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Filtering Techniques

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Abstract
Our aim is to reduce the noise in the images and also for the speech enhancement using the filtering techniques. In this paper, we used the filtering techniques like Kalman filter, Wiener filter, and H-infinity filter and also we used the spectral subtraction method. These methods and filtering techniques are more useful to get the accurate results of any system what the user wants. The techniques are helpful in many applications like wiener filter in image processing, denoise audio signals, especially speech, as a pre-processor before speech recognition and Kalman filter in speech enhancement, 3D modelling, weather forecasting and h-infinity filter is used in control theory and also for the speech enhancement.
Keywords: *Kalman Filter, Wiener Filter, H-infinity Filter.*

1. Introduction

Filtering techniques like a Kalman filter uses the algorithm that return the random variables and remaining inaccuracies and green goods the more precise unknown variables that are based on the single measure . Wiener filter is a filter used to produce an appraisal of a desired or target random process by linear meter -invariant filtering of an observed noisy process, assuming known stationary signaling and haphazardness spectra, and additive noise. The Wiener filter minimizes the mean foursquare erroneous belief between the estimated random process and the desired process. H-eternity filtering is presented for speech sweetening. This glide slope differs from the traditional modified Wiener/Kalman filtering approach in the following two aspects: 1) no a priori knowledge of the noise statistics is required; instead the noise signaling are only assumed to have finite energy; 2) the estimate touchstone for the filter design is to minimize the worst possible amplification of the estimation error signal in the condition of the modeling errors and additive noises. Spectral minus is a method for restoration of the power spectrum or the magnitude spectrum of a signal observed in additive noise, through reduction of an estimate of the average noise spectrum from the noisy signal spectrum.

2. Description of various Filtering Tecniques

2.1 Kalman filter:

Kalman filtering also known as linear, quadratic estimate (LQE), is an algorithm that uses a series of measurements observed over time, containing dissonance (random variety) and other inaccuracies, and green goods, ideas of alien variables that tend to be more precise than those based on a single measurement alone. More precisely, the Kalman filter operates recursively on streams of noisy input signal information to produce a statistically optimal estimate of the underlying system land. The filter is named for Rudolf (Rudy) E. Kálmán, one of the primary developers of its theory.

The Kalman filter has numerous applications in technology. A typical application is for guidance, navigation and control of vehicles, particularly aircraft and spacecraft. Furthermore, the Kalman filter is a widely applied concept in prison term series analytic thinking used in the field of force such as a signal outgrowth in and Econometrics. The algorithm employed in a two-tone process. In the prediction step, the Kalman filter green goods estimation of the current state variables, along with their dubiety. Once the outcome of the next measuring (necessarily corrupted with some amount of error, including random disturbance) is observed, these appraisals are updated using a free weighted average, with more weight being given to estimates with higher sure things. Because of the algorithm's recursive nature, it can run into the real prison term using only the present input measurements and the previously calculated state and its doubt matrix; no additional past information is required.

It is a common misconception that the Kalman filter assumes that all computer error full term and measurements are Gaussian distributed. Kalman's archetype paper derived the filter using an orthogonal sound projection hypothesis to show that the covariance is minimized, and this result, does not require any presumption, e.g., that the error is Gaussian. He then showed that the filter yields the exact conditional probability estimate in the special case that all errors are Gaussian-distributed. Extension and generalizations to the method have also been advanced, such as the extended Kalman filter and the unscented Kalman filter which work on nonlinear systems. The base model is a Bayesian model similar to a pelt Markov model, but where the nation space of the latent variable star is continuous and where all latent and observed variables have a Gaussian distribution.

The Kalman filter is an efficient recursive filter that approximation the internal province of matter of a linear dynamic system from a series of noisy measure . It is used in a wide range of technology and econometric applications from radar and computer vision to estimation of structural macroeconomic models, [octad] [Nina from Carolina] and is an important topic in control theory and control system engineering. Together with the linear-quadratic equation regulator (LQR), the Kalman filter solves the linear-quadratic-Gaussian control problem (LQG). The Kalman filter, the linear-quadratic regulator and the linear-quadratic-Gaussian controller are solutions to what arguably are the most first harmonic problems in control theory. In most applications, the internal state is much larger (more degrees of freedom) than the few "observable" parameters which are measured. However, by compounding a series of measurements, the Kalman filter can assess the entire internal state. In Dempster–Shafer theory, each state equation or reflection is considered a special case of a linear notion function and the Kalman filter is a special case of combining linear belief social occasion on a join-tree or Markov tree. Additional approaches include belief filter which uses Bayes or evidential updates to the state equations.

A wide motley of Kalman filter has now been developed, from Kalman's original formulation, now called the "simple" Kalman filter, the Kalman–Bucy filter, Schmidt 's "extended" filter, the information filter, and a variety of "square-root" filter that were developed by Bierman, Thornton and many others. Perhaps the most commonly used type of very simple Kalman filter is the phase-locked loop, which is now ubiquitous in radio, especially oftenness modulation (FM) radios, TV bent, satellite Synonyms/Hypernyms (Ordered by Estimated Frequency) of noun communication receivers, outer space communications organization, and nearly any other electronic communications equipment. One of the Kalman filter disadvantage we can find that it is necessary to know the initial conditions of the mean and variance state vector to start the recursive algorithm.

