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# Automatic ECG Anomalous Identification Using XML Data Processing

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**Abstract:** ***Electrocardiography is the recording the electrical task of the heart. Traditionally this is in the form of a transthoracic interpretation of the electrical activity of the heart over a period of time. Existing methodology focuses on diagnosing the 37 cardiac abnormalities by using XML ontology and ontological schema to identify the disease acquired. This methodology does not tune-up the image of the ECG before processing as the noise percentage misleads to the diagnosis report. In the proposed methodology, an image validation of histogram check is formulated to rectify the noise acquired in the input ECG Image. The Validated ECG sample image has been measured with its height and amplitude to measure the abnormalities using XML ontology. Thus the proposed system overcomes the conflicts faced in the existing system and the performance in terms of time and accuracies has been visualized graphically.***

**Keywords:** Electrocardiography, XML, Ontology, ECG Image, Image Validation, HL7.

## 1. Introduction

Image process is any type of signal process that the input is a picture, like a photos or video frames. The output of image process is also either a picture or a group of characteristics or parameters associated with the picture. Approximately, in the image processing techniques involve to perform the image as a two dimensional signal and applying common place signal processing techniques. Image process typically refers to digital image process, however optical and analogue image processes are also doable. This text is concerning general techniques that apply to any or all of them. The acquisition of pictures (producing the input image within the initial place) is stated as imaging. The projected system overcomes the matter of false prediction of syndrome by substantiating the input image mistreatment bar graph techniques that validates the element for additional process .The resultant of the projected system generates the syndrome diagnosing with a legitimate input image thereby distinguishing the rhythm ,endpoint and axis positions of the curve.

Electrocardiography (ECG or EKG from Greek: kardia, meaning heart) is the recording of the electrical activity of the heart. Traditionally this is in the form of a transthoracic (across the thorax or chest) interpretation of the electrical activity of the heart over a period of time, as detected by electrodes attached to the surface of the skin and recorded or displayed by a device external to the body. The recording produced by this non-invasive procedure is termed an electrocardiogram (also ECG or EKG). It is possible to record ECGs invasively using an implantable loop recorder.

An ECG is used to measure the heart's electrical conduction system. It picks up electrical impulses generated by the polarization and depolarization of cardiac tissue and translates into a waveform. The waveform is then used to measure the rate and regularity of heartbeats, as well as the size and position of the chambers, the presence of any damage to the heart, and the effects of drugs or devices used to regulate the heart, such as a pacemaker.

Most ECGs are performed for diagnostic or research purposes on human hearts, but may also be performed on animals, usually for diagnosis of heart abnormalities or research.

Small metal electrodes are stuck on to your arms, legs and chest. Wires from the electrodes are connected to the ECG machine. The machine detects and amplifies the electrical impulses that occur at each heartbeat and records them on to a paper or computer. A few heartbeats are recorded from different sets of electrodes. The test takes about five minutes to do.
The electrodes on the different parts of the body detect electrical impulses coming from different directions within the heart. There are normal patterns for each electrode. Various heart disorders produce abnormal patterns. The heart disorders that can be detected include:

- Abnormal heart rhythms. If the heart rate is very fast, very slow, or irregular. There are various types of irregular heart rhythm with characteristic ECG patterns.
- A heart attack (myocardial infarction), and if it was recent or some time ago. A heart attack causes damage to heart muscle, and heals with scar tissue. These can be detected by abnormal ECG patterns.
- An enlarged heart. Basically, this causes bigger impulses than normal. Examples of ECG patterns in different heart conditions are found at www.ecglibrary.com

An ECG is a simple and valuable test. Sometimes it can definitely diagnose a heart problem. However, a normal ECG does not rule out serious heart disease. For example, you may have an irregular heart rhythm that 'comes and goes', and the recording can be normal between episodes. Also, not all heart attacks can be detected by ECG.

Angina, a common heart disorder, cannot usually be detected by a routine ECG. Specialised ECG recordings sometimes help to overcome some limitations. For example:

- Exercise ECG. This is where the tracing is done when you exercise (on a treadmill or exercise bike). This helps to

assess the severity of the narrowing of the coronary arteries which causes angina.
- Ambulatory ECG. This is where you wear a small monitor which constantly records your heart rhythm. This test records the electrical activity of your heart when you are walking about (ambulatory) and doing your normal activities. It aims to detect abnormal heart rhythms that may 'come and go'. The electrical activity is usually recorded for 24-48 hours.

