

Exsys Case Study



Diagnosing Heart Diseases by Signal Processing

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Auscultation is the science of listening to the sounds of internal body organs, in this case the heart. Skilled experts can make diagnoses using this technique. It is a non-invasive screening method of providing valuable information about the conditions of the heart and its valves, but it is highly subjective and depends on the skills and experience of the listener. Researchers from the Department of Electrical & Electronic Engineering at Universiti Teknologi Petronas, have developed an Exsys Corvid expert system, SIPMES (Signal Processing Module Integrated Expert System), to analyze digitally processed heart sound.

The system utilizes digitized heart sound algorithms to diagnose various conditions of the heart. Heart sounds are effectively acquired using a digital electronic stethoscope. The heart sounds were collected from the Institut Jantung Negara (National Heart Institute) in Kuala Lumpur, and the Fatimah Ipoh Hospital in Malaysia. A total of 40 patients aged from 16 to 79 years old with various pathologies were used as the control group, and to test the validity of the system using their abnormal heart sound samples and other patient medical data.

The heart sounds are transmitted using a wireless link to a nearby workstation that hosts the Signal Processing Module (SPM). The SPM has the capability to segments the stored heart sounds into individual cycles, and identifies the important cardiac events.

The SPM data was then integrated with the Exsys Corvid knowledge automation expert system. The rules in the system use expert physician reasoning knowledge, combined with information acquired from medical journals, medical textbooks, and other noted publications on cardiovascular diseases (CVD). The system provides the diagnosis, and generates a list of diseases arranged in descending order of their probability of occurrence.

SIPMES was designed to diagnose all types of cardiovascular heart diseases. The system can help general physicians diagnose heart diseases at the earliest possible stages under emergency situations where expert cardiologists and advanced medical facilities are not readily available.

The diagnosis made by the system has been counter checked by senior cardiologists, and the results coincide with these heart experts. A high coincidence factor of 74% has been achieved using SIPMES.



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