Finding a fETus with UltraSound (FETUS)

Westminster Enterprise Week **#WEW2021**

10th November 2021

Tareen Dawood, Guilherme Gomes De Figueiredo, Shu Wang, and **Miguel Xochicale**

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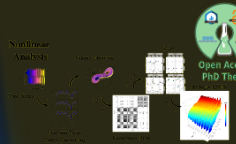
@mxochicale @_mxochicale

Contents

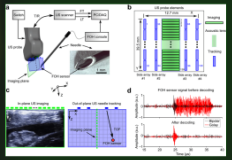
Who are we? / Where we come from? / Do we have hobbies?

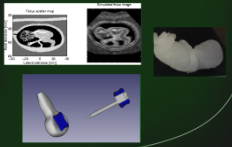
Miguel Xochicale

Ph.D. in Human-Robot Interaction
University of Birmingham



Research Associate in Ultrasound Guidance Interventions
King's College London





H.S. | B.Sc. | M.Sc. | T.A. | R.A. | Ph.D. | R.A.

2000 | 2010 | 2020 | 2030 | *t[years]*

Who are we? / Where we come from? / Do we have hobbies?

Tareen Dawood

Defence and Finance

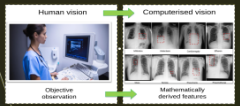
Pay back bursary - Worked

Jobs - scarce ≡ Finance

MSc - Mech Eng - Operational

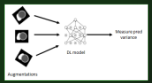
Masters - Ultrasound Imaging - TB/HIV/Lymphoma Feature Detection

Imaging features from images to earlier detect Lymphomas



Ph.D. in Cardiac Imaging - Learning to Trust AI

Medical Image Analsyis - Cardiac Application



Predictive Cardiac Models

Prevention, Treatment and Decision Suppot Tool

H.S. | B.Sc. | Internship | Working | Masters | Ph.D.

2000 | 2010 | 2030 | t[years]

Who are we? / Where we come from? / Do we have hobbies?

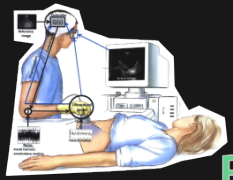
Shu Wang

Guilherme Gomes De Figueiredo

Where we are based?

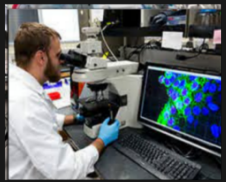
School of Biomedical and Imaging Science

Ultrasound Imaging



Machine Learning and Deep Learning with Medical Imaging

Biomedical Imaging



Biomedical Engineering

PET and MR Acquisition and Reconstruction

Image Computing, Analysis and Robotics

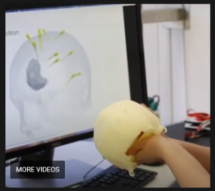
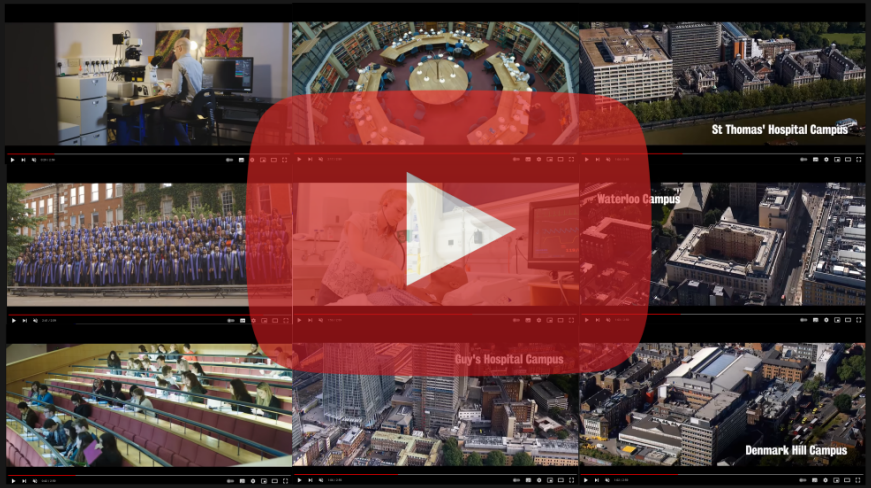


Image-guided navigation

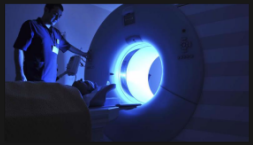
Faculty of Life Sciences & Medicine: video



[https://www.youtube.com/watch?v=iLZmT_fZqQo]

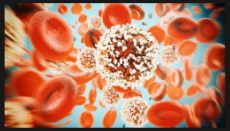
School of Immunology & Microbial Sciences

School of Biomedical Engineering & Imaging Sciences



School of Basic & Medical Biosciences

Faculty of Life Sciences & Medicine



School of Cancer & Pharmaceutical Sciences

School of Cardiovascular Medicine & Sciences

School of Life Course Sciences

[https://www.kcl.ac.uk/lsm/schools]

