Pilot Contamination in Massive MIMO: A Measurement-based Analysis using 2D-MUSIC

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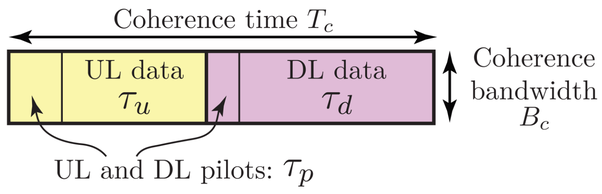
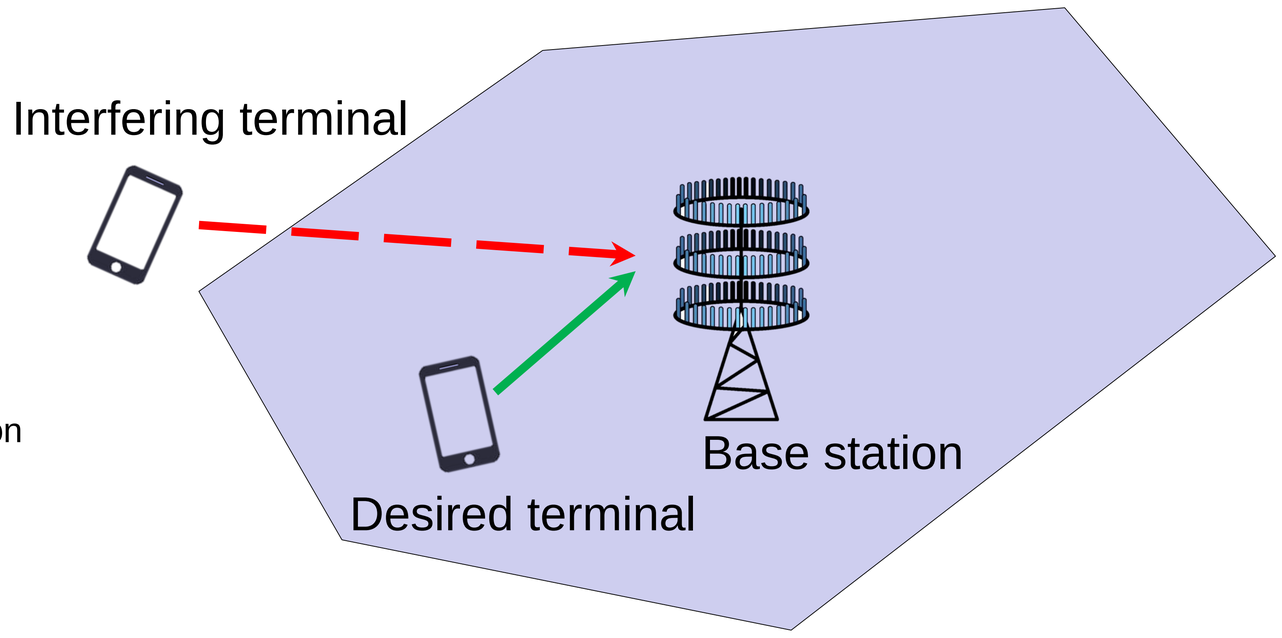
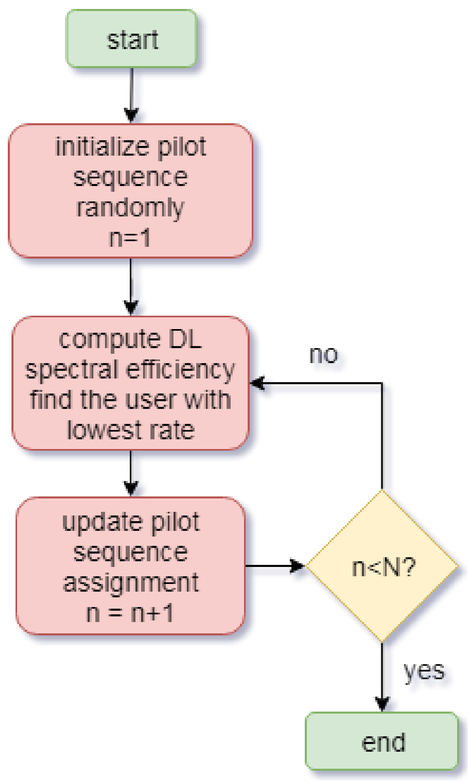
1. What is pilot contamination (PC)?





- When estimating the channel from the desired terminal, the base station cannot easily separate the signals from the two terminals.
- **Pilot sequence reuse/collision.**

