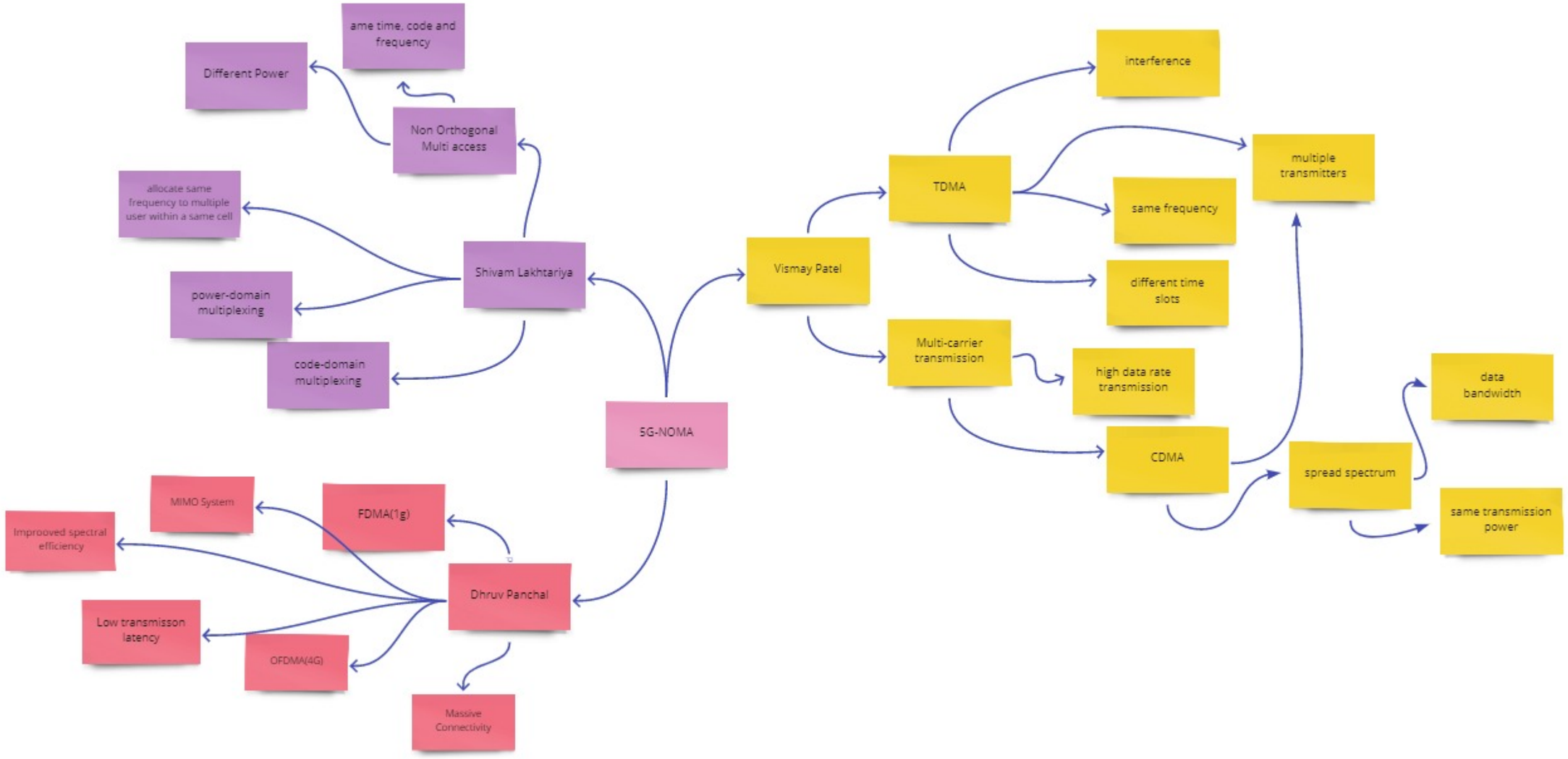
