13th HiPC Student Research Symposium (SRS)

Approximating Communication Systems: Reality or Fantasy?

Ish Kool[1], Alish Kanani[2], **Rajat Bhattacharjya**[1]
[1]Indian Institute of Information Technology Guwahati
[2] Indian Institute of Technology Jodhpur



Outline

- Introduction
- Motivation
- Background
- Methodology
- Results
- Conclusion and Future Work

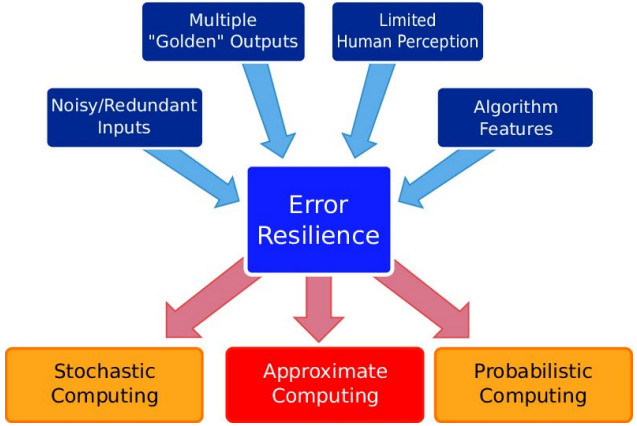
Introduction

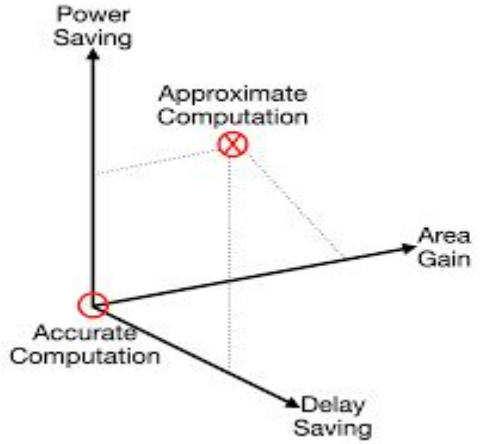
- Over the next 5 years up to 2025, global data creation is projected to grow to more than **180 zettabytes [1].**
- Data transmission will increase as 5G disrupts the market.
- More antennae, more bandwidth, more compute power will be needed and hence more energy is required to power these devices.

[1] https://www.statista.com/statistics/871513/worldwide-data-created/

Motivation

- Era of 5G has brought up **data explosion**.
- **Faster processing** at the edge needed.
- **Approximate computing** is a computing paradigm that aims at achieving substantial speed up at the cost of loss in precision.
- This technique is suitable in **non mission critical** use cases.
- The goal of approximation schemes is to have **acceptable error margins** in order to not introduce drastic effects on the end application.





