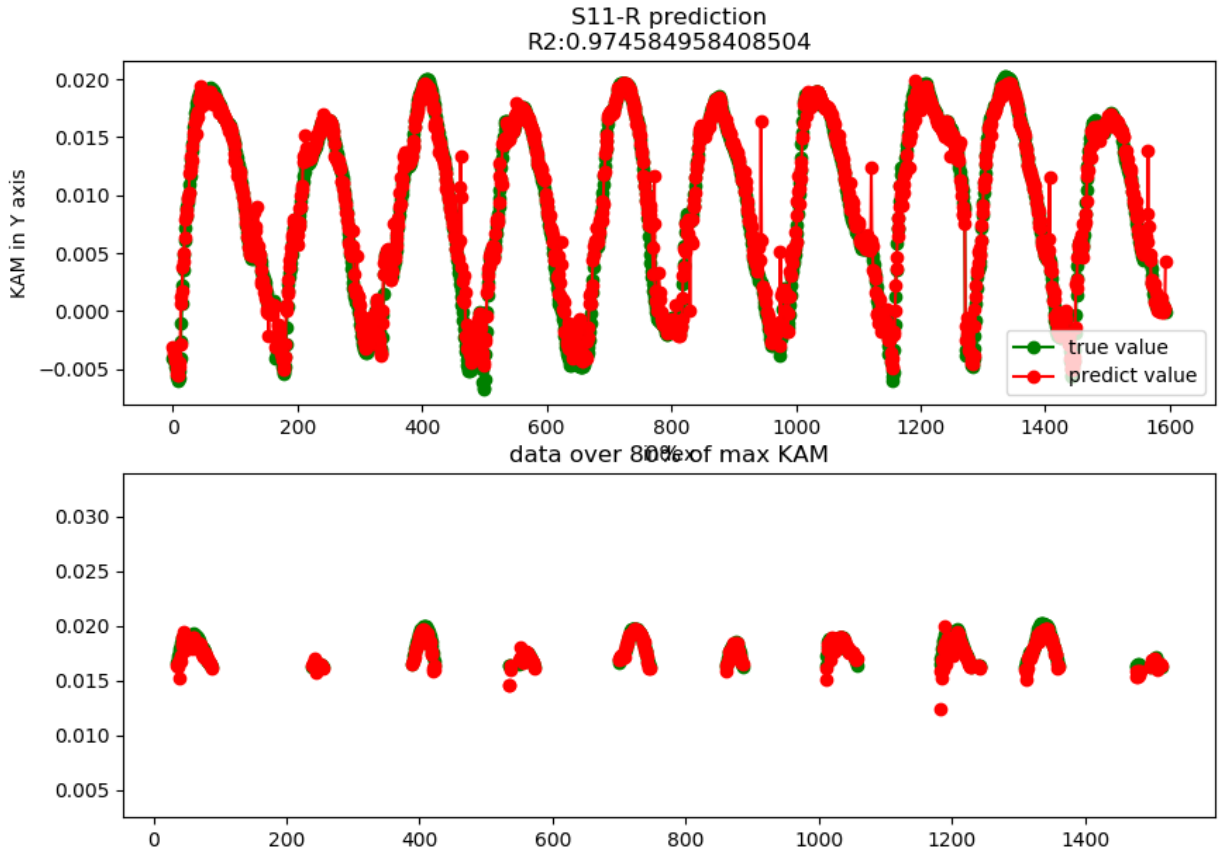


IoT-subject23-left foot



Noraxon-subject11-right foot





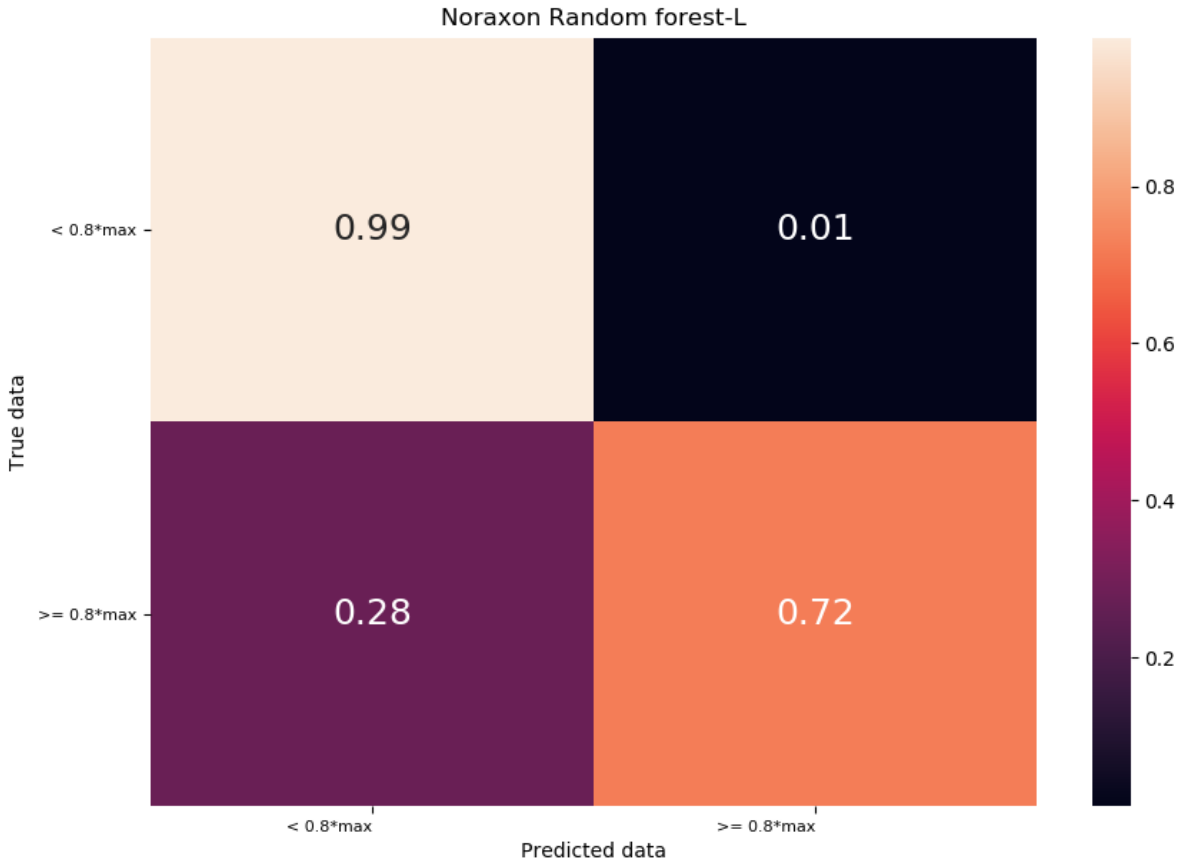
Overall confusion matrix

TP	true positive
TN	true negative
FP	false positive
FN	false negative

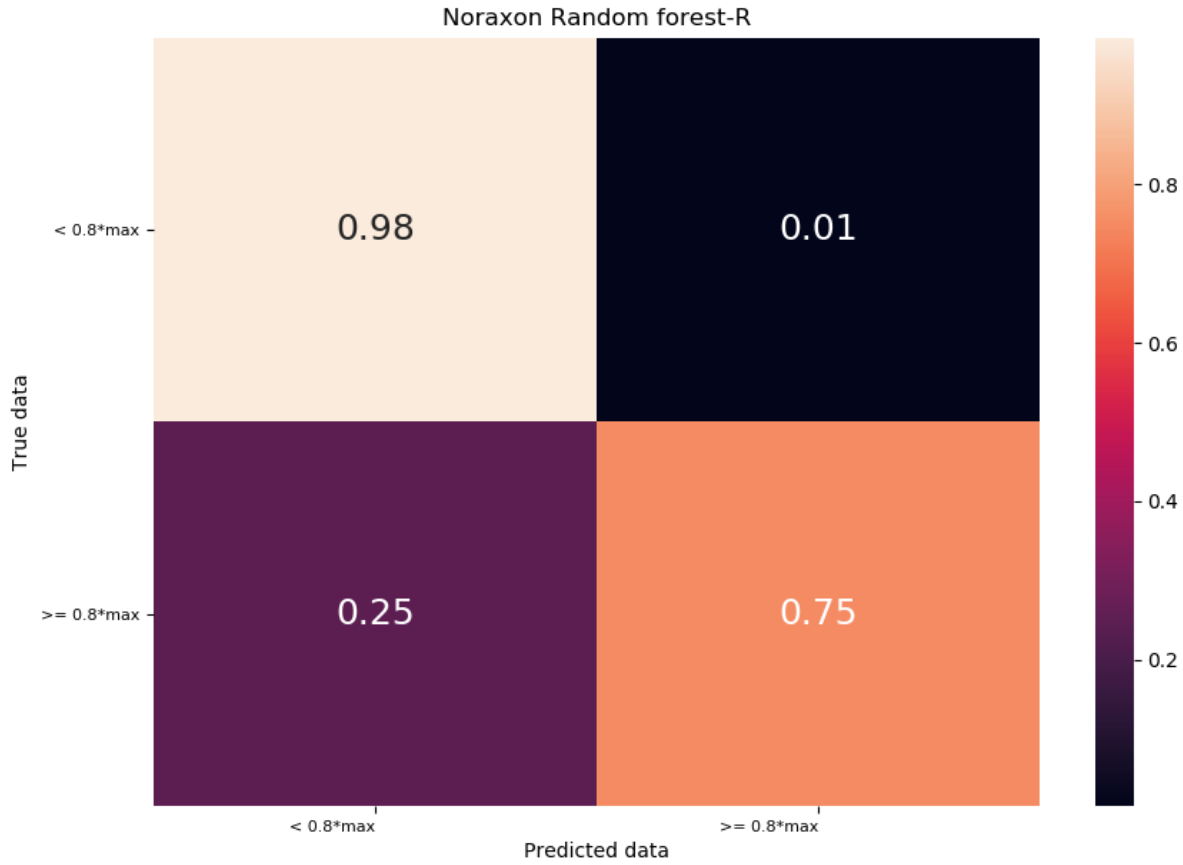
- Mean of some parameters

Confusion matrix result								
Model	**R2**	**RMSE**	**Mean KAM**	**RMSE/mean**	**TP**	**TN**	**FP**	**FN**
Noraxon Random forest-L	0.9589	0.001876	0.01684	0.1201	0.7235	0.9888	0.01113	0.2765
Noraxon Random forest-R	0.9634	0.001831	0.01809	0.1037	0.7524	0.985	0.01497	0.2475
IoT Random forest-L	0.9664	0.00165	0.01658	0.1021	0.8183	0.994	0.005958	0.1816
IoT Random forest-R	0.9556	0.001781	0.0148	0.123	0.7429	0.9936	0.006364	0.257

