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HEARTBEAT DISEASE DIAGNOSIS USING TEXT-BASED APPROACHES

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HEARTBEAT DISEASE DIAGNOSIS USING TEXT-BASED APPROACHES

By

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Dedicated to my dear parents
Abstract of thesis to be presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirements for the degree of Master of Science

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Heart sound signals are the important asset for heart examination in primary healthcare centers to aid significantly in the diagnosis of heart diseases. Interpretation of heart sounds is a problematic and difficult skill that requires cardiology specialists. The diagnosis of heart disease from heart sound can differ between cardiologists and would require more detailed and expensive tests. However, heart disease diagnosis by heartbeat is preferable and still widely used as the first step to diagnosis. Computer aided auscultation has emerged as a cost-effective technique to analyze and interpret the heart sounds. Digital heart sound recordings with background noise, similarity among heart diseases, recording environment conditions, auscultation body points makes detection of heart diseases complicated.
There are several methods for automated detection and classification of heart diseases and heart sound analysis that have been proposed. Some of them used Artificial Neural Network method for detection and classification of heart sounds. Another technique that it used for diagnosis the heart problem is Hidden Markov Model (HMM) that they suggest HMM for segmentation of heart sound recorded for clinical and classification purpose. However, to the best knowledge of the researcher, no prior study has encoded heart sound to text string.

In this study, we propose a feasible technique for developing a heartbeat sound retrieval system using text encoding techniques which is useful towards automated heart disease detection. The audio format of heart sound recordings are preprocessed and transcribed into the MIDI format. The MIDI files are then encoded to text strings using the pitch and duration information based on n-gram, these text strings then form musical words. These text strings are then indexed and tested for retrieval using both database and Information Retrieval (IR) systems. The Longest Common Subsequence (LCS) matching algorithm was used for identifying similarities from the database. With IR, full text indexing of the recordings was used and retrieved using known item searches from a search engine.

The feasibility of these text encoding techniques were shown from retrieval experiments with around 100 digital heart sound recordings. Overall, experimental results performed clearly showed the feasibility of using proposed text encoding techniques for diagnosing heart problems. Thus, it can be said that the results
presented for heart sound retrieval system are very promising for queries in Normal and Abnormal heart sound categories.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

DIAGNOSIS PENYAKIT DEGUPAN JANTUNG MENGUNAKAN PENDEKATAN TEXT-BASED

Oleh

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Pentafsiran degupan jantung merupakan kemahiran yang sukar dan bermasalah serta memerlukan pakar kardiologi. Diagnosis penyakit jantung daripada degupan jantung boleh berbeza di kalangan pakar kardiologi dan memerlukan ujian yang lebih terperinci dan mahal. Walau bagaimanapun, diagnosis penyakit jantung melalui degupan jantung adalah lebih baik dan digunakan secara meluas sebagai langkah pertama untuk diagnosis. Auscultation berbentuk komputer telah muncul sebagai teknik kos yang berkesan untuk menganalisis dan mentafsir degupan jantung. Rakaman digital degupan jantung dengan latar belakang bunyi bising, kesamaan antara penyakit jantung, keadaan rakaman persekitaran, dan auscultation tubuh badan telah merumitkan lagi pengesanan penyakit jantung.

Beberapa kaedah untuk pengesanan automatic, klasifikasi penyakit jantung, dan analisis degupan jantung telah dicadangkan. Sebahagian daripada mereka
menggunakan kaedah Artificial Neural Network untuk mengesan dan klasifikasi degupan jantung. Satu lagi teknik yang digunakan untuk diagnosis masalah jantung ialah Hidden Markov Model (HMM) yang mencadangkan HMM untuk segmentasi degupan jantung dirakam untuk tujuan klinik dan klasifikasi. Kajian ini merupakan pengetahuan penyelidik yang terbaik, kerana tiada penyelidikan yang merekodkan degupan jantung kepada rentetan teks (text string).

Dalam kajian ini, kami mencadangkan satu teknik yang membangunkan sistem dapatan semula degupan jantung dengan menggunakan kaedah rentetan teks untuk pengesanan penyakit jantung secara automatik. Format audio rakaman degupan jantung diproses dan disimpan dalam format MIDI. Setelah itu fail MIDI tersebut dienkod kepada rentetan teks berdasarkan N-gram dengan maklumat yang didapatkan daripada nada dan jangka masa. Selepas ini, rentetan teks yang dienkod akan membentuk bunyi muzik. Rentetan teks ini kemudiannya diindeks dan diuji untuk dapatan semula dengan menggunakan kedua-dua cara, iaitu pangkalan data dan sistem dapatan semula maklumat (IR). Longest Common Subsequence (LCS) dipadankan dengan algoritma yang hampir sama untuk mengenal pasti persamaannya daripada pangkalan data. Dengan IR, indeks teks lengkap daripada rakaman dan dapatan semula dengan carian item yang diketahui melalui enjin carian telah digunakan.

Kemungkinan pendekatan dapatan semula berdasarkan teks ini boleh dilihat daripada eksperimen dapatan semula melalui lebih kurang 100 rakaman digital
degupan jantung. Keseluruhannya, keputusan uji kaji yang dilakukan menunjukkan keboleh laksanaan yang jelas dengan menggunakan pendekatan pengekodan teks yang dicadangkan untuk mendiagnosis masalah jantung. Oleh its, ia boleh dikatakan bahawa keputusan yang ditunjukkan untuk sistem dapatan semula degupan jantung sangat memberi harapan untuk pertanyaan dalam kategori bunyi jantung yang normal dan tidak normal.
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Finally, thanks God for giving me another opportunity to know myself by living in Malaysia.
I certify that an Examination Committee met on 6 September 2011 to conduct the final examination of Ehsan Safar Khorasani on his Master degree thesis entitled “HEARTBEAT DISEASE DIAGNOSIS USING TEXT-BASED APPROACHES” in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The committee recommends that the student be awarded the Master of Science.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institutions.

______________________________
EHSAN SAFAR KHORASANI

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