General symptoms indicating use of electrocardiography include:
- Symptoms of myocardial infarction
- Symptoms of pulmonary embolism
- Cardiac murmurs
- Syncope or collapse
- Seizures
- Perceived cardiac dysrhythmias

It is also used to assess patients with systemic disease, as well as monitoring during anaesthesia and critically ill patients.

### 1.1 Extensible Mark-Up Language

**Extensible Mark-up Language** (**XML**) is a mark-up language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable. It is defined by the W3C's XML 1.0 Specification and by several other related specifications, all of which are free open standards.

The design goals of XML emphasize simplicity, generality and usability across the Internet. It is a textual data format with strong support via Unicode for different human languages. Although the design of XML focuses on documents, it is widely used for the representation of arbitrary data structures such as those used in web services.
Several schema systems exist to aid in the definition of XML-based languages, while many application programming interfaces (APIs) have been developed to aid the processing of XML data.

## 2. Related Work

By using ECG digital data as inputs, abnormal cardiac conditions can be automatically diagnosed but sometimes produces wrong report .So we using image acquisition to get a data from the ECG Image. And use Histogram Validation to improve the quality of the image to generate diagnosis report automatically. [1] This system develop with two different model they are a) develop an ontological model and subsequent software system to promote open exchange and presentation of ECG data; and b) use this ontology as an aid for the automatic diagnosis of a number of common cardiac abnormalities that may be present in ECG output. The general approach was to make use of an emerging standard for electronic exchange of medical data; to develop ontology for the explicit specification of such a standard; to implement this ontology in a widely accepted machine readable format so that ECG data exchange can be done efficiently without the need of proprietary algorithms or software; and finally, to use the ontology as the basis for automated ECG diagnosis of 37 specific cardiac abnormalities. This research included data from 12-lead ECGs operating both in at-rest situations and in continuous monitoring situations such as ambulatory recordings. [2]This tool is use to decrease time and work pressure for busy physicians. Not accurate to find a defects. Tool was designed to detecting heart defects such as irregular heartbeat and heart blocks using Electrocardiogram signal analysis dependent on the time and frequency domain spectrum. Also used to provide local clinics with computer aided electrocardiogram diagnostic tool used to reduce time and work pressure for busy physicians particularly in areas anywhere only one general doctor is employed and amore number of cases is to be diagnosed. This tool was mainly used to detecting heart defects such as cardiac arrhythmias and heart blocks using Electrocardiogram signal analysis depending on the time domain representation and frequency domain spectrum. [3] Image retrieval is a technique to retrieving the information from the image. The ECG waveform is the P wave, QRS complex and T wave. Additionally a small U wave is occasionally present. The cardiac cycle starts with the P wave which similar to the period of atrial depolarization in the heart. This is followed by the QRS complex, which is generally the most genuine feature of an ECG waveform and similar to the period of ventricular depolarization. Unfortunately this side-effect was not detected in the clinical trials and only came to light after a large number of people had unexpectedly died whilst taking the drug. In this paper we consider the problem of automated ECG interval analysis from a machine learning perspective. In particular, we examine the use of hidden Markov models for automatically segmenting an ECG signal into its constituent waveform features. A redundant wavelet transform is used to provide an informative representation which is both robust to noise and tuned to the morphological characteristics of the waveform features. Finally we investigate the use of hidden semi-Markov models for explicit state duration modeling. [4] PhysioNet provides to access web freely to over 50collections of recorded physiologic signals, time series, and related open-source software, in support of basic, clinical, and applied research in medicine, physiology, public health, biomedical engineering and computing, and medical instrument design and evaluation. It has three major components: 1) PhysioBank is a large and growing archive of well characterized digital recordings of physiologic signals, time series, and related data for use by the biomedical research community. 2) PhysioToolkit is a large and growing library of software for physiologic signal processing and analysis, detection of physiologically significant events using both classical techniques and novel methods based on statistical physics and nonlinear dynamics, interactive display and characterization of signals, creation of new databases, simulation of physiologic and other signals, quantitative evaluation and comparison of analysis methods, and analysis of non-equilibrium and non-stationary processes. 3) PhysioNetWorks is a virtual laboratory for development of data and software resources that will eventually become components of PhysioBank and PhysioToolkit. By providing large, secure workspaces with redundant backup to active researchers who can easily share them with colleagues anywhere, PhysioNetWorks encourages investigators to create well-organized and documented, usable data and software repositories during the conduct of their research. [5]