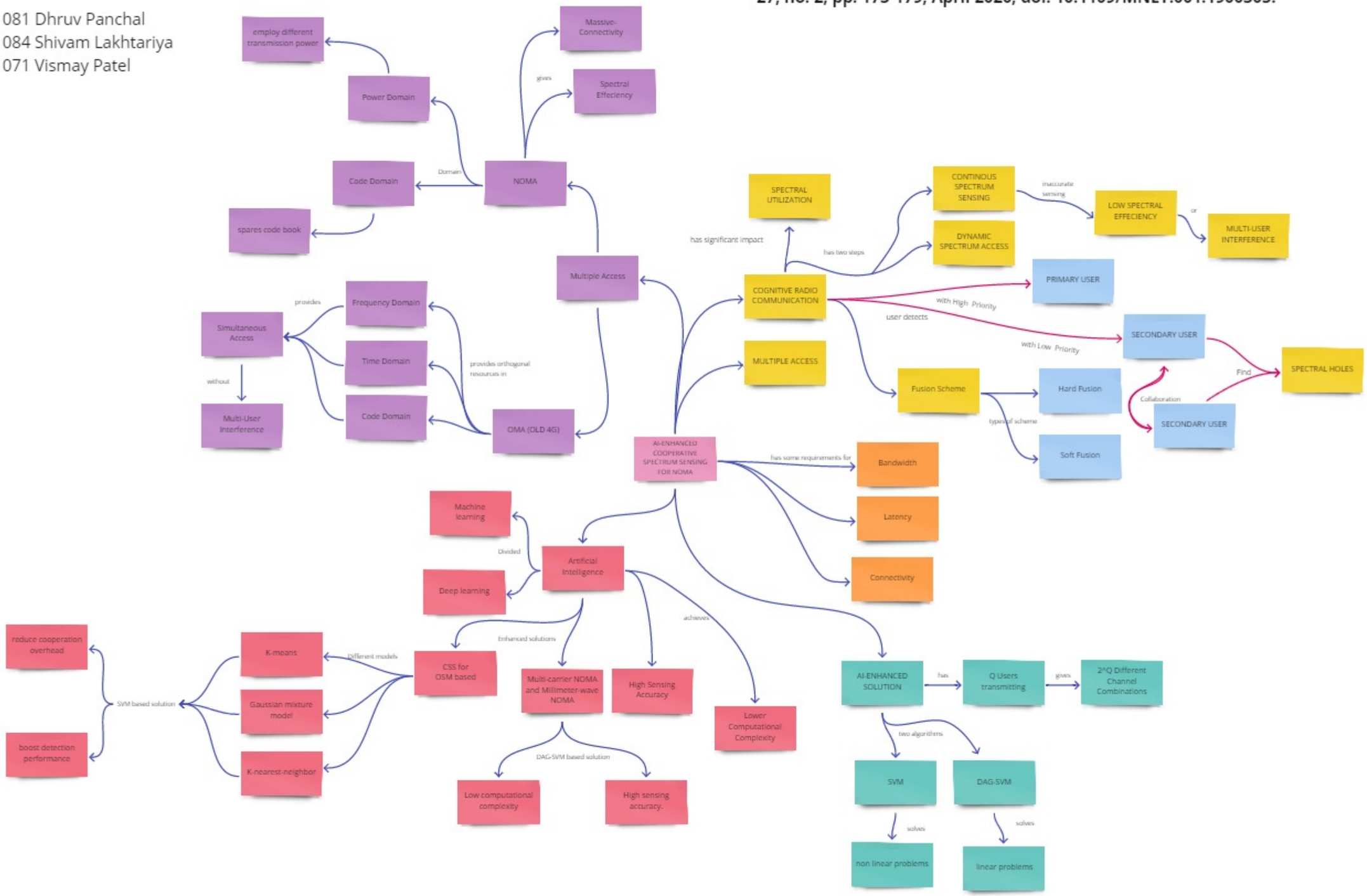

