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Predicting Human Activity Sensor Data using an Auto Neural Model with Stepwise Logistic Regression Inputs

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Sudarshan Vennelakanti

ABSTRACT

Due to advances in medical care and rise in living standards, life expectancy on an average increased to 79 years in US. This resulted in increase of aging population and increase in demand for development of technologies to aid elderly people to live independently and safely. This demand can be addressed through Ambient-Assisted Living (AAL) technologies. Much research has been done on Human Activity Recognition (HAR) in the last decade and it is expected that HAR to be future technology for e-health systems.

E-Health systems such as AAL can be developed using patients' routine data collected from wearable sensors. The most common methods used to recognize human activity are image processing and usage of wearable sensors. Image processing requires installation of cameras and good light. In addition, its operations are restricted to indoor environments. The use of wearable sensors has addressed all these problems, but requires wearing of equipment by the user for long durations.

DATA DESCRIPTION

Variables in the dataset represent metrics of accelerometers mounted on waist, left thigh, right arm and right ankle of four individuals performing five different activities recorded over a period of eight hours. The target variable predicts human activity such as sitting, sitting down, standing, standing up and walking. 60% of the data is used to train the model and 40% to validate the model.

AUTO NEURAL MODEL

- Various models such as Decision Trees, Neural Network and Auto Neural were built in SAS® Enterprise Miner™ 14.1. Of which Auto Neural proved to be the best model with accuracy of 98.73% and sensitivity of 98.42%.
- Stepwise Logistic Regression is built initially and is given as input to Auto Neural to increase model performance.
- Auto Neural model is built using a single hidden layer, low tolerance value, and logistic activation function. Logistic function was used, as it is better than other functions at predicting qualitative variables.

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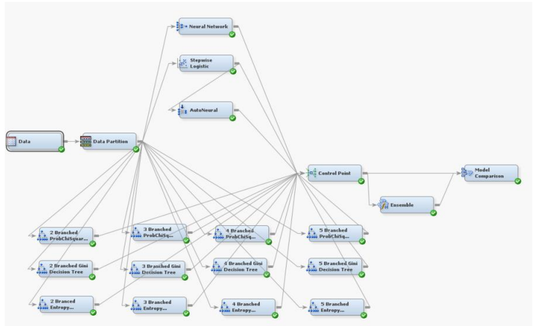
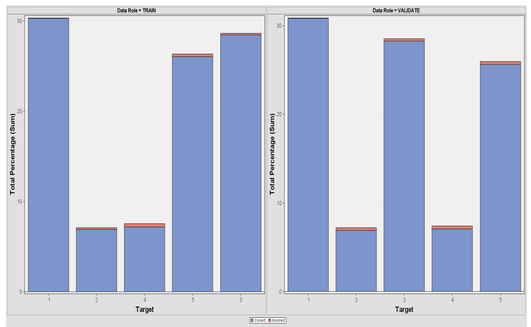
RESULTS



Selected Model	Model Description	Selection Criterion: Valid: Misclassification Rate	Train: Misclassification Rate
Y	AutoNeural	0.012648	0.011431
	Ensemble	0.018248	0.015818
	5 Branched Entropy Decision Tree	0.026127	0.020054
	5 Branched Gini Decision Tree	0.027576	0.021071
	5 Branched ProbChiSq Decision Tree	0.029025	0.022731
	4 Branched Gini Decision Tree	0.029946	0.025075
	4 Branched Entropy Decision Tree	0.030278	0.025941
	4 Branched ProbChiSq Decision Tree	0.032632	0.030097
	3 Branched Gini Decision Tree	0.049869	0.047575
	3 Branched Entropy Decision Tree	0.051032	0.048853
	3 Branched ProbChiSq Decision Tree	0.071514	0.070256
	Neural Network	0.089717	0.091729
	2 Branched Gini Decision Tree	0.123255	0.124079
	2 Branced Entropy Decision Tree	0.135541	0.134544
	2 Branched ProbChiSquare Decision Tree	0.159661	0.159026
	Stepwise Logistic	0.167328	0.169752



Fit Statistics	Statistics Label ▲	Train	Validation
AIC	Akaike's Information Criterion	9019.51	.
AVERR	Average Error Function	0.016123	0.018621
ASE	Average Squared Error	0.003684	0.004034
DFE	Degrees of Freedom for Error	397016	.
DIV	Divisor for ASE	496900	331265
ERR	Error Function	8011.51	6168.346
FPE	Final Prediction Error	0.003693	.
MAX	Maximum Absolute Error	1	1
MSE	Mean Squared Error	0.003689	0.004034
MISC	Misclassification Rate	0.011431	0.012648
DFM	Model Degrees of Freedom	504	.
_NW_	Number of Estimated Weights	504	.
WRONG	Number of Wrong Classifications	1136	838
RASE	Root Average Squared Error	0.060697	0.063512
RFPE	Root Final Prediction Error	0.060774	.
RMSE	Root Mean Squared Error	0.060736	0.063512
SBC	Schwarz's Bayesian Criterion	14509.58	.
SUMW	Sum of Case Weights Times Freq	496900	331265
NOBS	Sum of Frequencies	99380	66253
SSE	Sum of Squared Errors	1830.645	1336.251
DFT	Total Degrees of Freedom	397520	.

CONCLUSIONS

- Human Activity Recognition has a very wide applications ranging from security-related applications and logistics support to location-based services.
- Predicting HAR sensor data accurately can help in the development of AAL technologies that help elderly people to live more independently and safely.
- In this paper, we designed different models to predict human activity recognition. Of which, Auto Neural whose input taken from Stepwise Logistic Regression proved to be the best model.

REFERENCES

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