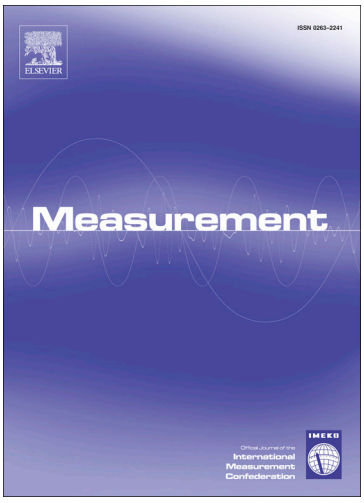

Classification prediction analysis of RSSI parameter in hard switching process for FSO/RF systems

Ján Tóth, Ľuboš Ovseník, Ján Turán, Linus Michaeli, Michal Márton

PII: S0263-2241(17)30754-6
DOI: https://doi.org/10.1016/j.measurement.2017.11.044
Reference: MEASUR 5113

To appear in: *Measurement*

Received Date: 15 June 2017
Revised Date: 13 November 2017
Accepted Date: 16 November 2017

Please cite this article as: J. Tóth, L. Ovseník, J. Turán, L. Michaeli, M. Márton, Classification prediction analysis of RSSI parameter in hard switching process for FSO/RF systems, *Measurement* (2017), doi: https://doi.org/10.1016/j.measurement.2017.11.044

Classification prediction analysis of RSSI parameter in hard switching process for FSO/RF systems

[1]*Ján TÓTH,* [2]*Ľuboš OVSENÍK,* [3]*Ján TURÁN,* [4]*Linus MICHAELI,* [5]*Michal MÁRTON*

[1,2,3,4,5]Department of Electronics and Multimedia Communications, Faculty of Electrical Engineering and Informatics, Technical University of Košice, Slovak Republic

[1]jan.toth@tuke.sk, [2]lubos.ovsenik@tuke.sk, [3]jan.turan@tuke.sk, [4]linus.michaeli@tuke.sk, [5]michal.marton@tuke.sk

***Abstract* — The main objective of this paper is to analyze prediction of RSSI parameter for hard FSO/RF switching. First chapter is dedicated to a deep analysis of negative effects encountered when light propagates through an atmospheric channel and deteriorate optical signal. In following, we paid attention to practical design and assembly of a monitoring device. The further discussion evaluates the methodologies of so called soft and hard switching between FSO and RF link. The primary attention was paid to the hard switching technique and to relations between the received signal strength indicator with the parameters influencing atmospheric channel. Some specific machine learning methods were applied it this analysis to estimate received optical power parameter based on series of weather parameters. Such a process involves classification and regression methods. This paper presents finding out an optimal scheme for input matrix as an essential for machine learning training process. Considering time and calculation requirements is compensated by employing automation tools in overall process. Finally, we conclude and evaluate the outcomes of machine learning models in FSO/RF hard switching process.**

***Keywords* — FSO, Received Signal Strength Indicator (RSSI), availability, machine learning**

I. WIRELESS OPTICS

Wireless optical communication systems knows as Free Space Optics (FSO) are capable to establish a communication link within several kilometers. FSO links setup is constructed of two transceivers that provides full-duplex, sufficiently high speed link, usually more than 1.25 Gbps. FSO links require so called *Line of Sight* (LOS) in order to establish reliable connection. In addition, 99.999% yearly link availability has to be satisfied. However, these requirements can't be met only by employing FSO link. In fact, FSO link has to be backed up with a secondary link. Standard radio-frequency is usually assembled in so called hybrid FSO/RF setup. In most cases FSO signal would be deteriorated mainly by contribution of negative atmospheric conditions along a transmission path between FSO transceivers. Various kinds of fog, heavy rain, snowing, flying objects, pollution etc. significantly affect transmitted optical signal. FSO link can result in signal fade when critical atmospheric conditions are met. Such events can occur rather in autumn and spring months of year. Optical signal can actually be attenuated because of scattering and absorption phenomena. Effect of absorption is in fact compensated with an accurate wavelength. There are three so called optical windows where an attenuation is the lowest 850 nm, 1330 nm or 1550 nm) [1], [2]. Effect of scattering has basically the highest contribution in therms of overall attenuation. Total attenuation can be numerically evaluated by *Beer law* as show in following

$$\tau = e^{-\beta L}[\text{dBm}], \tag{1}$$

where L represents a distance between FSO nodes and total β refers to a sum of absorption attenuation coefficient β_{abs} and scattering attenuation coefficient β_{scat}.

$$\beta = \beta_{abs} + \beta_{scat}[\text{dBm}]. \tag{2}$$