ame time, code and frequency
Different Power
Non Orthogonal Multi access
allocate same frequency to multiple user within a same cell
Shivam Lakhtariya
power-domain multiplexing
code-domain multiplexing
5G-NOMA
Vismay Patel
TDMA
interference
multiple transmitters
same frequency
different time slots
Multi-carrier transmission
high data rate transmission
CDMA
spread spectrum
data bandwidth
same transmission power
MIMO System
FDMA(1g)
Improoved spectral efficiency
Dhruv Panchal
Low transmisson latency
OFDMA(4G)
Massive Connectivity

Concept map

AU1841081 Dhruv Panchal
AU1841084 Shivam Lakhtariya
AU1841071 Vismay Patel

Z. Shi, W. Gao, S. Zhang, J. Liu and N. Kato, "AI-Enhanced Cooperative Spectrum Sensing for Non-Orthogonal Multiple Access," in IEEE Wireless Communications, vol. 27, no. 2, pp. 173-179, April 2020, doi: 10.1109/MNET.001.1900305.



On the Performance of NOMA-Based Cooperative Relaying Systems Over Rician Fading Channels

AU1841081 Dhruv Panchal
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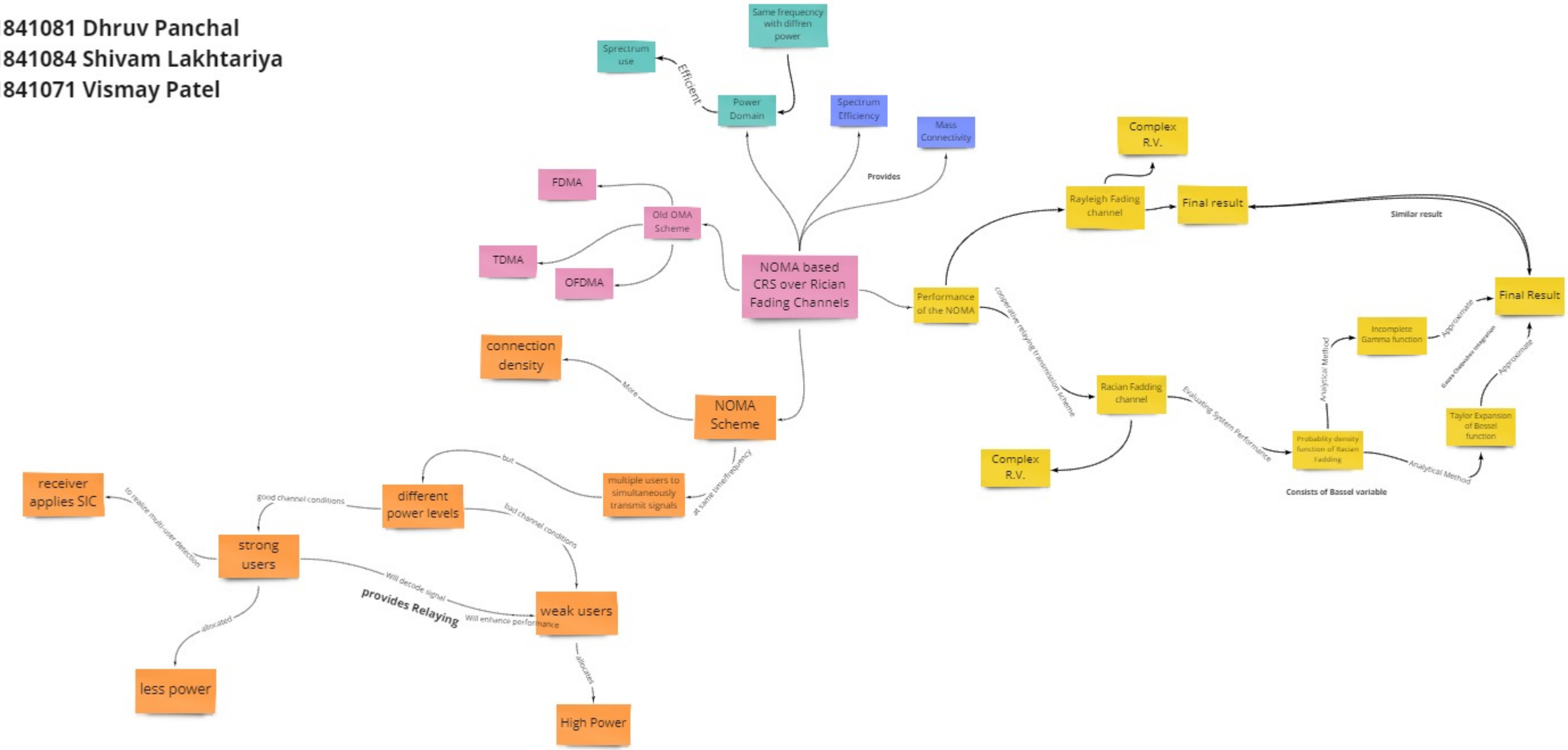
AU1841071 Vismay Patel



