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Model based echo processing architectures for sonar target classification

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The discrimination between man-made and natural targets is faced to the problem of setting up appropriate processing architectures that extract relevant and robust parameters that could be used for classification. To be robust, signal models have to be associated to physical models and echo parameters have to be associated to physical ones. Several models already published are investigated: bright spots, generalized bright spots, resonances. Associated processing architectures are presented: matched filter, bank of filters, AR modeling. Their performance are compared on experimental data set obtained in tank. The discriminating performance are compared in the case of shells (man-made) and solid targets (natural) of the same shape insonified in a random incidence (monostatic). Following a detailed description of echo formation mechanisms in the time-frequency plane, an explicit time-frequency architecture is presented: the time-frequency filtering. Finally a new (all chirp) model based on velocity dispersion of surface waves ,is proposed that could reduce the number of discriminating parameters and be robust to minor changes of shell characteristics.