# NEURAL NETWORKS: APPLICATION IN GALLBLADDER CANCER DETECTION

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## ABSTRACT

*Gallbladder cancer is one of the biggest challenges in medicine and one of the leading causes of deaths in world. The cost and human expertise involved in diagnose delays the process itself and in majority cases it is detected when it is too late to start the treatment. We have proposed a method to speed up the diagnosis process and reduce the cost using of a new methodology in application artificial neural networks to the medical diagnosis images.*

*Keywords: Artificial Neural networks, Endoscopic Ultrasound Elastography*

## INTRODUCTION

Artificial neural network models have been studied for many years in the hope of achieving human like performance in several fields such as speech and image understanding. An increasing occurrence of cancer cases around the world and especially in developing countries has alarmed the researchers to investigate the use of neural networks in early and correct diagnosis of cancer [1]. Cancer is the leading cause of death in economically developed countries and the second leading cause of deaths in developing countries. Gallbladder cancer is most common cancer in males and is sometimes medically correlated to gallbladder stone which is not seen as a serious disease.

The usage of diagnostic tests to detect cancer in early stages provides brighter chances for patients to obtain effective treatment with reduced side effects. Patients whose cancers are found in early stage and treated in a timely manner are likely to survive these cancers compared to those in whom cancers remain hidden until symptoms appear. Until recently biopsy (medical and needle biopsy) had been the only tool to detect cancer. Because the gallbladder is located deep inside the body, early tumors cannot be seen or felt during routine physical exams. Presently there are no blood tests or other tests that can reliably detect gallbladder cancers early enough to be useful as screening tests. (Screening is testing for cancer in people without any symptoms.) Without effective screening tests, most gallbladder cancers are found only when the cancer has grown enough to cause symptoms and is in the later stage where the treatment is in vain [2].

The images produced by other diagnostic tests such as tomography etc are complex to understand and comment on. It requires experienced and skilled physicians to study these images before concluding weather the test is positive for cancer or not. In many cases where

the tissue is benign but to avoid a slight risk of wrong diagnose, physicians recommend costly treatment like chemotherapy to the patient. Chemotherapy is not only painful but also not required in such cases where it is doubtful to ascertain the presence of cancer. If cancer is present and its presence has been ignored then is surely going to delay the treatment process which cannot be started on a later stage. So it is dependent on the skill of physician to correctly diagnose the disease.

Since this skill is not only used for the perception of facts but also for knowledge, ways of providing computers with this same pattern processing skill of human beings has been sought for [3]. This could lead not only to a simpler way of using computers, but also to more efficient applications in real world tasks. This possibility has increased the interest to understand how to handle information expressed as patterns.

## ARTIFICIAL NEURAL NETWORKS

An artificial neural network (ANN) is a computational model that attempts to account for the parallel nature of the human brain [3]. Artificial Neural Networks are a programming paradigm that seek to emulate the structure of the brain, and are used extensively in artificial intelligence problems from simple pattern-recognition tasks, to advanced symbolic manipulation. The Multilayer Perceptron is an example of an artificial neural network that is used extensively for the solution of a number of different problems, including pattern recognition and interpolation. It is a development of the perceptron neural network model that was originally developed in the early 1960s. ANN is a network of highly interconnecting processing elements (neurons) operating in parallel. These elements are inspired by biological nervous systems. As in nature, the connections between elements largely determine the network function. A subgroup of processing element is called a layer in the network. The first layer is the input layer and the last layer is the output layer. Between the input and output layer, there may be additional layer(s) of units, called hidden layer(s). Fig.1 represents the typical neural network with one input layer, one hidden . You can train a neural network to perform a particular function by adjusting the values of the connections (weights) between elements.

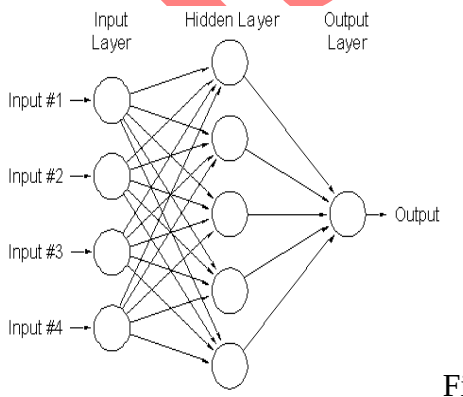


Fig 1. A Neural Network model

## ENDOSCOPIC ULTRASOUND ELASTOGRAPHY (EUSE)

Medical Diagnosis using Artificial Neural Networks is currently a very active research area in medicine and it is believed that it will be more widely used in biomedical systems in the next few years. This is primarily because the solution is not restricted to linear form. Neural Networks are ideal in recognizing diseases using scans since there is no need to provide a specific algorithm on how to identify the disease.

Florin Gorunescu, Marina Gorunescu, Smaranda Gorunescu, Adrian Saftoiu, Peter Vilmann investigated the potential contribution of a technique of Artificial Intelligence - the neural network - in computer-aided gallbladder cancer detection [4]. The group used Endoscopic UltraSound Elastography (EUSE) a newly developed imaging procedure that characterizes the differences in the hardness and strain between diseased tissues and normal tissues. This information can be obtained during real-time scanning with the results being displayed in color superimposed on the conventional grey-scale image. Colors express the difference in elasticity between healthy and diseased tissues. EUSE has been used in several pilot studies for the characterization and differentiation of benign and malignant lymph nodes, with sensitivity, specificity and accuracy which vary but are higher than with conventional EUSmethods

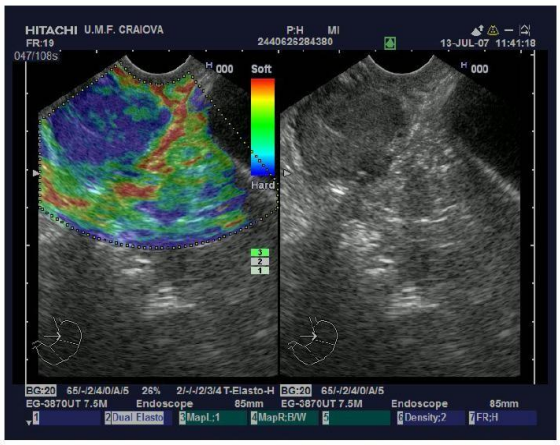


Fig 2. EUSE sample movie frame showing a hard tumor mass (depicted with blue), in contrast with the soft surroundingtissues.

## CONCLUSION

The conclusion of the above study is the application of neural networks models in non-invasive cancer diagnosis, using EUSE sample movies, represents a promising complementary method, enhancing and supporting the differential diagnosis of benign and malignant tumors made by physicians, in real time and with a high degree of accuracy, compared to traditional methods, but much faster. For future work different techniques like Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), projection pursuit, and Independent Component Analysis (ICA) can be applied, so as to achieve a suitablesegmentation.Thecharacteristictobeusediscolor,inorderforthesolution

proposed to be general. Better results can be obtained using definition of a new clustering algorithm based on re-definition of the input image.

As for the classification stage, different solutions using neural networks can be compared, the results obtained being accepted where error is less than 10%.

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