School of Engineering and Applied Science (SEAS), Ahmedabad University

B.Tech(ICT) Semester V: Wireless Communication (CSE 311)

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- Base Article Title:

  1) Z. Ding, P. Fan and H. V. Poor, "Impact of Non-Orthogonal Multiple Access on the Offloading of Mobile Edge Computing," in IEEE Transactions on Communications, vol. 67, no. 1, pp. 375-390, Jan. 2019, doi: 10.1109/TCOMM.2018.2870894.

  2) "Implementation of NOMA and MEC for static and mobile users"

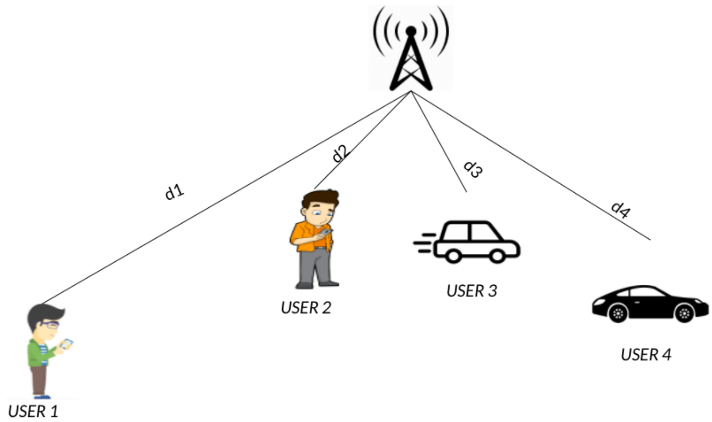
1 New Performance Analysis

To solve the limitations of mobility under NOMA and MEC technology, we came up with a new innovative idea. This will make more practical use NOMA and MEC technology.

First of all we consider that the below shown Base station is integrated with the MEC servers, that will help the users to offload their tasks easily and will help to achieve better user performance. This will be considered as Primary User(PU). Secondly, we are considering that there are many users who offload their task to these MEC servers and we call them as Secondary Users(SU). These Seconday users might be static or mobile. If they are mobile then, they might be moving with high mobility or low mobility. Now our task is to implement the idea of NOMA to both static and mobile users to offload their tasks successfully to MEC servers.

Symbol	Description
P_n	Offloading Probability
L	number of branches
m	shape parameter
d_i	distance of i^{th} user from base station
$det(\Lambda)$	correlation parameter(ρ) of the antenna branches [2]
γ_i	Channel gain of i$^{th} user$

- System Model/Network Model



Here, in the diagram, the static users' distance from the Base Station is fixed while the mobile users' distance from the Base Station varies with respect to time. Considering this scenario, we can say that channel gain of static user is constant while the channel gain of mobile users may vary with respect to distance. Here, the displacement in distances is given as $\int_0^t v(t)dt$ where $v(t)$ follows the log-normal distribution for dense traffic condition [3]. we focus on the derivation of the distribution of received SNR over arbitrarily correlated Nakagami-m channels under vehicle mobility.

- Detailed derivation of performance metric-I

First of all, we get the PDF of received SNR for the case that SU is Nearer to PU From [1].

$$p_{\gamma_1}(\gamma_1) = \frac{\left(\frac{\gamma_1 m}{\bar{\gamma}}\right)^{d_1(Lm-1)} \exp\left(\frac{-\gamma_1}{\bar{\gamma}\times(1-\det(\Lambda))}\right) \times \alpha}{(1-\det(\Lambda))^{d_1(L-1)}\Gamma(\text{Lm})} \tag{1}$$

where α is the generalized Gaussian hyper geometric function

Secondly, we get the PDF of received SNR for the case that SU is at far distance from PU From [1].

$$p_{\gamma_2}(\gamma_2) = \frac{\left(\frac{\gamma_2 m}{\bar{\gamma}}\right)^{d_2(Lm-1)} \exp\left(\frac{1}{\bar{\gamma}\times(\det(\Lambda))}\right) \times \beta}{(\det(\Lambda))^{d_2(L-1)}\Gamma\left(d''\right)} \tag{2}$$

where β is the generalized Gaussian hyper geometric function

Now, to implement the idea of NOMA, where two or more users share the same resources, so to achieve this, we have to find the joint PDF of received SNR to get the offloading probability. To get the best pairing among users, we have considered the above two scenarios. Now if we assume that both users are independent of each other than the joint PDF can be obtained as follows:

$$p_{\gamma_1,\gamma_2}(\gamma_1,\gamma_2) = p_{\gamma_1}(\gamma_1) \times p_{\gamma_2}(\gamma_2)$$

$$= \frac{\left(\frac{\gamma_1 m}{\bar{\gamma}}\right)^{d_1(Lm-1)} \exp\left(\frac{-\gamma_1}{\bar{\gamma}\times(1-\det(\Lambda))}\right) \times \alpha}{(1-\det(\Lambda))^{d_1(L-1)}\Gamma(\mathrm{Lm})} \times \frac{\left(\frac{\gamma_2 m}{\bar{\gamma}}\right)^{d_2(Lm-1)} \exp\left(\frac{1}{\bar{\gamma}\times(\det(\Lambda))}\right) \times \beta}{(\det(\Lambda))^{d_2(L-1)}\Gamma\left(d''\right)}$$

With the joint PDF obtained, we can get the offloading probability for the users with different mobility.

2 Contribution of team members

2.1 Technical and Non-Technical contribution of all team members

Tasks	Umang Kamdar	Jainesh Patel	Vatsal Patel
Analysis For Innovation	✓	✓	✓
Report writing	✓	✓	✓
Creation of MIRO frames	✓	✓	✓
Gathering of references	✓	✓	✓
Video creation	✓	✓	✓

3 REFERENCES

[1] S. Kavaiya, D. K. Patel, Y. L. Guan, S. Sun, Y. C. Chang and J. M. Lim, ”On the Energy Detection Performance of Arbitrarily Correlated Dual Antenna Receiver for Vehicular Communication,” in IEEE Communications Letters, vol. 23, no. 7, pp. 1186-1189, July 2019, doi: 10.1109/LCOMM.2019.2916317

[2] M. Z. Win et al., “MRC performance for M-ary modulation in arbitrarily correlated Nakagami fading channels,” IEEE Commun. Lett., vol. 4, no. 10, pp. 301–303, Oct. 2000.

[3] S. Zhu et al., “Performance analysis of cooperative spectrum sensing in cognitive vehicular networks with dense traffic,” in Proc. IEEE VTC Spring, May 2016, pp. 1–6.