2.2 Wiener Filter

The Weiner filter was the first statistically designed filter to be proposed and subsequently give rise to many others including the famous Kalman filter. In signaling processing, the Norbert Wiener filter is a filter used to produce an estimate of a desired or target a random process of linear time-invariant filtering of an observed noisy process, assuming known stationary signal and interference spectra, and additive noise. The Wiener filter minimizes the mean public square computer error between the estimated random process and the desired process. The main goal of the Wiener filter is to filter out noise that has corrupted a signal. It is based on a statistical feeler, and a more statistical account of the possibility is given in the MMSE estimator clause.

Wiener filters are characterized by the following:

1. Assumption: signal and (additive) noise or stationary linear stochastic operation with known spectral characteristics or known autocorrelation and cross-correlation.
2. Requirement: the filter must be physically realizable/cause (this requirement can be dropped, resulting in a non-causal solution) ternary.
3. Functioning criterion: minimum mean-second power mistake (MMSE)

Applications: The Wiener filter can be used in persona processing to remove stochasticity from a picture. For example, using the Mathematica function: Wiener Filter [image,2] on the first image on the right, green groceries the filtered image below it. It is commonly used to diagnose sound recording signals, especially speech, as a preprocessor before speech recognition.

2.3 H-Infinity Filter

The global signal-to-noise proportion (SNR), time domain of a function, speech representation and listening valuation are used to verify the performance of the H-infinity filtering algorithm. This H-infinity filter can be used in control theory.

H∞ (i.e. "H-infinity") method are used in control theory to synthesize controllers achieving stabilization with guaranteed functioning. To use H∞ methods, a control designer expresses the control job as a mathematical optimization problem and then break through the controller that solves this optimization. H∞ proficiency has the advantage over serious control techniques in that they are readily applicable to problems involving multivariate system of rules with cross-coupling between canal ; disadvantages of H∞ techniques include the level of mathematical understanding needed to apply them successfully and the need for a reasonably commodity model of the system to be controlled. It is important to keep in mind that the resulting controller is only optimal with respect to the prescribed cost function and does not necessarily represent the best controller in terms of the usual performance measures used to evaluate controllers such a subsiding prison term, energy expended, etc. Also, nonlinear constraints such as saturation are generally not well-handled.

The phrase H∞ ascendency comes from the name of the mathematical place over which the optimization takes place: H∞ is the space of matrix -valued map that are analytic and bounded in the open air right-half of the complex plane defined by Re(s) > 0; the H∞ average is the maximum singular value of the function over that space. (This can be explained as a maximum gain in any guidance and at any relative frequency; for SISO arrangements, this is effectively the maximum magnitude of the frequency reception .) H∞ techniques can be used to minimize the closed grommet impingement of a disruption : depending on the trouble expression, the impact will either be measured in terms of stabilization or carrying into action . Simultaneously optimizing robust public presentation and robust stabilization is arduous. One method that comes close to achieving this is H∞ loop-shaping , which allows the control designer to apply classical loop-shaping concepts to the multivariable frequency response to get commodity long lasting performance, and then improve the response near the system bandwidth to achieve good long-lasting stabilization.

3. Conclusion

In this paper, we present the idea of removing the noise from the images and also the enhancement in the speech. We used the filtering techniques like Kalman filter, Wiener filter, spectral subtraction method and also the h-infinity filter. This H-infinity filter is used in the extension of the previous filters. This filter overcomes the drawbacks that are there in the previous filtering techniques. This H-infinity filter is used in the control theory and also to reduce the noise from the images.

References

1. http://www.eng.newcastle.edu.au/~mf140/home/Papers/Huaizhong.pdf
2. http://www.jpier.org/PIERM/pierm04/13.08061206.pdf
3. http://www.ubicc.org/files/pdf/72ubiccjournalvolume2no5_72.pdf
4. http://www.ar.media.kyoto-u.ac.jp/EN/bib/intl/GOM-ICASSP10.pdf
5. http://www.iaeng.org/IJCS/issues_v38/issue_1/IJCS_38_1_10.pdf
6. http://www.eurasip.org/Proceedings/Ext/ISCCSP2006/defevent/papers/cr1078.pdf
7. http://dsp-book.narod.ru/304.pdf
8. http://webee.technion.ac.il/people/shimkin/Estimation09/ch3_Wiener.pdf
9. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-011-introduction-to-communication-control-and-signal-processing-spring-2010/readings/MIT6_011S10_chap11.pdf
10. http://www.math.tau.ac.il/~turkel/notes/wiener7-2.pdf
11. ftp://ftp.esat.kuleuven.be/sista/doclo/reports/04-239.pdf
12. http://en.wikipedia.org/wiki/H-infinity_methods_in_control_theory
13. http://research.microsoft.com/pubs/194586/ShenDengYasmin1996.pdf
14. http://www.nt.ntnu.no/users/skoge/prost/proceedings/acc04/Papers/0502_ThM07.4.pdf
15. http://biorobotics.ri.cmu.edu/papers/sbp_papers/integrated3/kleeman_kalman_basics.pdf
16. http://en.wikipedia.org/wiki/Kalman_filter#Example_application.2C_technical
17. http://stanford.edu/class/ee363/lectures/kf.pdf
18. http://www.cl.cam.ac.uk/~rmf25/papers/Understanding%20the%20Basis%20of%20the%20Kalman%20Filter.pdf
19. http://www.cs.cornell.edu/Courses/cs4758/2013sp/materials/cs4758_kalmanexamples.pdf
20. http://en.wikipedia.org/wiki/Wiener_filter