HL7 a ECG Implementation Guide, **HealthLevel7** refers to a set of international standards for transfer of clinical and administrative data between Hospital information systems. Use only XML based data formats. The Food and Drug Administration start again to be concerned about calculate non cardiac drugs for negative cardiac effects. After all, the Food and Drug Administration could not systematically calculate the Electrocardiogram waveforms and measurement areas those findings arrived from. Most Electrocardiograms in practical test were collected with papers and not electronically saved. The next logical process for the Food and Drug Administration was to ask for the digital waveforms and measurement locations be made vacant with the request. A required process for submitting the ECG waveforms and measurements to the Food and Drug Administration was to have a regular format for the information. An estimate the existing ECG waveform values found no existing values that met all the Food and Drug Administration*'s* requirements. [6] There is a need to develop methods to harmonize electrocardiogram data representation and management. The prevalence of multiple electrocardiogram data formats and devices, together with the variety of architectures and platforms for storing, reading and viewing ECG data that are currently in operation motivates the need for a unified, platform- and device independent approach to such tasks. Attempts to address this problem include the Standard Communications Protocol for Computer-Assisted Electrocardiography .This standard allows the representation of the ECG waveforms, patient demographics, as well as measurement and interpretation results. Although this protocol is well-documented and supported by a professional community, the utilization of SCP-ECG has demonstrated some disadvantages. The advantage of representing ECG with ECGML is the same as the advantages of XML itself. [7] **HEART** arrhythmias result from any disturbance in the rate, regularity, and site of origin or conduction of the cardiac electric impulse. Broadly speaking, arrhythmias can be divided into two groups. The first group includes ventricular fibrillation and tachycardia which are life-threatening and require immediate therapy with a defibrillator. Detection of these arrhythmias is well researched and successful detectors have been designed with high sensitivity and specificity. This study investigated the second group which includes arrhythmias that are not imminently life-threatening but may require therapy to prevent further problems. It consists of three stages are a pre-processing stage, a processing stage and a classification stage. Automatic heartbeat detection results in some errors in heartbeat detection and this will cause a reduction in the performance of the presented heartbeat classifier method. [8] **T**he ECG is the most commonly performed cardiac test. With the rapid development of telemonitoring platforms based on the new information and communication technologies, the transmission, storage, and management of digital ECG signals have turned into major topics of debate and investigation. Within the context of this debate, the standardization of these processes has been a key issue lasting recent decades. Indeed, several competing formats and standards for the representation, storage and exchange of ECG recordings can be found in the digital ECG standardization arena. Such formats and standards have successfully been applied in prototypes or even real environments, as has been remarked in much of the relevant bibliography. In order to partially solve this problem, numerous mappings between digital ECG formats and standards have been proposed in the literature. In this context, this review paper provides 1) a comprehensive enumeration and a concise overview won existing digital ECG formats and standards, 2) a collection of the main applications and cardiology settings using such formats and standards, 3) a thorough compilation of the relationships and mappings between the formats and standards available in the literature, and 4) a reflection on the current situation and foreseeable future of the interoperable exchange of ECG signals.

## 3. Proposed Approach

In the proposed approach, incorporates a technique of automatic generation of diagnosis report with ECG image that will be a useful innovation to the medical field. The manipulation of diagnosis report with the ECG curve acquires many variations in heartbeat such as irregular, slow, fast and normal. A validation process is incorporated in the proposed system to remove the noisy information from the inputted image as it deceives the accuracy of the diagnosis report. Adjust horizontal and vertical resolution because of given image is supportable to your system. Get the points from the image clearly with the help of gray scale conversation. Image Segmentation is the process of dividing images into multiple parts. This is typically used to indentify objects or other relevant information in digital image. An ontological schema is designed to identify the cardiac predictions of curves and xml schema is exploited in an approach to map the ontological schema information with the inputted image. This XML Schema is used to encoding documents in a format which is both human readable and machine readable purpose. And finally generate the diagnosis report. Below diagram shows overall process of the proposed system.