Overall confusion matrix

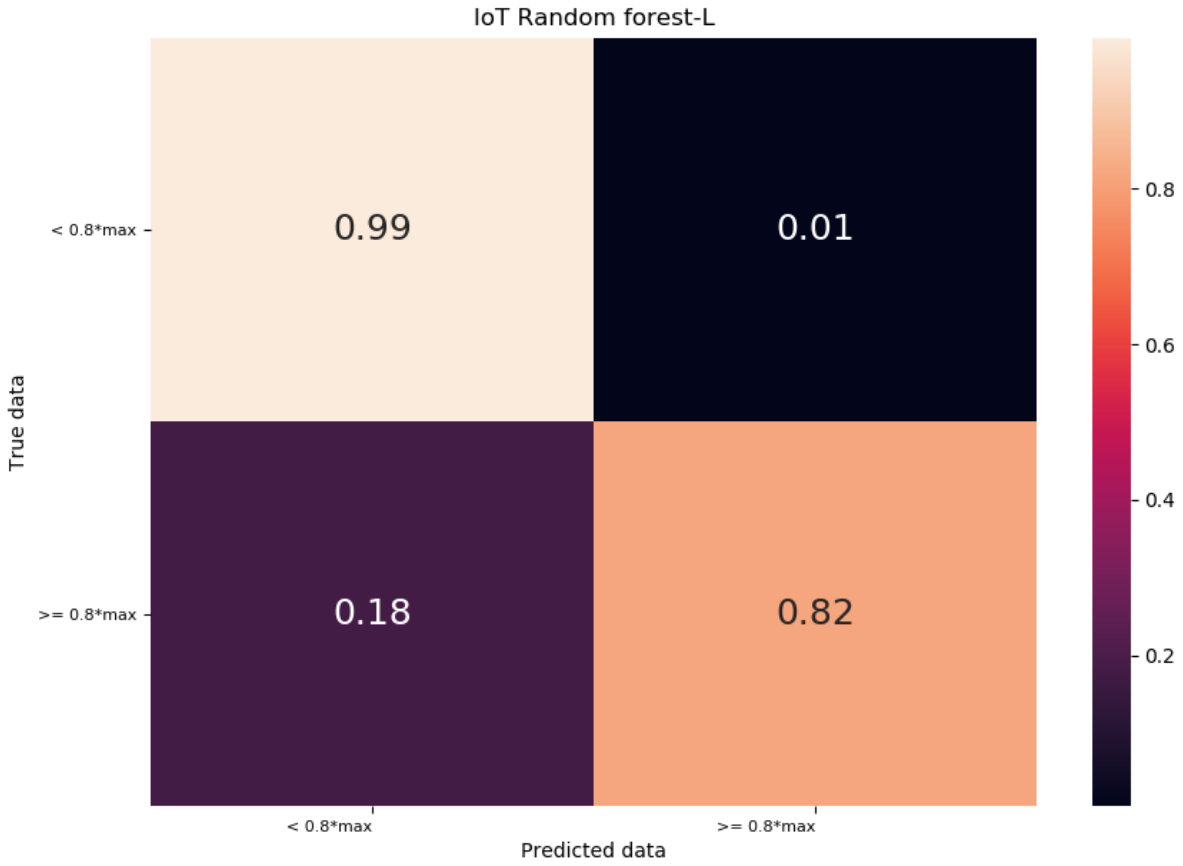


Overall Noraxon RF-L

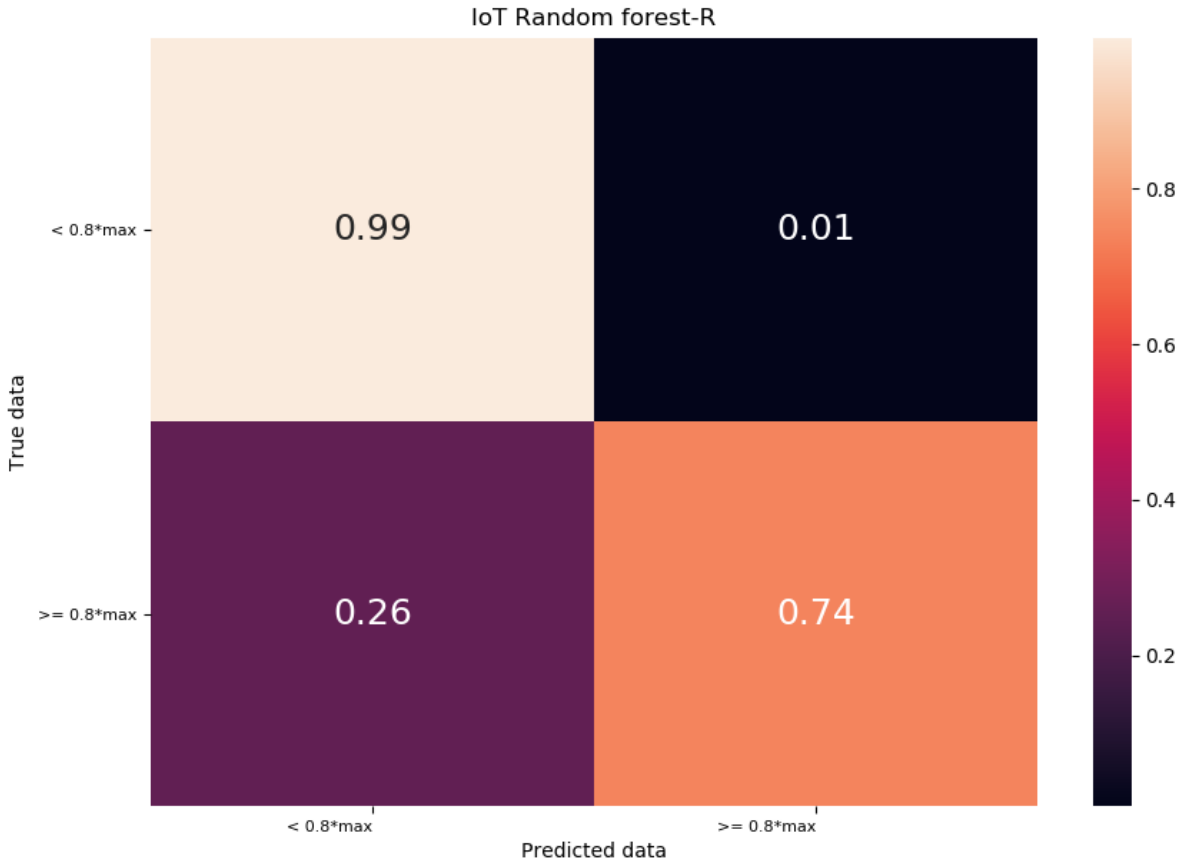


Overall Noraxon RF-R

