ROHINI
COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
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Maximum Likelihood (ML)

C.PRISCILLA,AP/ECE

Definition

- The **Maximum Likelihood (ML)** method selects the signal parameters that **maximize the probability of receiving the observed data**.

Working Principle

- Assumes a statistical model of the received signal
- Evaluates all possible transmitted signals
- Chooses the signal that best explains the received antenna data
- Often assumes **Gaussian noise**

Mathematical Formulation

The ML estimate is:

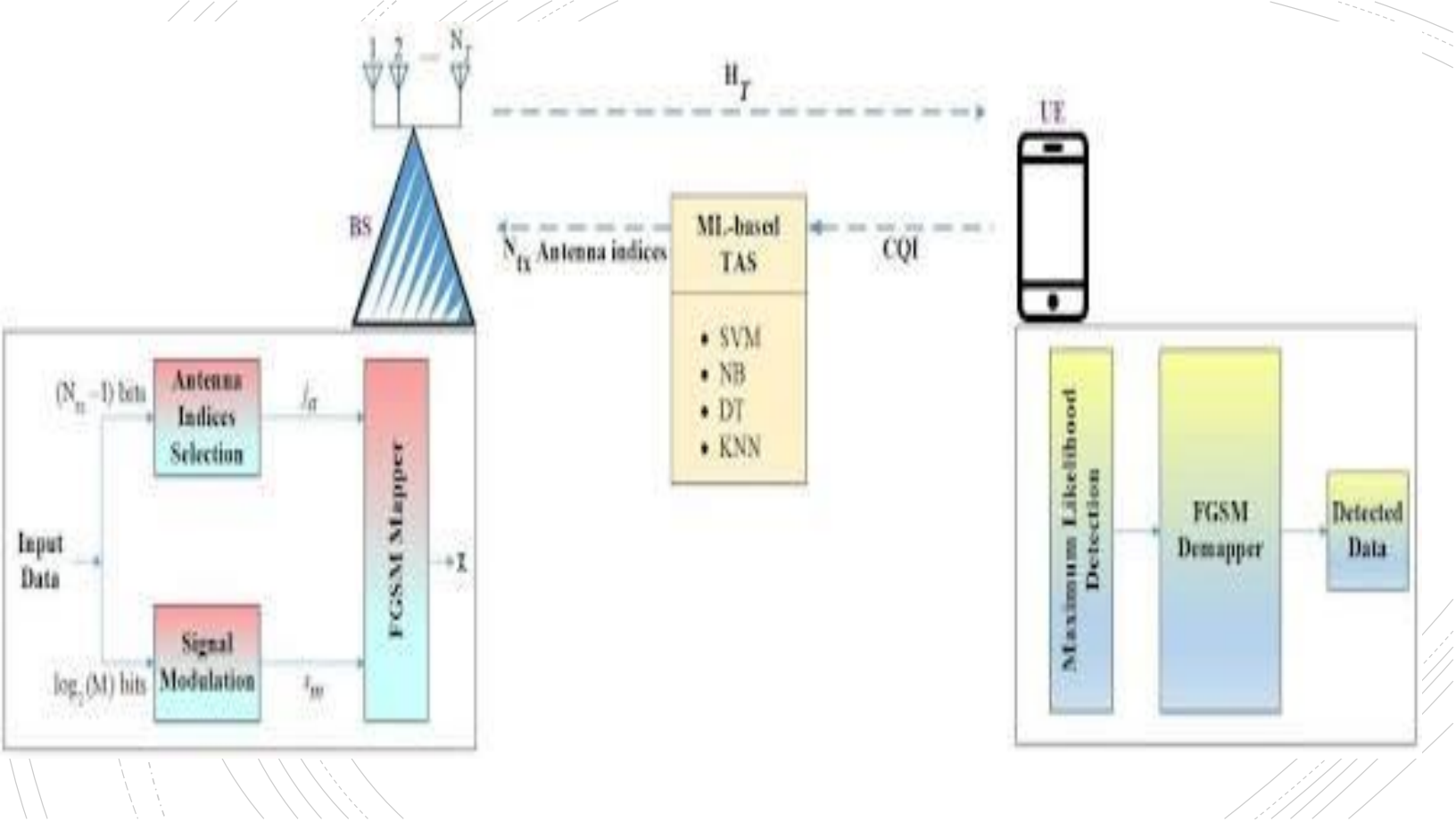
$$\hat{s} = \arg\max_{s} P(y|s)$$

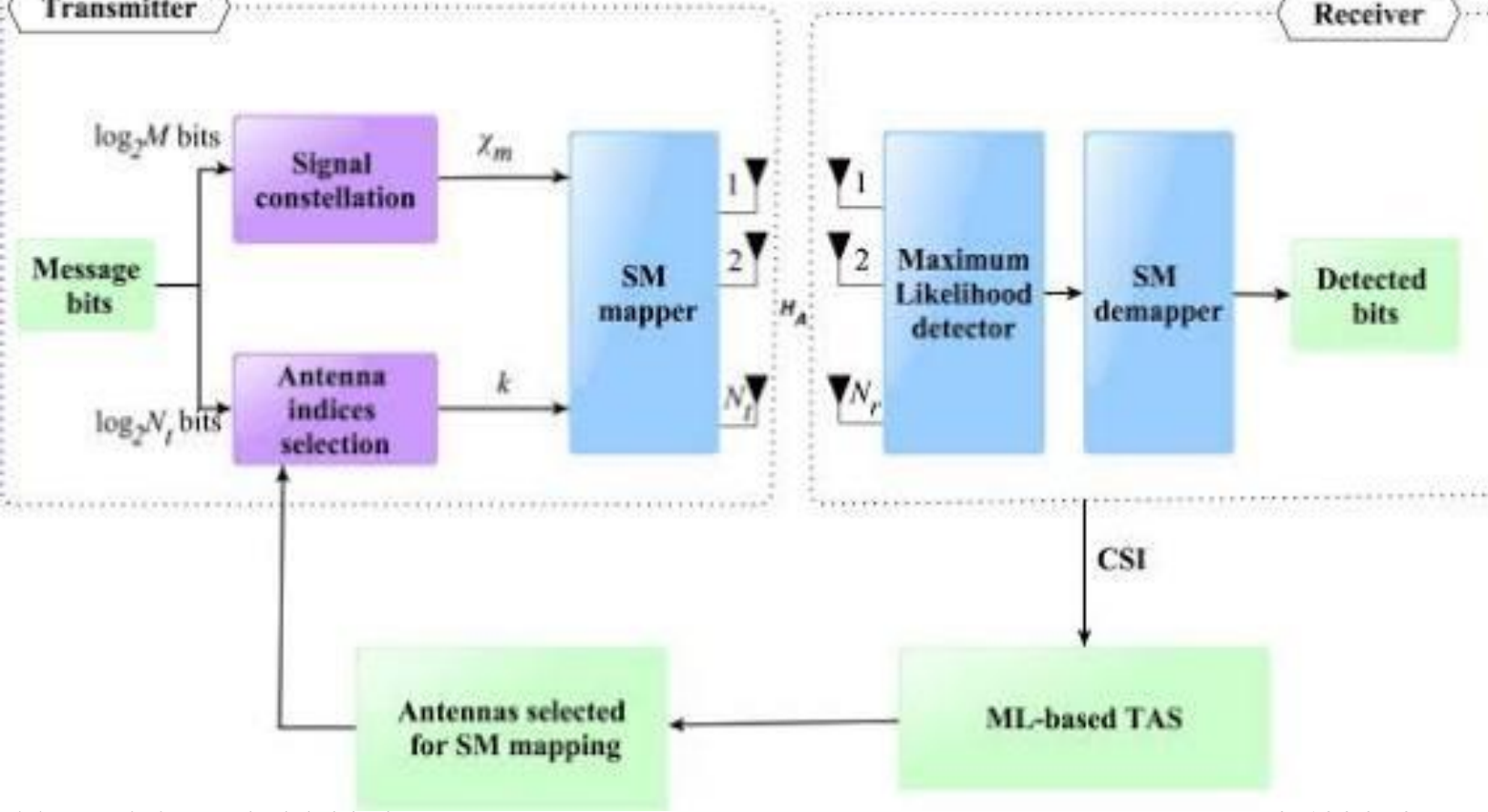
For Gaussian noise, this becomes a minimum distance problem:

$$\hat{s} = \arg\min_{s} \|y - Hs\|^2$$

where:

- y = received signal vector
- H = channel/array response matrix
- s = transmitted signal vector


1
2
N_T
H_T
UE
BS
N_{tx} Antenna indices
ML-based TAS
• SVM
• NB
• DT
• KNN
CQI
$(N_n - 1)$ bits
Antenna Indices Selection
l_n
Input Data
Signal Modulation
$\log_2(M)$ bits
s_m
FGSM Mapper
x
Maximum Likelihood Detection
FGSM Demapper
Detected Data


Transmitter
Receiver
log2M bits
Signal constellation
χm
Message bits
SM mapper
1
2
Nt
HA
1
2
Nr
Maximum Likelihood detector
SM demapper
Detected bits
log2Nt bits
Antenna indices selection
k
CSI
Antennas selected for SM mapping
ML-based TAS

Advantages

- Statistically optimal detection
- Minimum probability of error
- Excellent performance in low-noise environments

Limitations

- Very high computational complexity
- Not suitable for real-time large antenna systems
- Requires accurate channel knowledge

Applications

- Signal detection
- Channel estimation
- Radar and sonar systems