Existing system attains the problem of inappropriate diagnosis as the inputted ECG image sample acquires noisy information that leads to false prediction of syndromes. The proposed system overcomes the problem of false prediction of syndrome by validating the input image using histogram techniques that validates the pixel for further processing. The resultant of the projected system generates the syndrome diagnosis with a valid input image thereby identifying the rhythm, endpoint and axis positions of the curve.In the planned methodology, a picture validation of bar chart check is developed to rectify the noise non inheritable within the input electrocardiogram Image. The valid electrocardiogram sample image has been measured with its height and amplitude to live the abnormalities victimization XML metaphysics. Segmentation is the allocation of every pixel in an image to one of a number of categories, which correspond

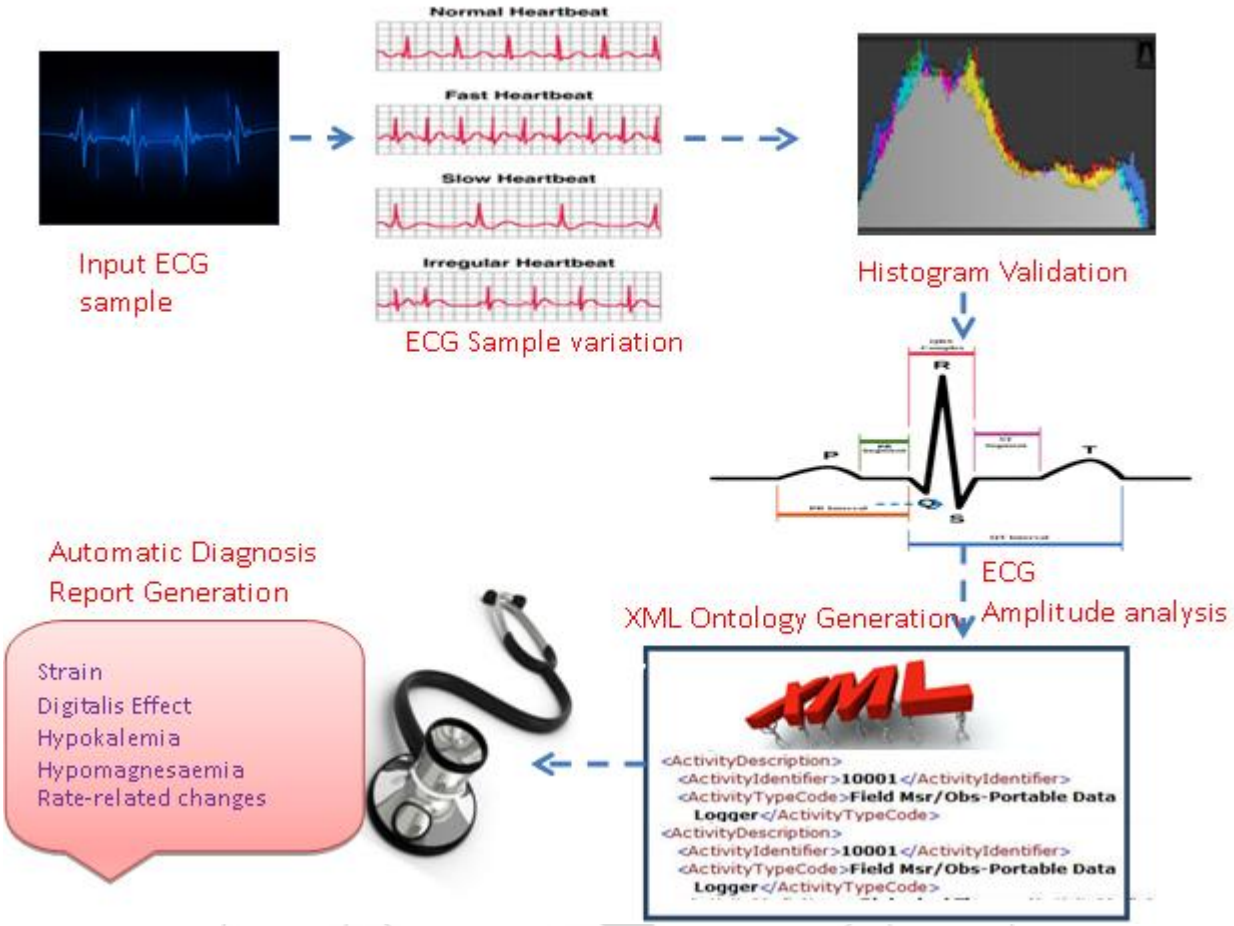


**Figure 1**: System Architecture

to objects or parts of objects. Commonly, pixels in a single category should have similar pixel values, form a connected region in the image, be dissimilar to neighbouring pixels in other categories.

### 3.1 Segmentation Algorithm

Segmentation algorithms may either be applied to the original images, or after the application of transformations and filters. Three general approaches to segmentation are: thresholding, edge-based methods and region-based methods.

1) Region-based segmentation: In region-based segmentation algorithms operate iteratively by grouping together pixels which are neighbors and have similar values and splitting groups of pixels which are dissimilar in value. Region-based methods can be similarly categorized into: those which merge pixels, those which split the image into regions, those which both split-and-merge in an iterative search scheme.
2) Edge-based segmentation: Detects and links edge pixels to form contours. Edge detection is the most common approach for detecting meaningful discontinuities in gray level .An edge is the boundary between two regions with relatively distinct grayscale level properties. In edge based segmentation, an edge filter is applied to the image, pixels are classified as edge or non-edge depending on the filter output, and pixels which are not separated by an edge are allocated to the same category. Results show the boundaries of connected regions after applying Prewitt's filter and eliminating all non-border segments containing fewer than 500 pixels.

