AI-BASED SIGNAL PROCESSING FOR FULL-DUPLEX IN 6G: THE ALTERNATIVE FOR MAXIMIZING SPECTRUM EFFICIENCY

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Introduction (I/II)
Introduction (II/II)

Increase in transmission capacity needed

- Traditional spectrum efficiency improvement:
  - Channel coding
  - Constellation design
  - …
  - Already approaching Shannon limit

- Proposal for spectrum efficiency improvement:
  - In-Band Full-Duplex (IBFD)
Transmitting and receiving at the same frequency and at the same time.

**IBFD**

**Pros**
- Doubles the spectral efficiency compared with half-duplex systems
- Cost reduced when compared to other alternatives

**Challenge**
- Loopback signal leakage
IBFD loopback reduction

Modification of the radiation pattern of receiver antenna

Reduction of the leaked loopback signal
Beamforming (I/II)

Receiver antenna

Direct

Without beamforming

Noise

With beamforming

Direct

Noise

Loopback

Loopback

TSR Lab

Universidad del País Vasco
Euskal Herriko Unibertsitatea
Beamforming (II/II)

CLASSICAL METHODS:
MMSE:
- Not optimum solution.
- Computationally very demanding.

AL METHODS:
Reinforcement:
- Seeks dynamically for a solution.
- More optimized for certain hardwares.
Digital cancellation (I/III)

- Direct
- Loopback
- Noise
- Loopback channel
- Loopback message

Receiver antenna

- Known values
- Unknown values
Convolutional NNs and Transformers between others, excel at extracting information of signals with those characteristics.
Digital cancellation (III/III)

Diagram:
- Direct
- Loopback
- Noise
- Loopback estimation
- Cancellation noise
- Noise
Conclusions

We propose AI-aided IBFD for spectrum efficiency improvement

BEAMFORMING
- Reinforcement learning
- CNNs and Transformers

DIGITAL CANCELLATION
- Supervised learning
- CNNs and Transformers
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