

An extension to Image Analysis and Processing using High Frequency Filter (Artificial Intelligence and Neural networks)

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ABSTRACT: The purpose of this study is to detect the holes, cracks and any other minor faults in an oil pipe. Though there are existing man-made methods, to carry out a process through computerized software has not yet been invented. In this paper, high frequency filter-GTO detect discontinuities method, is used for image recognition. A camera is passed in to the pipe and the images taken by the camera is sent back, which is stored in a database. Later these images are viewed for defects using GTO detect method. The Camera images are converted into Raster images and they are read as pixel groups. If the pixel groups are clear, it denotes that the pipeline, is without any fault else even a small deterioration in any one of the pixel will make the picture blurred or unclear, to know the place where the corrosion has occurred. The blurred picture will help to locate the defected place in the pipeline, thus helping to make an effective and perfect path to carry oil or any other liquids without leakages and loss. The distance travelled by the camera through the entire pipeline has to be fixed for calculations and to recognize the blurred pixel group, algorithms has to be written, using HFF and GTO Techniques. As yet another technical usage, images can also be recognized using Laplacian Surfaces method.

I. INTRODUCTION

What is an oil pipe?

Pipelines are defined as the tubular arrangement for the transmission of crude oil, refined products, and natural gas from the wellhead, refinery, and storage facility to the customer. Pipeline measures 14 to 42 inches in diameter, but is usually 20 to 36 inches. It is often composed of 40-foot lengths but lengths may be as long as 60 or 80 feet. The pipe is wrapped and coated for protection against



Corrosion, especially since it runs underground. About half of all gas and oil is moved by pipeline.

A Pipe runs from the wells to the seaport.

How is it Cleaned, coated?

From the moment a pipe is coated with a Pipe clad fusion-bonded-epoxy coating, and installed into a harsh environment, maximum corrosion protection is assured. The unique chemical characteristics of our coating are carefully engineered for optimum protection of pipes.

Pipe clad fusion-bonded-epoxy coating protects against underground soil stress, bacteria and fungus attacks, soil acids and alkalis—as well as the corrosive elements associated with underwater use, including saltwater, waste water, petrochemicals, solvents and corrosive gases.

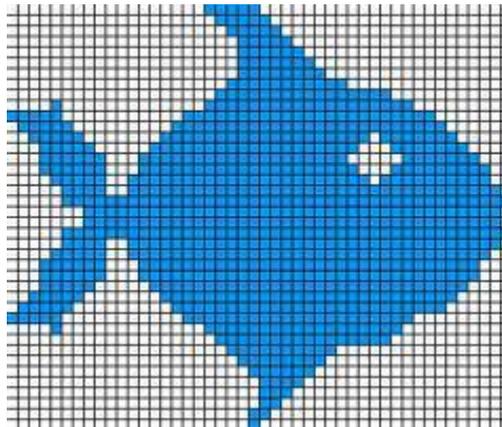
These coatings are designed for application on a wide variety of pipe sizes and wall thickness and can be utilized as the corrosion layer for a single, dual and three layer applications.

What is our Goal?

This paper is going to help us to find the defected parts in a coated pipeline, using a computerized program. A camera is sent inside the pipeline, where the pictures are taken and sent back to the system and it is stored in a database.

The camera travels to the entire length of a pipe, records the image for further study. The data in the database is analyzed using an algorithm, where the pixel images which are converted to Raster images are read for defects.

Raster Images



A Raster image, also called a bitmap is a way to represent digital images. It can be created in a wide variety of formats, including the familiar .gif, .jpg, and .bmp. The image is represented in a series of bits of information that translate into pixels on the screen. These pixels form points of colour that create an overall finished image.

When a raster image is created, the image on the screen is converted into pixels. Each pixel is assigned a specific value that determines its colour. This format uses the red, green, blue (RGB) colour system. An RGB value of 0,0,0 would be black, and the values go all the way through to 256 for each colour, allowing the expression of a wide range of values. In photographs with subtle shading, this can be extremely valuable.

When the image is viewed, the pixels usually smooth out visually for the user, who sees a photograph or drawing. When blown up, however, the individual dots of color become apparent. While this effect is sometimes a deliberate choice on the part of an artist, it is usually not desired. Depending on resolution, some images can be enlarged to very large sizes, while others quickly become difficult to see. The smaller the resolution, the smaller the digital image file, so people who work with computer graphics must find a balance between resolution and image size.

The algorithm used for investigations is an unsupervised learning algorithm.

Image Analysis

Image analysis combines techniques that compute statistics and measurements based on the gray-level intensities of the image pixels. The image analysis function is used to determine whether the image quality is good enough for an inspection task. An image is analyzed, to understand its content and to decide which type of inspection tools to use to handle the application. Image analysis functions also provide measurements to perform basic inspection tasks such as presence or absence verification.