problem definition: The main issue with NOMA is multi-user detection and increasing power domain

Consider two channel conditions

good channel conditions: strong users

bad channel conditions: weak users

less power allocated

more power allocated

transmitter side

sending superposition of signals by allocating different power levels

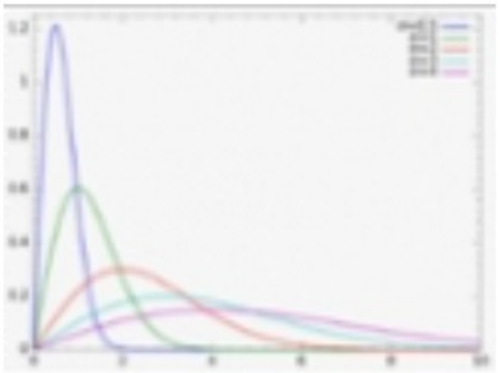
successive interference cancellation

to multiple users

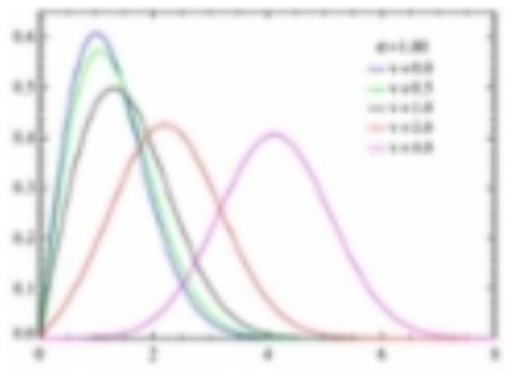
reciever side

STRONG USERS DECODE THE SIGNAL AND ACT AS RELAYS TO IMPROVE THE PERFORMANCE OF THE WEAK USERS

PDF :