Overall confusion matrix



Overall IoT RF-L

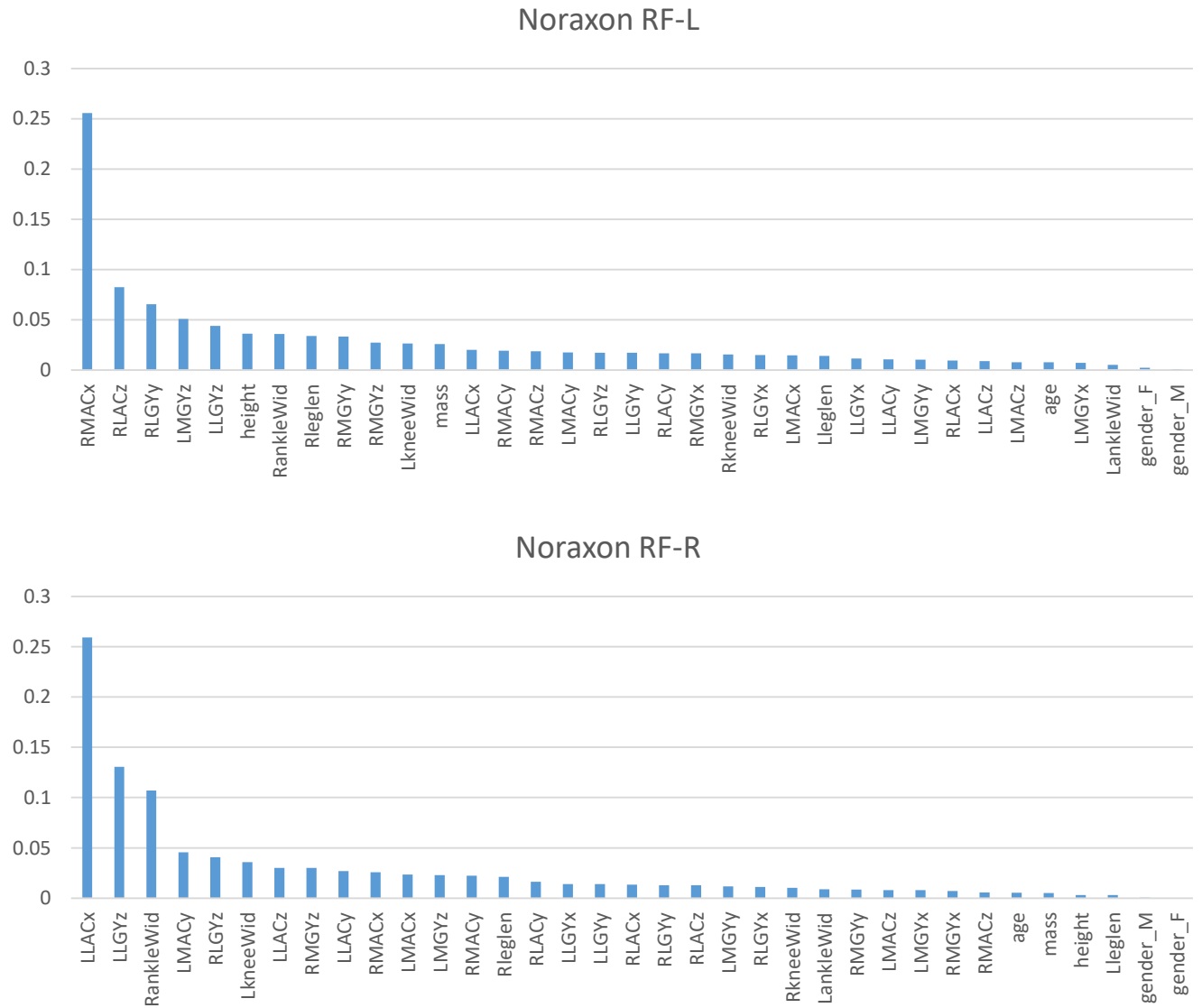


Overall IoT RF-R

Feature importance

Noraxon data random forest model			
Left foot coefficient		Right foot coefficient	
RMACx	0.2555	LLACx	0.2594
RLACz	0.0824	LLGYz	0.1306
RLGYy	0.0656	RankleWid	0.1071
LMGYz	0.0509	LMACy	0.0457
LLGYz	0.0441	RLGYz	0.0407

