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Edge Detection of Weld Images

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Abstract-This project purposes the study of image processing to obtain as much information possible from the image. This information is useful in biomedical, military and mechanical applications. In mechanical applications, weld images are the images of two metal pieces fused together having flaws and detecting these meaningful discontinuities in grey level of weld images that is the faults in the weld images is important considering industrial fields. In classical methods of analyzing the images, human experts make the quality control of welded joints by identifying defect characteristics in NDT images and the results depend on quality of images, previous experiences of human experts and their mental fitness. The classical process is slow and results are varying from expert to expert and even the same person can give different results for the same image depending on his mental state. Thus we have proposed this project which will edge detect and enhance the faults which can be easily seen.

Keywords: Image processing, gray scale,NDT

I. INTRODUCTION

Image processing is a subtopic of signal processing. As the modifications done with the date of image is signal processing. In Image processing, modification and enhancementof image results into another image. It is used to improve the quality of the image for human perception and data storage in computers. Image processing shrinks the data which is useful for transmission of images. It is divided into three levels i.e. Low level, Mid level and High level. Low level includes aspects such as brightness and contrast. Mid level includes image attributes that is segmentation, erosion, edges, etc. this project on image processing in weld images falls under Mid level Image processing.Edge is defined as the transformation from low value pixel to high value pixel. Sometimes, weldments are not properly joined together during the welding process due to different reasons, which produce flaws of different types in weldments. These flaws are seen in the form of gaps, cracks or pores and cavities. Common weld defects include—lack of fusion, lack of penetration or excess penetration, gas cavities, slag inclusions, cracks, undercuts, lamellar tearing, shrinking cavities etc.In an X-ray image of weldments, variation in intensity is caused by in homogeneity of the weldments. Light patches or lines seen on the films correspond to different types of discontinuities due to lack of penetration, cracks, cavities, slag inclusion, undercuts and shrinkage cavities. The thickness of material in welding process, weld type, weld position and radiographic methods plays an important role in image quality. The flaws can also be detected during the welding process on hot welds, which further helps in quality control as well as in cost reduction.Image processing plays an important role to detect flaws in weldments. With the help of image processing a semi-automated system can be developed which is more reliable as compared to the classical methods and also helpful in taking decision with the help of a set of manipulating tools. Edge detection forms a very important part in image processing. An edgeis defined as a boundary between two regions of relatively uniform intensity indicated by a strong gradient or discontinuity in intensity function.Various methods used for edge detection are as follows:

1.The **Sobel method** finds edges using the Sobel approximation to the derivative. It returns edges at those points where the gradient of I is maximum.
2.The **Prewitt method** finds edges using the Prewitt approximation to the derivative. It returns edges at those points where the gradient of I is maximum.
3.The **Roberts method** finds edges using the Roberts approximation to the derivative. It returns edges at those points where the gradient of I is maximum.
4.The **zero-cross method** finds edges by looking for zero crossings after filtering I with a filter you specify.
5.The **Canny method** finds edges by looking for local maxima of the gradient of I. The gradient is calculated using the derivative of a Gaussian filter. The method uses two thresholds, to detect strong and weak edges, and includes the weak edges in the output only if they are connected to strong edges. This method is therefore less likely than the others to be fooled by noise, and more likely to detect true weak edges.

II. PROBLEM DEFINITION

There are several flaws in image processing such as the lack of fusion results from too little heat input and/or too rapid traverse movement of the welding torch (gas or electric), Lack of penetration or excess penetration arises from a too high heat input and/or too slow movements of the welding torch (gas or electric),Gas cavities occur when gases are trapped in the solidifying weld metal. During solidification gases are trapped in the welded zone resulting in porosity, Slag inclusion is of different types. It can be of any shape in any direction—slag lines (elongated cavities containing slag or other foreign matter), wearing faults, faults from bad chipping, faults at electrode change, faults at junction of seams, Cracks areoften caused by Sulphur and phosphorus and are more likely to occur in higher carbon steels. They are of two types: longitudinal cracks and transverse cracks. Longitudinal cracks normally appear in straight lines along the centerline of the weld bead while transverse cracks are straight lines perpendicular to centerline and occasionally appear, Undercut is due to the reduced thickness of one (or both) of the sheets at the toe of weld, due to inaccurate settings/procedure, Lamellar tearing is mainly a problem with low quality steels. It occurs in plates that have low ductility with laminar segregation, Shrinkage cavities are due to thermal shrinkage or due to a combination of steam accompanying phase change and their shrinkage cavities