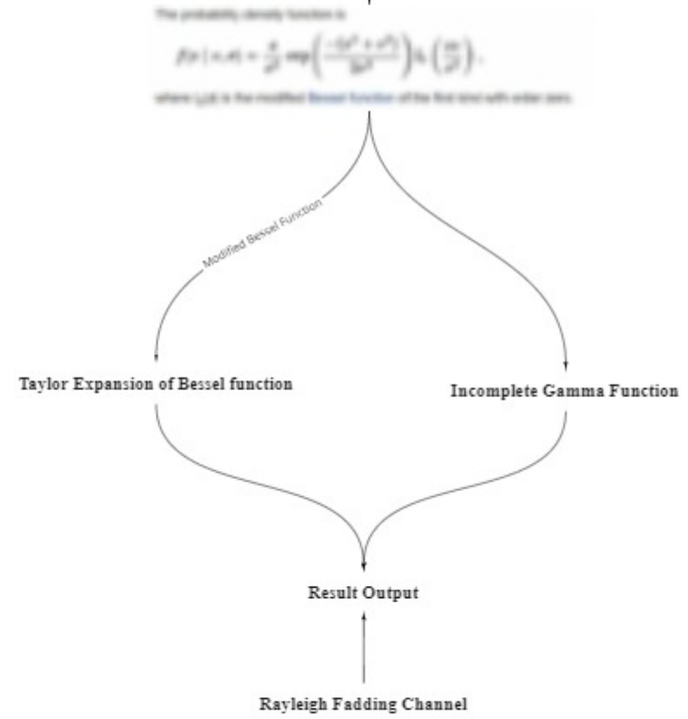
Rayleigh Fadding Channel



Racian Fadding channel

Assumption for calculation

For Solving Racian Fadding channel



LIMITATIONS OF THE EXISTING FRAMEWORK

- Relay works in half duplex mode which lowers the spectra effeciency
- Quality of service for primary user is not protected
- complexity of hardware and software due to massive users
- Relay works in half duplex mode which lowers the spectra effeciency
- Interference caused by NOMA
- Mutual interference due to primary and secondary users
- Low spectral effeciency

CRNs can achieve good performance by using the user-pairing strategy that two users with the best channel conditions are selected to pair

crn v/s noma

Noma uses the user with best channel conditions to pair with user with worst channel conditions

There are three types of paradigms in CRN

- interleavemode
  - sensing slot
    - spectrum sensing is performed to know that whether the primary user has occupied the frequency slot or not
  - data transmission slot
    - During the data transmission slot, the secondary network can access the frequency bands of PUs and provide services for multiple SUs by using NOMA when PUs are detected to be inactive
- overlay mode
  - the secondary network provides cooperation for the primary network in order to obtain the chance to access the frequency band
    - They do not need a sensing slot as they can exist at same frequency at the same time
- underlay mode
  - the secondary network coexists with the primary network on the condition that the interference caused by SUs is tolerable to PUs

So till now we were taking all the assumptions based on perfect csi and two users so the below given we will try to implement in our innovation part

- CRS based NOMA

Innovation Framework:
1.In the beginning we considered perfect CSI but now we will try to implement imperfect CSI.
2. Then we will consider multiple user and observe the effect.
3. Then we will try to find the probability of detection in cognitive radio(CR) NOMA.
4. At last we will compare the performance of NOMA and CR NOMA.

Performance Improvement:
1.Improves spectral efficiency and user connectivity density.
2.Energy efficiency is also high.
3.Good performance as pairing is done by selecting two users with best channel conditions.
4.Also manages interference caused by multiple users.
5.Secure transmission
6.Quality of Service of primary users is protected

Problem statement: massive connectivity and multiple user detection and improve the performance of weak users

IN NOMA BASED CRS WE CAN SEND TWO SIGNALS IN TWO TIME SLOTS

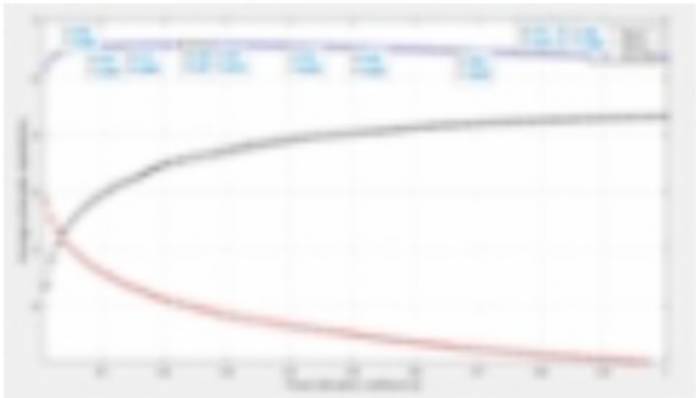
S-to-D and S-to-R link denote

R-to-D link denote

IN MOST NOMA SCHEMES RAYLEIGH FADING CHANNEL IS CONSIDERED WHERE IT TAKES ONLY LOS IN CONSIDERATION WHERE AS WE HAVE USED RICIAN FADING CHANNEL WHICH CONSIDERS BOTH LOS AND NLOS SCENARIOS.