2. Standard method to detect PC is inefficient

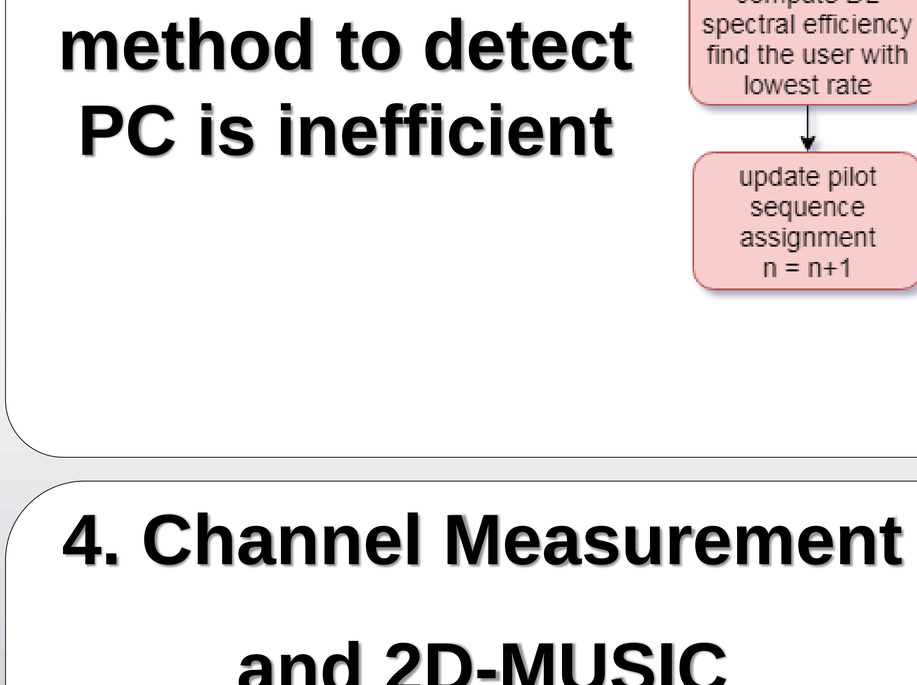


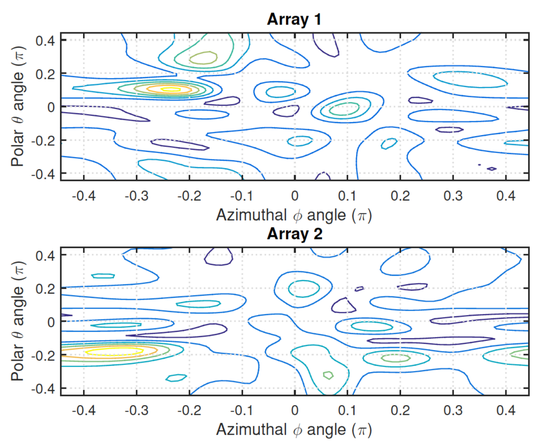
3. Angular information is a faster indicator

- Could we find an intuitive correlation from the channel characteristics?
- Transform channel matrix into angular domain -> 2D-MUSIC
- Correlate the **angular overlap region** to the **channel estimation error**.
- We expect the higher correlation in their angular domain, the worse the channel estimation error.

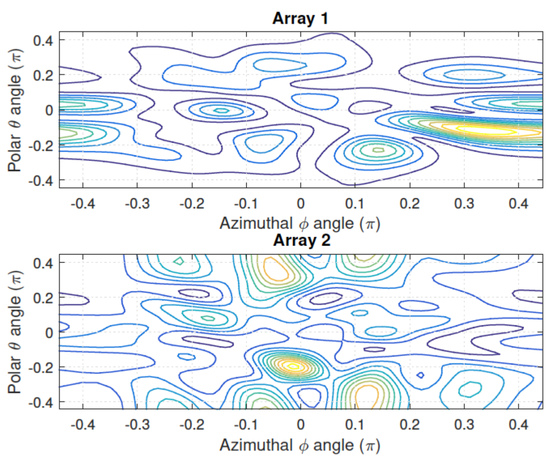
Better metric for pilot scheduling

4. Channel Measurement and 2D-MUSIC

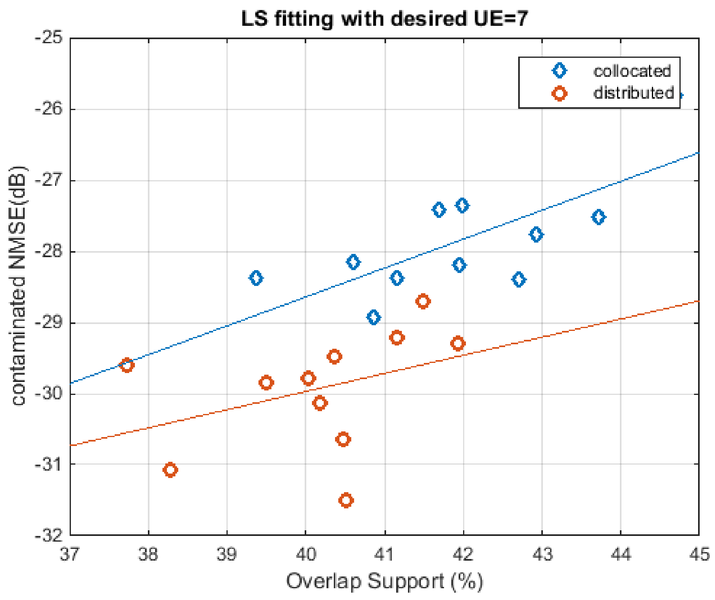




Angular transform for user 1, Seen by two co-located arrays



Angular transform for user 1, Seen by two distribute arrays



CE error is proportional to the overlapping in channel angular transform

5. Conclusion

- **Angular information** provides us the correlation between channel of desired and interfering terminals.
- This is **useful for pilot sequence scheduling** to **reduce pilot contamination**.

https://www.esat.kuleuven.be/telemic/research/NetworkedSystems

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Cheng-Ming Chen is currently a PhD candidate of electrical engineering department of KU Leuven His interests include MIMO signal processing, channel measurements and system optimization