INTRODUCTION TO RADAR SYSTEMS

UNIT-IV

Lecture-4

Inverse Probability

- The detection criteria discussed thus far were based on the concept of direct probabilities.
- A direct probability describes the chance of an event happening on a given hypothesis. For example, the probability that a particular radar will detect a certain target under specified conditions is a direct probability.
- On the other hand, if the event actually happened, the problem of forming the best estimate of the cause of the event is a

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- Upon obtaining this voltage, it is of interest to determine whether the output was caused by noise or by signal in the presence of noise.
- The probabilities of obtaining noise and signal-plus-noise before the event takes place are the a priori probabilities.
- The probability that the receiver output was caused by signal-plus-noise is an a posteriori probability and represents the state of knowledge obtained as a result of observing the output.

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- The method of inverse probability involves the use of the a priori probabilities associated with each of the possible hypotheses which could explain the event.
- The a priori probabilities are used, along with a knowledge of the event, to compute the a posteriori probabilities. A separate a posteriori probability is computed for each hypothesis. That hypothesis which results in the largest a posteriori probability is selected as the most likely to explain the event.

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- The similarity between the likelihood ratio and the a posteriori probability also exists when the signal parameters (phase, time delay, etc.) are not completely known.
- The chief difference between the two representations is that the concept of inverse probability requires a knowledge of the a priori probabilities whereas the likelihood ratio does not.

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- The likelihood ratio can be derived from inverse probability if the assumption is made that the a priori probabilities are equally likely.
- Both the a posteriori method and the likelihood method may be implemented by computing the cross-correlation function between the received signal and the signal s(t).
- A limitation of the method of inverse probability based on the application of Bayes rule is the difficulty of specifying the a priori probabilities.

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- In most cases of practical interest, one is ignorant of the a priori probabilities. For example, it would be necessary to specify the a priori probability of finding a target at any particular range at any particular time.
- This is an almost impossible task. In the absence of better data, it might be assumed that all range intervals are equally probable a priori, and the a priori probability may be considered to be constant.

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- However, such an assumption applied blindly to computations involving inverse probability can sometimes lead to erroneous and contradictory conclusions.
- In closing this topic it should be mentioned that one of the important by-products of the work is their reemphasis of the fact that the signal-to-noise power ratio is not as fundamental a description of radar detection performance as is the signal-to-noise energy ratio E/No.