Background

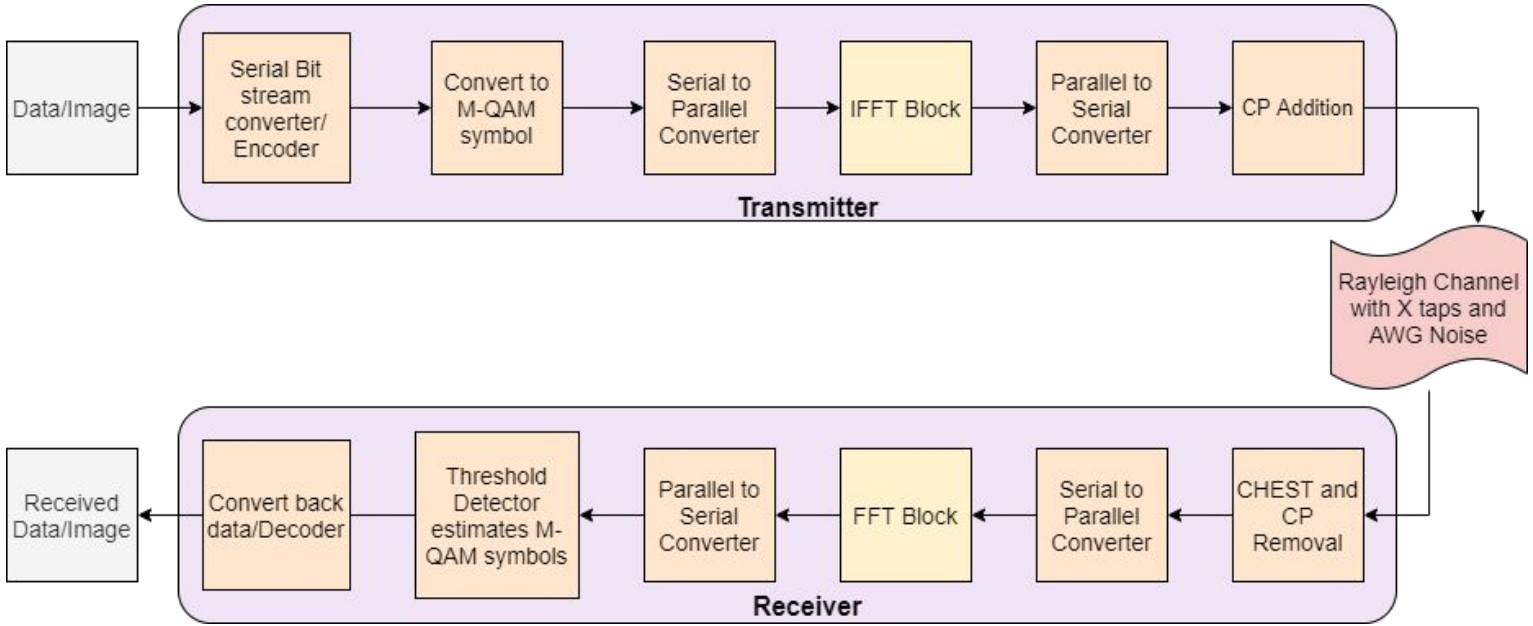
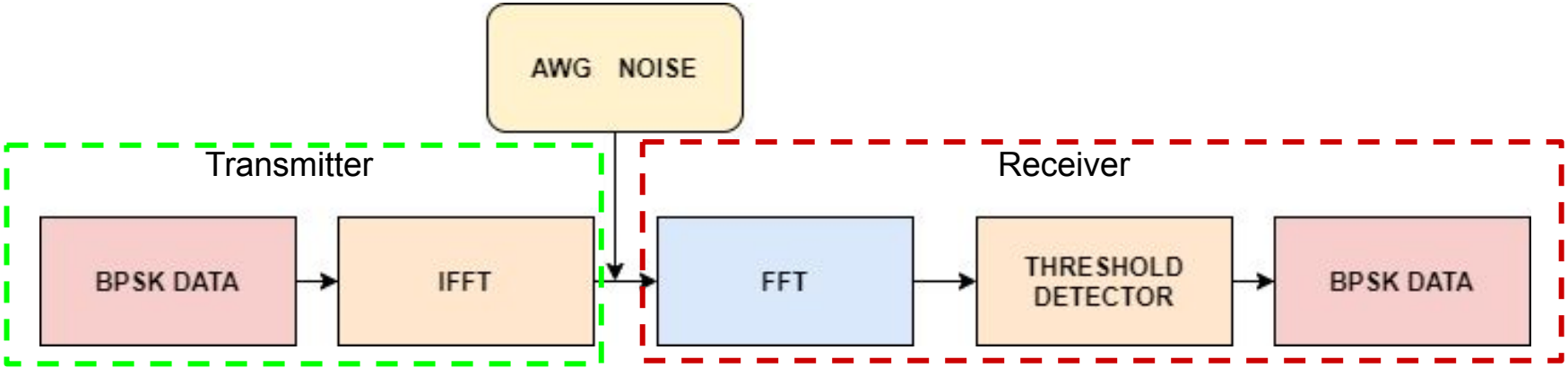
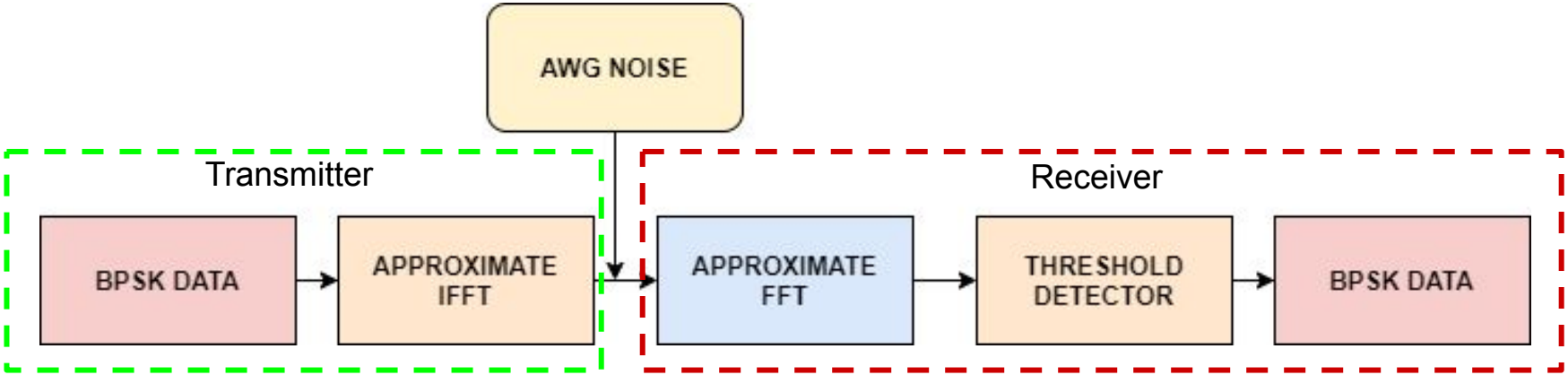


