

Seminar 4

Decision criteria

DEDP

1. A signal can have four possible values: -6, -2, 2, 6. Each value lasts for 1 second. The signal is affected by white noise with normal distribution. The receiver takes 1 sample per second. Using ML criterion, decide what signal has been transmitted, if the received samples are:

$$4, 6.6, -5.2, 1.1, 0.3, -1.5, 7, -7, 4.4$$

2. A signal can have two possible values, $s_0 = -3$ or $s_1 = 3$. The signal is affected by gaussian noise with distribution $\mathcal{N}(0, 1)$. The receiver performs ML decision based on a single sample r .
 - a. In hypothesis H_0 , which for what values of r do we get a false alarm?
 - b. Compute the four conditional probabilities (correct rejection, false alarm, miss, correct detection)
3. A vehicle airbag system detects a crash by evaluating a sensor which provides two values: $s_0(t) = 0$ (no crash) or $s_1(t) = 5$ (crashing). The signal is affected by gaussian noise $\mathcal{N}(\mu = 0, \sigma^2 = 1)$. The costs of the scenarios are: $C_{00} = 0$, $C_{01} = 100$, $C_{10} = 10$, $C_{11} = -100$. The probabilities of the two hypotheses are $P(H_0) = 2/3$, $P(H_1) = 1/3$.
 - a. Find the decision taken based on a sample $r = 3.1$, with the ML / MPE / MR criterion
 - b. Find the decision regions R_0 and R_1 , with the ML / MPE / MR criterion
 - c. What if the noise is uniform $U[-3, 3]$?
4. O sursa de informație furnizează două mesaje cu probabilitățile $p(a_0) = 2/3$, $p(a_1) = 1/3$. Mesajele sunt codificate prin semnale constante cu valorile $s_0(t) = -5$ (a_0), și $s_1(t) = 5$ (a_1). Semnalele sunt afectate de zgomot uniform cu distribuția $U[-6, 6]$. La recepție se ia un singur eșantion r din semnal.

- a. Care sunt regiunile de decizie, conform criteriului Neyman-Pearson cu valoarea maximă a P_{af} de 10^{-2} ?
- b. Care este probabilitatea detecției corecte în acest caz?