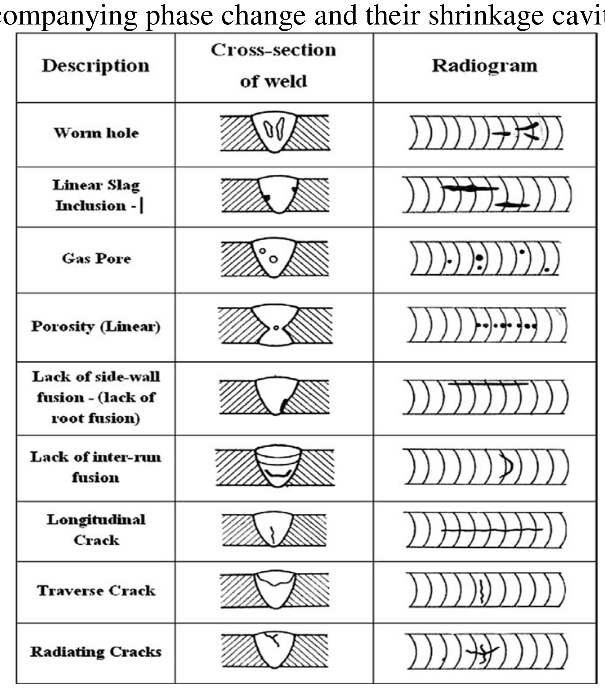


Fig.1:Flaws in weld images

III. PROPOSED METHODOLOGY

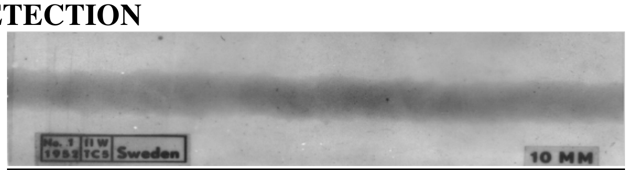
3.1 ALGORITHM

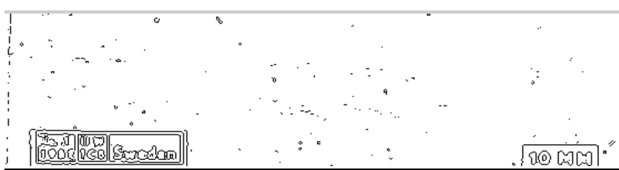
1. Image Acquisition is done.
2. Convolve an image g with a Gaussian of scale σ.
[Remember that this step is not explicitly necessary—simply convolve with derivatives of Gaussians when performing differentiation.]
3. Estimate local edge normal directions n for each pixel in the image.
[Remember: n is the gradient direction.]
4. Find the location of the edges (non-maximal suppression).
[i.e., find the zero crossings]
5. Compute the magnitude of the edge
[i.e., compute the gradient magnitude as well]
6. Threshold edges in the image with hysteresis to eliminate spurious responses.
[Threshold the gradient magnitude as discussed above.]
7. Aggregate the final information about edges at multiple scale using the 'feature synthesis' approach [3, 4].

