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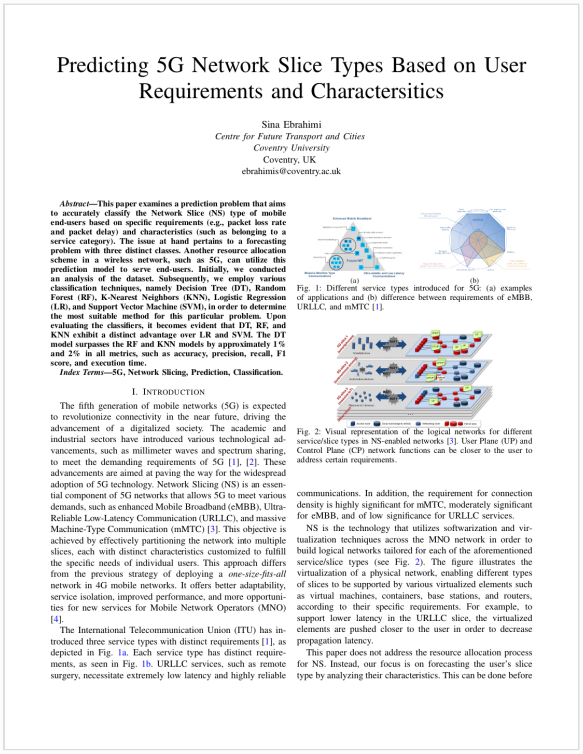

Predicting 5G Network Slice Types Based on User Requirements and Charactersitics

Sina Ebrahimi
Centre for Future Transport and Cities
Coventry University
Coventry, UK
ebrahimis@coventry.ac.uk

***Abstract*—This paper examines a prediction problem that aims to accurately classify the Network Slice (NS) type of mobile end-users based on specific requirements (e.g., packet loss rate and packet delay) and characteristics (such as belonging to a service category). The issue at hand pertains to a forecasting problem with three distinct classes. Another resource allocation scheme in a wireless network, such as 5G, can utilize this prediction model to serve end-users. Initially, we conducted an analysis of the dataset. Subsequently, we employ various classification techniques, namely Decision Tree (DT), Random Forest (RF), K-Nearest Neighbors (KNN), Logistic Regression (LR), and Support Vector Machine (SVM), in order to determine the most suitable method for this particular problem. Upon evaluating the classifiers, it becomes evident that DT, RF, and KNN exhibit a distinct advantage over LR and SVM. The DT model surpasses the RF and KNN models by approximately 1% and 2% in all metrics, such as accuracy, precision, recall, F1 score, and execution time.**

***Index Terms*—5G, Network Slicing, Prediction, Classification.**

I. Introduction

The fifth generation of mobile networks (5G) is expected to revolutionize connectivity in the near future, driving the advancement of a digitalized society. The academic and industrial sectors have introduced various technological advancements, such as millimeter waves and spectrum sharing, to meet the demanding requirements of 5G [1], [2]. These advancements are aimed at paving the way for the widespread adoption of 5G technology. Network Slicing (NS) is an essential component of 5G networks that allows 5G to meet various demands, such as enhanced Mobile Broadband (eMBB), Ultra-Reliable Low-Latency Communication (URLLC), and massive Machine-Type Communication (mMTC) [3]. This objective is achieved by effectively partitioning the network into multiple slices, each with distinct characteristics customized to fulfill the specific needs of individual users. This approach differs from the previous strategy of deploying a *one-size-fits-all* network in 4G mobile networks. It offers better adaptability, service isolation, improved performance, and more opportunities for new services for Mobile Network Operators (MNO) [4].

The International Telecommunication Union (ITU) has introduced three service types with distinct requirements [1], as depicted in Fig. 1a. Each service type has distinct requirements, as seen in Fig. 1b. URLLC services, such as remote surgery, necessitate extremely low latency and highly reliable

(a) (b)

Fig. 1: Different service types introduced for 5G: (a) examples of applications and (b) difference between requirements of eMBB, URLLC, and mMTC [1].

Fig. 2: Visual representation of the logical networks for different service/slice types in NS-enabled networks [3]. User Plane (UP) and Control Plane (CP) network functions can be closer to the user to address certain requirements.

communications. In addition, the requirement for connection density is highly significant for mMTC, moderately significant for eMBB, and of low significance for URLLC services.

NS is the technology that utilizes softwarization and virtualization techniques across the MNO network in order to build logical networks tailored for each of the aforementioned service/slice types (see Fig. 2). The figure illustrates the virtualization of a physical network, enabling different types of slices to be supported by various virtualized elements such as virtual machines, containers, base stations, and routers, according to their specific requirements. For example, to support lower latency in the URLLC slice, the virtualized elements are pushed closer to the user in order to decrease propagation latency.

This paper does not address the resource allocation process for NS. Instead, our focus is on forecasting the user's slice type by analyzing their characteristics. This can be done before