

Advanced Multi Material Decomposition of Dual Energy in Computed Tomography Image

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ABSTRACT: The Research about Advanced Multi Material Decomposition of Dual energy in Computed Tomography image to find the liver diseases. The Existing system Multi material Decomposition(MMD) to find the liver disease using single energy. It was use Virtual Unenhancement algorithm. which is digitally removal of the effect of contrast agents from contrast-enhanced dual-energy CT exams. In proposed Method for Advanced Multi Material Decomposition of Dual Energy in CT image also find the liver Disease effectively using Dual energy. It can be used by Enhanced Liver fat Quantification algorithm. which accurately quantifies the fat concentration in the liver from binary-power CT exams. ELFQ can form the basis of a clinical application targeting the diagnosis and treatment of fatty liver disease. In this method also show the liver components in liver. The Advanced Multi Material Decomposition find the liver disease effectively then Multi material Decomposition.

KEYWORDS: Computed tomography (CT), dual-energy CT, liver-fat quantification, material decomposition, virtual un-enhancement

1. INTRODUCTION

X-ray computed tomography (CT) images the spatial distribution of attenuation coefficients of the object being scanned. Attenuation maps have many applications both in medical diagnosis and treatment and in industry for nondestructive evaluation. A conventional CT scanner measures a single sinogram at single X-ray source potential. Conventional image reconstruction methods process such measurements to produce a scalar-valued image of the scanned object. In practice the scanned object always contains multiple materials. An X-ray beam in clinical practice is usually composed of individual photons with a wide range of energies, and each photon energy is attenuated differently by the materials in the object. If uncorrected, this energy dependence causes artifacts in images reconstructed by conventional methods, such as beam-hardening artifacts. This energy dependence also allows the possibility of basis-material decomposition. Numerous applications of two material decomposition have been explored, including CT based attenuation correction for positron emission tomography beam-hardening artifacts correction and virtual un-enhancement (VUE) CT. Dual-energy (DE) CT methods are the most predominant approaches for reconstructing two basis materials (e.g., soft tissue and bone). They decomposed the energy dependence of attenuation coefficients into two components, one approximated the photoelectric interaction and another approximated Compton scattering, and separated these two components from two sets of measurements at two different source energies.

II. EXISTING SYSTEMS

The need for extending the material discrimination properties of dual-energy CT has been clearly recognized, and multiple solutions have been proposed in the literature. Methods based on the *K-edge* effect, or discontinuities in the mass attenuation curve of certain materials, have been proposed in. This requires energy-discriminating detectors and is still in the experimental phase, but in principle could allow for direct decomposition into three materials (as long as at least one of them show pronounced K-edge effects).to developed multi-material decomposition (MMD),A flexible, model-based method that extends dual-energy CT's core material discrimination capability to allow for the disambiguation of a larger number of materials.The first is the application of MMD to virtual un enhancement (VUE)

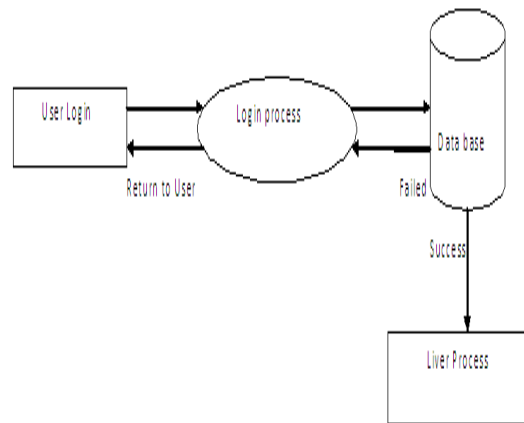
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III. PROPOSED SYSTEMS

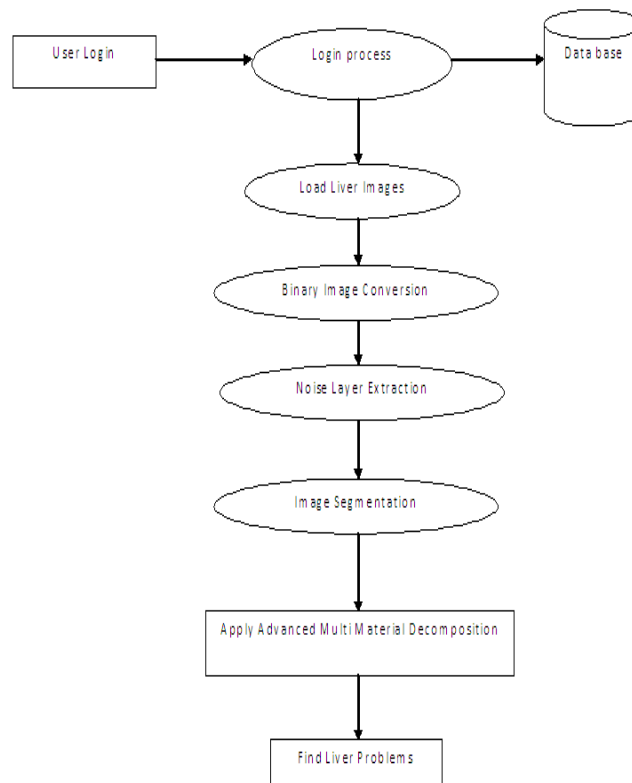
The proposed system consists of five phases namely Original image, Binary conversion, Noise Layer Extraction, image segmentation and Liver component.