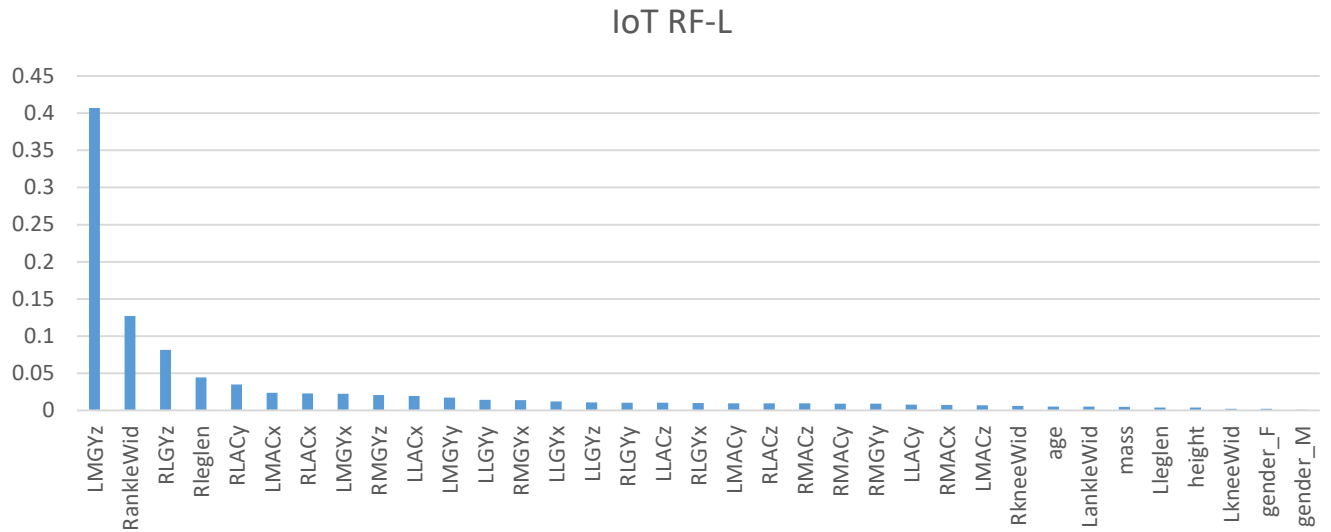
Noraxon RF top5 features

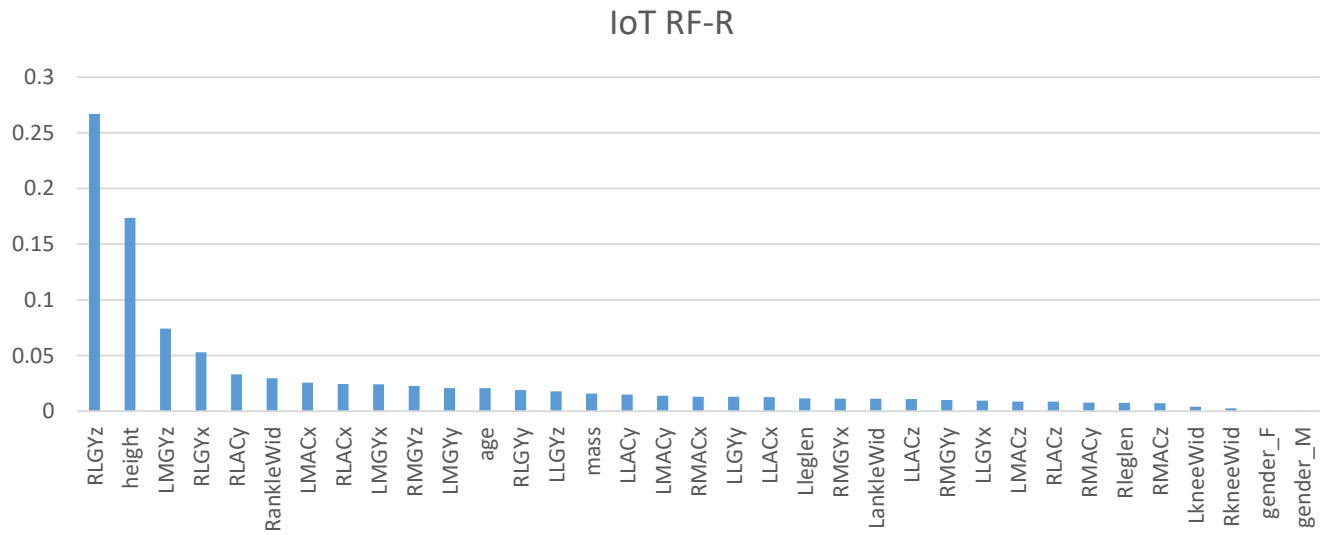


Feature importance

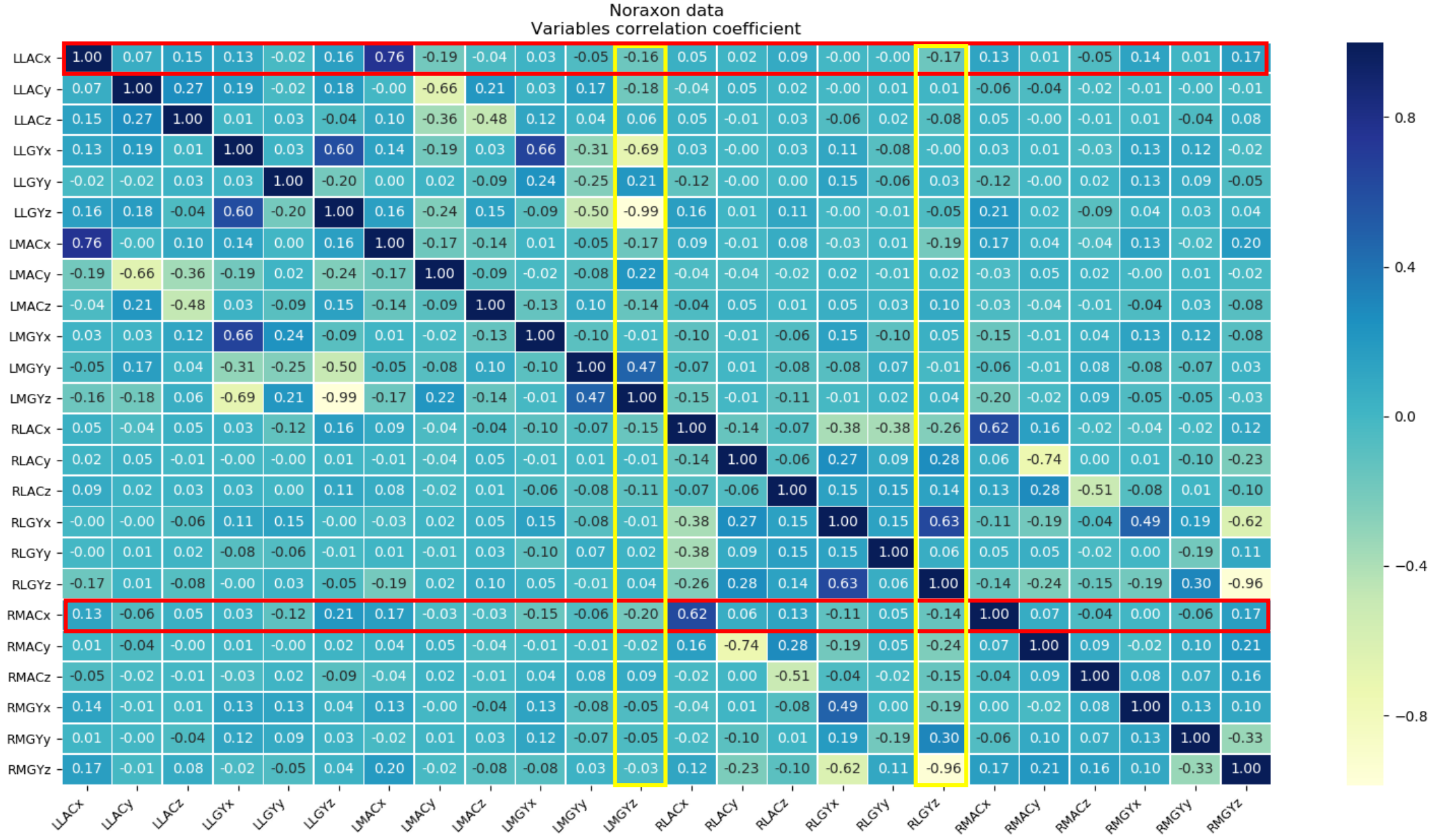
IoT data random forest model			
Left foot coefficient		Right foot coefficient	
LMGYz	0.4069	RLGYz	0.26682
RankleWid	0.1269	height	0.17367
RLGYz	0.0813	LMGYz	0.07429
Rleglen	0.0443	RLGYx	0.05295
RLACy	0.0347	RLACy	0.03311