IV. RESULTS AND DISCUSSIONS

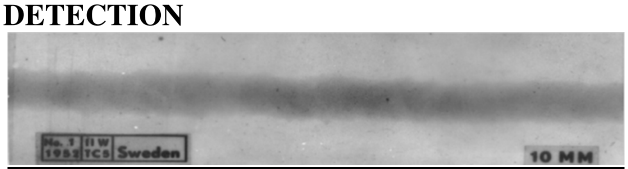
We have used a TIFF image and we have given a threshold of 0.03 to the image and edge detected it by five different methods as shown below:

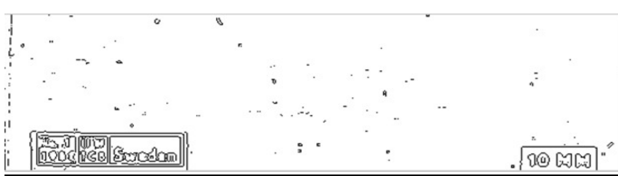
4.1: SOBEL EDGE DETECTION



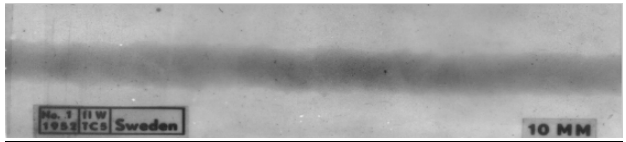


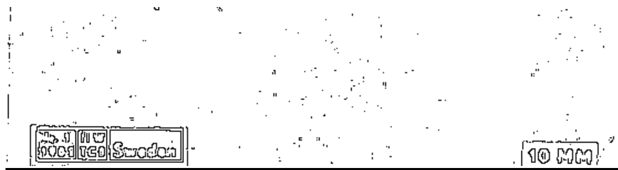
4.2: PREWITT EDGE DETECTION



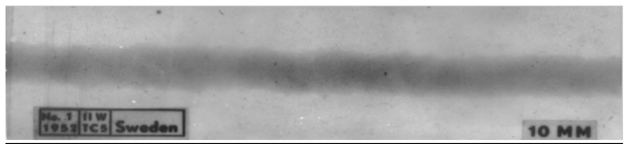


4.3: ROBERTS EDGE DETECTION

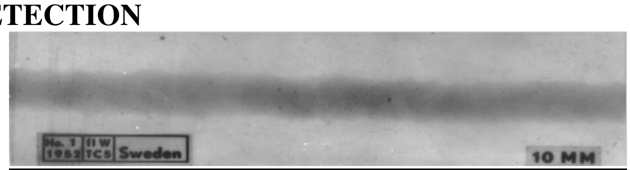


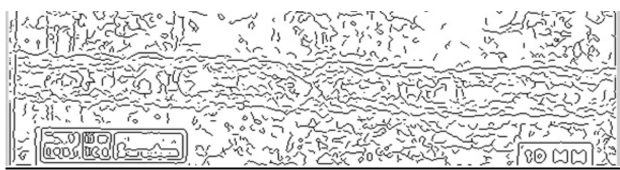


4.4: ZERO CROSSING EDGE DETECTION



4.5 CANNY EDGE DETECTION





V. FUTURE SCOPE

In the future, we can compare the results of various edge detection technique like canny edge detection, sobel edge detection and different parameters like PSNR and MSE.

VI. CONCLUSION

Edge detection helps in optimizing network bandwidth and it is needed to keep track of data flowing in and out of the network. It helps to extract useful features for pattern recognition. Although the Sobel operator is slower to compute, its larger convolution kernel smoothens the input image to a greater extent and so makes the operator less sensitive to noise. The larger the width of the mask, the lower its sensitivity to noise and the operator also produces considerably higher output values for similar edges. Sobel operator effectively highlights noise found in real world pictures as edges though; the detected edges could be thick. The Canny edge detector and similar algorithm solve these problems by first blurring the image slightly then applying an algorithm that effectively thins the edges to one pixel. Transferring a 2-D pixel array into a statistically uncorrelated data set enhances the removal of redundant data, which leads to the reduction of the amount of data required to represent a digital image. Considering data communication these days, especially the internet, massive data transfer causes serious problems for interactive network users and techniques such as these go a long way to enable faster data transfer and solve, to a certain extent, the memory consumption problem. The experiment proved that weld edge continuity is better and accurate result of positioning; pseudo edge is less, so the precision of the weld edge extraction is benefit to subsequent seam image feature points made good foundation.

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