Mobility Prediction Optimization of Mobile Hosts in Smart Antennas Systems using Adaptive Neuro-Fuzzy Inference System.(2017)

Nicholas Nkamwesiga[1], Dominic **B. O. Konditi*[2]** and Heywood A. Ouma[3]

[1]*Pan African University*
*[2]Department of Electrical and Communication Engineering. Technical University of Kenya
[3]University of Nairobi

Abstract Owing to the growing demand for wireless communication, the communication network should have better coverage, improved capacity, and higher transmission quality, which contribute to better Quality of Service. The use of smart antenna systems (SASs) is one of the promising technologies in achieving this demand. The SASs achieve this by dynamically radiating shaped signal beams to the mobile terminals in response to received signals. This has the effect of enhancing the performance characteristics such as capacity and hand-over in wireless systems. By using machine learning methods, it is possible to predict upcoming changes in the mobile terminal location at an early stage and then carry out beam forming optimization to alleviate the reduction in network performance. Prediction of Received Signal Strength (RSS) in wireless networks offers a strong base for mobility prediction and localization with minimal effort. The need for mobility prediction is significant and calls for the use of artificial intelligence approaches to make precise and efficient predictions. This paper presents the use of Grey model (GM) which is associated with benefits of reduced overheads in wireless cellular networks and Adaptive Neuro-Fuzzy Inference System (ANFIS) in improving mobility prediction. In this methodology, the ANFIS uses both measured data and the theoretical data used by Log-Normal Shadowing Model (LNSM) to achieve a better estimation of mobility. Mobility is based on the RSS at the mobile node (MN) as it moves towards or away from the transmitting antenna. The approach also takes into account the factors that contribute to the RSS including; path loss exponent, path loss at reference distance and distance of the MN from the transmitter. The results show that ANFIS achieves prediction with a mean absolute error (MAE); between 0.083 m and 0.690 m for short distances (1 m - 65 m), and between 0.322 m and 3.877 m for long distance (100 m - 1800 m). The results were compared against those from other models including the LNSM, GM and generic weighted GM which were found to achieve prediction with larger MAE than ANFIS.

Keywords Adaptive Neuro-Fuzzy Inference System, Grey Prediction Model, Mobility Prediction, Path Loss, Received Signal Strength.
Journal of Sustainable Research in Engineering Vol. 3 (3) 63-73.(2017)
See more at: http://sri.jkuat.ac.ke/ojs/index.php/sri/article/view/511