IoT RF top5 features

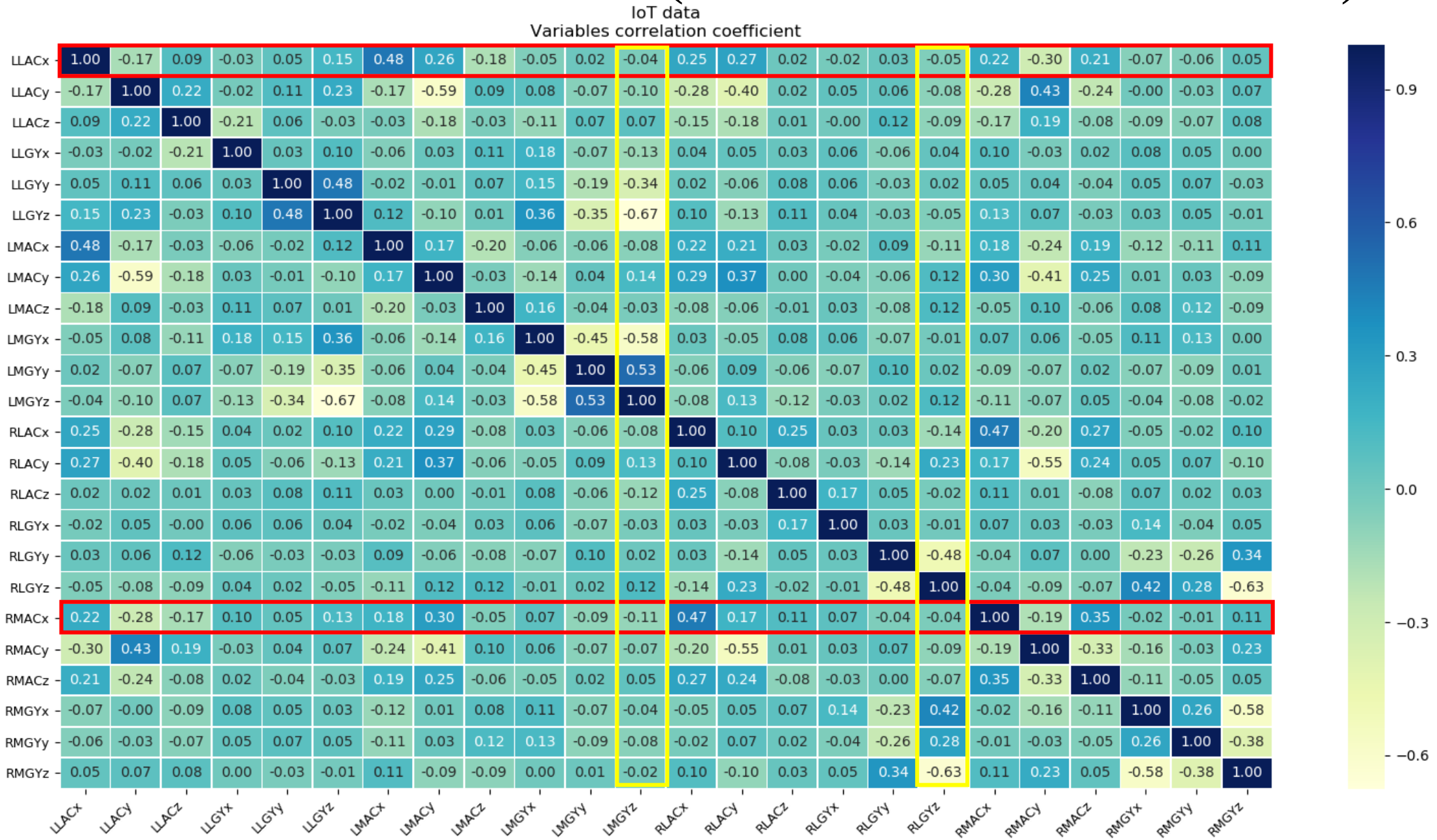




Noraxon Variables correlation coefficient



IoT Variables correlation coefficient (axis consistent with Noraxon axis)



Single sensor model

All 4 sensors' model has approximately 9% improvement of R2 coefficient

Single sensor model			
Dataset	**Model**	**R2**	**RMSE**
IoT-Left	RF-LL KAM	0.8408	0.004165
	RF-LM KAM	0.8641	0.003822
	RF-RM KAM	0.8111	0.004613
	RF-RL KAM	0.8415	0.004102
IoT-Right	RF-LL KAM	0.8312	0.004278
	RF-LM KAM	0.8526	0.004055
	RF-RM KAM	0.8159	0.004583
	RF-RL KAM	0.8566	0.003994

Multiple sensors model			
Dataset	**Model**	**R2**	**RMSE**
Noraxon	RF-left KAM	0.9349	0.002851
	RF-right KAM	0.9296	0.002956
IoT	RF-left KAM	0.9386	0.002628
	RF-right KAM	0.9385	0.002624