Level 0

Fig.1Flow of proposed system

Level 1

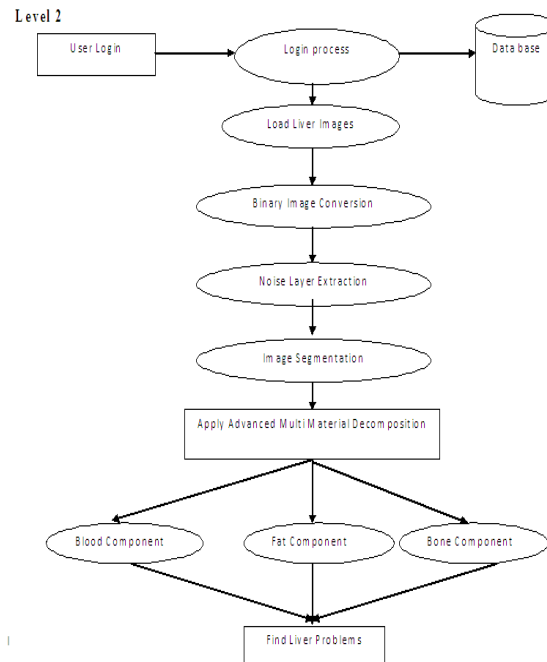


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Level 2



3.1 Binary Conversion

In this phase the original image to be converted into binary image and the contrast agent to be applied.

3.2 Noise layer Extraction

In this phase the noise to be remove from original image. The noise remove location to be show this image.

3.3 Image Segmentation

In this phase show the liver disease clearly and also increase the contrast level.

3.4 Liver component

There are 3 components

- 1.Fat component
- 2.Bone component
- 3.Blood component

This components show the fat, Blood, Bone level in liver.

IV. MODULE DESCRIPTION

The main modules in the proposed system are

- 1.Preprocessing
- 2.Multi-material decomposition
- 3.Dual-energy Level
- 4.Virtual Un enhancement

4.1 Preprocessing

The segmentation process is initialized when the user selects one of the top most axial liver slices. This is the only human intervention needed, as all other remaining processes are executed automatically. This initial slice is selected based on visual inspection. The criteria for this selection are:

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- 1) The liver has a good contrast with its surroundings.
- 2) The shape of the liver preferably has some resemblance to a circle or an ellipse. In order to estimate the seed points needed by the intelligent scissors in the initial slice, we threshold and skeletonize the corresponding salienation map. Because we know that the liver is on the left side of the image, we consider only the half left side edges in our calculation. As the liver is supposed to be roughly circular in this slice, we can estimate its “centre” by performing a Hugh transform for circle detection

4.2 Multi-Material Decomposition

Developed multi-material decomposition (MMD), a flexible, model-based method that extends dual-energy CT’s core material discrimination capability to allow for the disambiguation of a larger number of materials. This has the potential for a profound impact on dual-energy CT clinical application development. Two examples of clinical applications that use MMD as their algorithmic core are The first is the application of MMD to virtual unenhancement (VUE), which is the digital removal of the effect of contrast agents from contrast-enhanced dual-energy CT exams. With its ability to produce contrast-free images, without the need to acquire a contrast-free scan, VUE has received increasing interest and support from the clinical community. Proponents of VUE champion its potential to reduce patient dose and therefore minimize the risk of radiation-induced malignancy

4.3 Dual-Energy Level

Dual-energy CT has been clearly recognized, and multiple solutions have been proposed in the literature. Methods based on the *K-edge* effect, or discontinuities in the mass attenuation curve of certain materials, have been proposed. This requires energy-discriminating detectors and is still in the experimental phase, but in principle could allow for direct decomposition into three materials (as long as at least one of them shows pronounced K-edge effects). The method in criticizes the use of volume-preservation principles, an issue that will be addressed, and highlights the use of mass conservation for obtaining a post reconstruction triple material decomposition. However, it should be noted that *any* reasonable method for material decomposition already makes an implicit assumption of mass conservation.

4.4 Virtual Unenhancement Algorithm

Our VUE algorithm was applied to all multi-phase images from our database of 50 patients, and qualitative results are the coronal view of four registered dual-energy CT images from a multi-phase abdominal exam. The corresponding VUE images, produced from the displayed contrast-enhanced images, are also shown (note that the VUE algorithm is not run on contrast-free images, hence the lack of a corresponding VUE image for the contrast-free phase). demonstrates two key benefits of our VUE algorithm: the consistent ability to remove contrast regardless of the phase of contrast-enhanced imaging or the location of contrast in the human body, and the qualitative similarity between TUE and VUE images.

V. PROPOSED ADVANCED MULTI MATERIAL DECOMPOSITION STEP

AMMD Algorithm :when a single triangle is considered this effect can be disregarded and expression for the observed volume fraction a_i ;corresponding to a noisy observation $ul=ul+e$ of pair of linear attenuation coefficients $ul=(ul(e1).ul(e2))$ was derived

$$AI=ai+\frac{Li*nT*E}{2A}$$

Where a_i is the volume concentration of material I for the noise free input $ul:E$ is the two dimensional random vector of the additive noise perturbing $ul:li$ and n are the length of and the unity normal vector to the edges opposite to a_i in the triangle respectively and A is the area Of triangle.

VI. CONCLUSION

We introduced AMMD, a novel technique for material decomposition from dual-energy CT images. Whereas most material decomposition methods can only discriminate between two, or at most three, materials, AMMD can disambiguate among a much larger number of materials. The innovation lies on a simple idea: the use and validation of the ideal solution assumption augmented with a non-negativity constraint. We validated our AMMD method by

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developing two AMMD-based image analysis algorithms, VUE and LFQ, each targeted at distinct clinical applications. The clinical utility of our AMMD-based algorithms is confirmed through experiments and results with both patient and phantom data. Furthermore, the flexibility to tailor AMMD-based algorithms to specific clinical applications has the potential to improve clinical workflow and disease management using dual-energy CT.

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