Fig: Fundamental Communication Model

Methodology

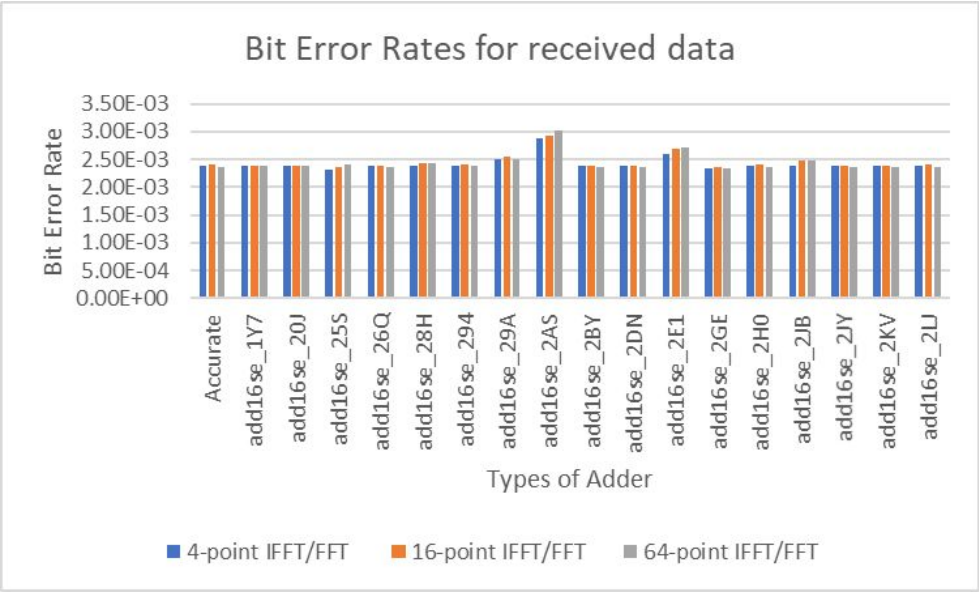




Results

- Fig. shows the BER for the communication system using accurate and approximate adders.
- On average, the deviation from of BER for approximate cases compared to accurate case is 3.7%.
- The savings are in terms of power/area/delay using approximate adders. [2]

Note: Lower the BER, better the accuracy.



The approximate adders are from the EvoApprox Library [2].

[2] V. Mrazek, R. Hrbacek, Z. Vasicek and L. Sekanina, EvoApprox8b: Library of approximate adders and multipliers for circuit design and benchmarking of approximation methods. Design, Automation & Test in Europe Conference & Exhibition (DATE), 2017, Lausanne, 2017

Conclusion and Future Work

- IFFT/FFT show error-resilience due to which they can be approximated.
- In a transceiver, the use of approximate computing helps in lowering power consumption and decreasing delay.
- Results show that the deviation in BER on average is 3.7% which is minimal.
- In the future, the plan is to extend this work for higher point FFTs and to try using various combinations for approximations.
- Subsequently, going for hardware implementation of the same.

Thank You

Questions?