### 3.2 Ontology Schema

An ontology - based system representing structure for the presentation, measurement of ECG data, and criteria for diagnosis was developed. The structure of the ontology was synthesized from existing data descriptions as listed in the HL7 medical device communication standard, the technical and clinical literature and recommendations from cardiac surgeons. The ontology integrates the ECG waveform data with HL7 textual measurement and diagnosis descriptions. In addition, through the type entitled Criteria, the developed ontology improves the use of the HL7 medical device communication standard by adding causal linkages between ECG measurements and abnormal conditions that represents a comprehensive set of diagnosis rules that draw upon HL7 measurements.

## 4. Modules

Following are the most frequently used project management Methodologies in the project management practice:

1. Image acquisition
2. Histogram image validation
3. Image segmentation
4. Ontology and XML schema mapping
5. ECG diagnosis report generation

### 4.1 Image Acquisition

In this Image acquisition module defined as the action of retrieving an image from some source, usually a hardware-based source, so it can be passed through whatever processes need. Performing image acquisition in image processing is always the first step in the workflow sequence because, without an image, no processing is possible.

### 4.2 Histogram Image Validation

This method usually increases the contrast and density of images because get the accurate data from the image. Through this adjustment, the intensities can be better distributed on the histogram.

### 4.3 Image Segmentation

Image Segmentation is the process of dividing images into multiple parts. This is typically used to indentify objects or other relevant information in digital image. It typically used to locate objects and boundaries like as lines, curves etc.., in images. Signal contains noise components due to various sources that are suppressed during processing of ECG signal.

### 4.4 Ontology and XML Schema Mapping

Ontology Schema Mapping is used to Identify Cardiac Predication of Curves.XML Schema are used to encoding documents in a format which is both human-readable and machine – readable.

### 4.5 ECG Diagnosis Report Generation

Finally it generates a diagnosis report for particular image. With the help of web browser to generate the report.

## 5. Conclusion

In this paper we have generate an diagnosis report, Where only developed ontology provides a structure for the representation and open exchange of ECG data so that it can be made readily available for viewing on a multitude of computing platforms. In addition, by using ECG digital image as inputs, abnormal cardiac conditions can be automatically diagnosed and presented. By using a gray scale conversion to get an accurate point from an ECG image. The ontology was encoded in XML vocabularies providing human and machine readable formats, allowing it to be displayed in an Internet browser. And we finally generate the diagnosis report.

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