STRONG USERS DECODE THE SIGNAL WITH SIC AND ACT AS RELAYS TO IMPROVE THE PERFORMANCE OF THE WEAK USERS

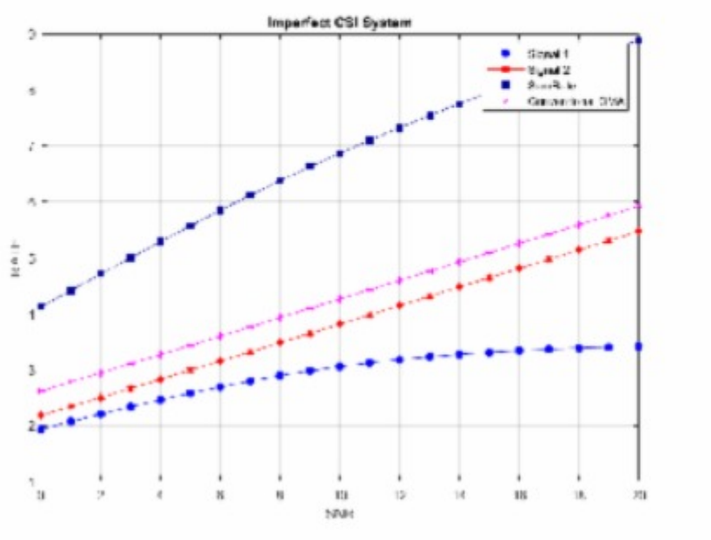
Good channel users will be allocated less power and weak channel users will be allocated more power.



1st slot time for D S1==Signal and noise ==S2
2nd time for D slot S2== signal from relay

We made an observation that if we blindly increase the channel co-efficient a2 then a2 will decrease the over all performance.

Imperfect CSI

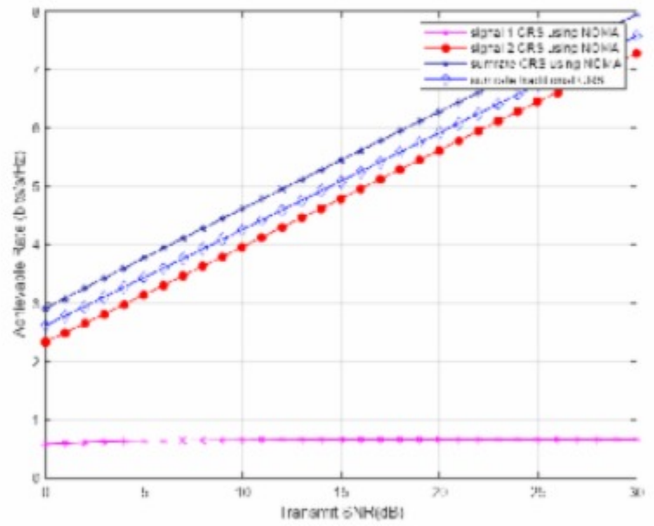


Example of imperfect CSI

HERE WHEN WE IMPLEMENTED IN IMPERFECT CSI WE SAW THAT THE PERFORMANCE OF NOMA INCREASED AS WE MULTIPLIED THE SNR BY RHO AND DIVIDED BY (1-RHO)^2.KEEPING ALL OTHER CONDTIONS SAME AS PERFECT CSI.

OBSERVATION

1) Imperfect CSI NOMA give better SUM-RATE than perfect CSI.
(At SNR 10 perfect CSI give sum-rate is nearly 4.2Hz where Imperfect CSI gave nearly 6.2 Hz)
2)In imperfect CSI traditional CRS(OMA) give the almost the same performance as the perfect CSI.



Example of perfect CSI

HERE WE SEE THAT FOR THE CONDITIONS WHICH ARE GIVEN IN OUR ARTICLE WE SEE THAT THE PERFORMANCE OF NOMA IS BETTER THAN TRADITIONAL OMA BUT THE GAP BETWEEN THE PERFORMANCE IS NOT THAT WIDE.