Image Processing

Using the information gathered from analysing the image, quality of the image has to be improved by inspection. Tools that can be used to improve image includes lookup tables, spatial filters, grayscale morphology, frequency-domain processing, blob analysis and unsupervised algorithm.

Blob Analysis

A blob (binary large object) is an area of touching pixels with the same logical state. All pixels in an image that belong to a blob are in a foreground state. All other pixels are in a background state. In a binary image, pixels in the background have values equal to zero while every nonzero pixel is part of a binary object. Blob analysis is used to detect blobs in an image and make selected measurements of those blobs. Blob analysis consists of a series of processing operations and analysis functions that produce information about any 2D shape in an image.

Blob analysis is used, for finding blobs, whose spatial characteristics satisfy certain criteria. In many applications where computation is time-consuming, blob analysis is used to eliminate blobs that are of no interest based on their spatial characteristics, and keep only the relevant blobs for further analysis.

Statistical Blob Analysis

Blob Analysis can be used to find statistical information-such as the size of blobs or the number, location, and presence of blob regions. With this information, many machines performs vision inspection tasks, such as detecting flaws on oil pipelines, silicon wafers, detecting soldering defects on electronic boards, or Web inspection applications such as finding structural defects on wood planks or detecting cracks on plastics sheets. Objects in motion control applications are also located, when there is significant variance in part shape or orientation.

In applications where there is a significant variance in the shape or orientation of an object, blob analysis is a powerful and flexible way to search for the object. A combination of the measurements obtained through blob analysis can be used to define a feature set that uniquely defines the shape of the object.

What is GTO?

Gate turn-off thyristors (GTOs) are four-layer PNP devices that act as switches, rectifiers, and voltage regulators. Like other **thyristors**, GTOs can be turned on by the application of a positive **gate** signal ($g > 0$); however, unlike other more conventional devices that can be turned off only at a zero crossing of current, GTOs can be turned off at any time by the application of a **gate** signal equal to zero.



Photo Courtesy of Yxlon International

A Pipeline Inspection done manually

Why unsupervised algorithm?

In machine learning, **unsupervised learning** refers to the problem of trying to find hidden structure in unlabelled data. Since the examples given to the learner are unlabelled, there is no error or reward signal to evaluate a potential solution.

This distinguishes unsupervised learning from supervised learning and reinforcement learning. Unsupervised learning is closely related to the problem of density estimation in statistics. However unsupervised learning also encompasses many other techniques that seek to summarize and explain key features of the data. Approaches to unsupervised learning include:

- 1) Clustering (e.g., k-means, mixture models, hierarchical clustering),
 - 2) blind signal separation using feature extraction techniques for dimensionality reduction
- Among neural network models, the self-organizing map (SOM) and adaptive resonance theory (ART) are commonly used unsupervised learning algorithms.

Motivation:

Micro array images challenge existing analytical methods in many ways given that gene spots are often comprised of characteristic imperfections. Irregular contours, donut shapes, artifacts, and low or heterogeneous expression impair corresponding values for red and green intensities as well as their ratio R/G. New approaches are needed to ensure accurate data extraction from these images.

A novel method is introduced for intensity assessment of gene spots.

The technique is based on clustering pixels of a target area into foreground and background. For this purpose we implemented two clustering algorithms derived from k-means and Partitioning Around Medoids (PAM) respectively. Results from the analysis of real gene spots indicate that our approach performs superior to other existing analytical methods. This is particularly true for spots generally considered as problematic due to imperfections or almost absent expression. Both PX_{PAM} and PX_{KMEANS} prove to be highly robust against various types of artifacts through adaptive partitioning, which more correctly assesses expression intensity values.

Availability: The implementation of this method is a combination of two complementary tools Extractiff (Java) and Pixclust (free statistical language R).

Study

Implementation for this paper starts with the pixel reading, the data in the database is read, each and every pixel is verified using the unsupervised algorithm. During pixel examination, even a small error or blurred image, whose pixels are stored as mismatched data, are identified and they are further studied to find the defected part in the pipeline.

If there is a hole or a crack in the pipeline, the pixel image is not a clear one, the image is not visible properly and the data stored as pixel bits, will show the level of the defect with the help of the density of the bit-map or Raster image. The step by step process carried out by the algorithm:

- Process 1: Evaluate the entire pipeline and save the images
- Process 2: Convert the images in to Raster type images using the algorithm
- Process 3: Feed the pixel data in to the database
- Process 4: Read the data using the algorithm to find the errors
- Process 5: Match the data with the bit-maps to find out the exact location of the defects
- Process 6: Convert the defected Raster image to normal images to rectify the defects in the pipeline

II. CONCLUSION

The data match with the image match gives clear verification for the process to work in a very innovative way, much to be discussed and developed to carry out this for a better implementation.

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.Software java and pixclust is available on request