Method for Rapid 3D Printing from Medical Images

Published date: July 27, 2018

Technology description

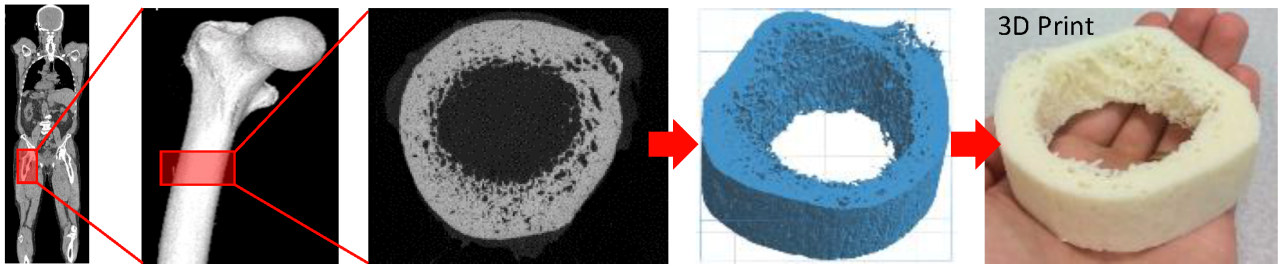
Method and software product allowing for direct conversion of any three dimensional image (e.g., CT, MRI, ultrasound, PET, etc.) into 3D printable instructions (i.e., G-Code).

Problem

Medical Digital Imaging and Communications in Medicine (DICOM) image files generated by CT or MRI scanners can be utilized to generate the instruction for 3D printers. However, the conventional method has several limitations such as significant user interaction, image manipulation, high processing time, and computer memory restrictions. Current method requires an intermediate step of converting DICOM files into StereoLithography (STL) format file before conversion into the G-code instructions readable by 3D printers which leads to loss of structural information.

Solution

Dr. Rajapakse at Penn has developed computer code that converts DICOM to G-Code without going through STL conversation. This approach substantially reduces the time to obtain a 3D print, provides greater customizability - from changing print speeds to allowing for different extrusion amounts for either increased porosity or better adhesion to varying print paths. The code accounts for parameters such as printer’ s resolution and speed of the extruder and allows for choosing the method of printing, from linear, to any inputted angle rotation between each layer. This method can be used also for bioprinting for various applications, such as bone, cartilage, muscle tissue fabrication, etc. and can be utilized for convenient and rapid 3D printing of patient-specific structures.



Reference Media

Hong et al., Feasibility of Fabricating Personalized 3D-Printed Bone Grafts Guided by High-Resolution Imaging .Proceedings of the SPIE Medical Imaging. 2017, p.10138.

Gadaleta et al. Fabrication of Patient-Specific, Tissue Engineered Nasal Septal Cartilage Graft: A Proof of Concept Study. International Symposium of Facial Plastic Surgery, Dallas, TX, 2018.

Leeet al. Rapid 3D Printing from Medical Images for Surgical Applications. Orthopaedic Research Society, New Orleans, LA, 2018.
Lee et al. Rapid 3D Bioprinting from Medical Images--An Application to Bone Scaffolding. Proceedings of the SPIE Medical Imaging, Houston, TX, 2018.
Gadaleta et al. Fabrication of Custom PCL Scaffold for Nasal Septal Perforation Repair . Proceedings of the SPIE Medical Imaging, Houston, TX, 2018.
Hong et al. Stiffness of High-Resolution Imaging-Based 3D Printed Bone Models. ORS, San Diego, CA, 2017.

Application area

• Novelty items - 3D printing of embryos, brain, etc
• Medical and bio- 3D printing: reconstructive surgery, bone, cartilage, teeth, various tissues fabrication and incorporation etc.
• Medical training purposes
• Medical phantoms

Advantages

• Patient-personalized 3D prints
• High speed and resolution
• Improved printing control
• High customizability

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