Sonographers

Radiologists

Social workers

Healthcare Professionals

General Doctor and Surgeons

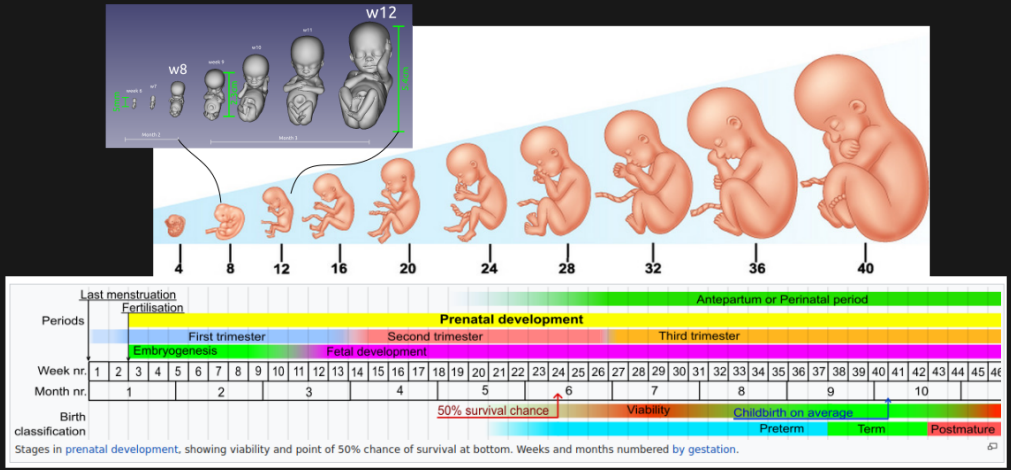
Nurses and Midwives

Physiotherapists

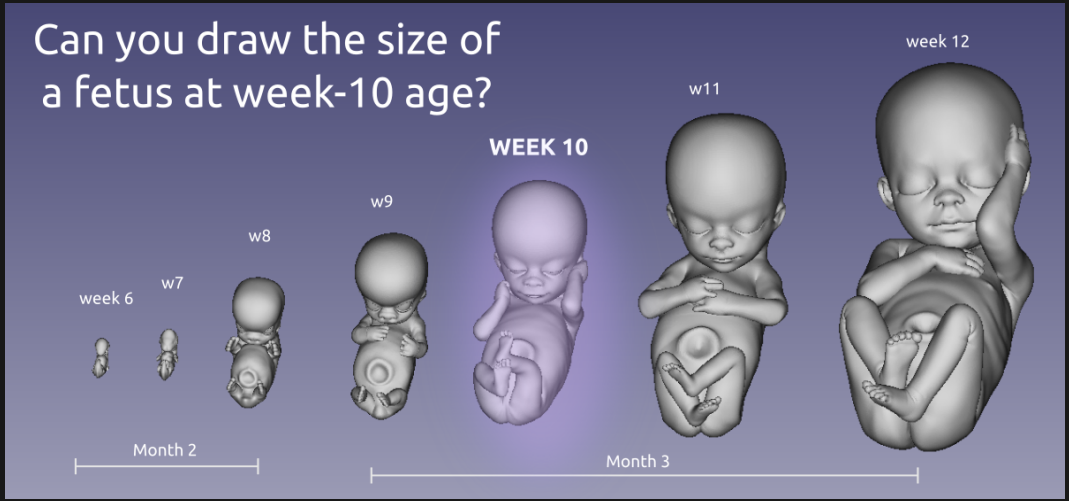
[W https://en.wikipedia.org/wiki/Health_professional]

Understanding Fetal Growth

Understanding Fetal Growth

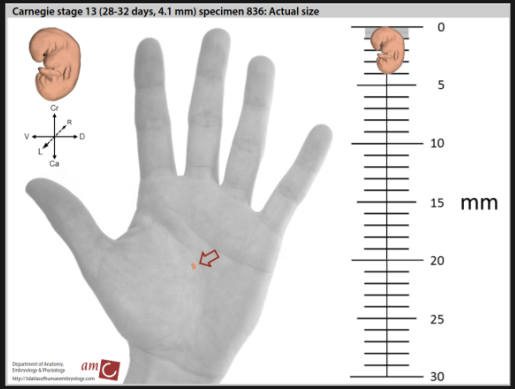


[ACTIVITY]: Guessing Fetal Growth

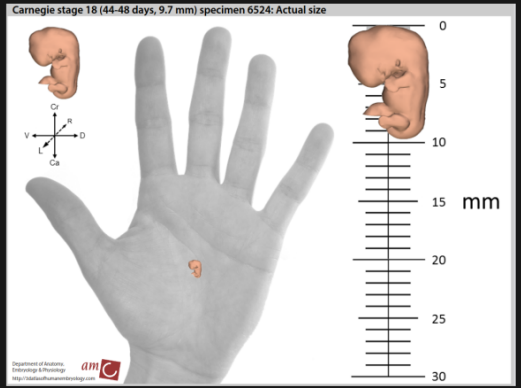


[ACTIVITY]: Understanding Fetal Growth

week 5

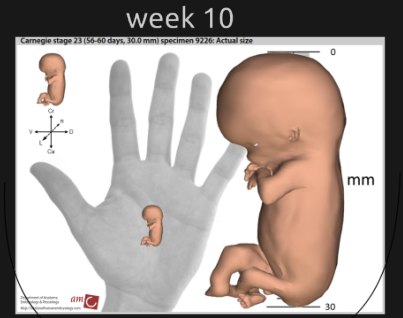


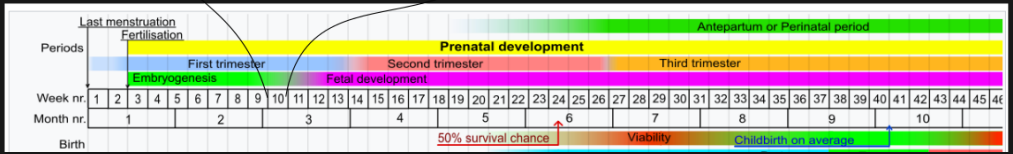
week 6



[de Bakker et al. 2016 in Science http://3datlas.3dembryo.nl/; https://www.whattoexpect.com/pregnancy/]

[ACTIVITY]: Understanding Fetal Growth

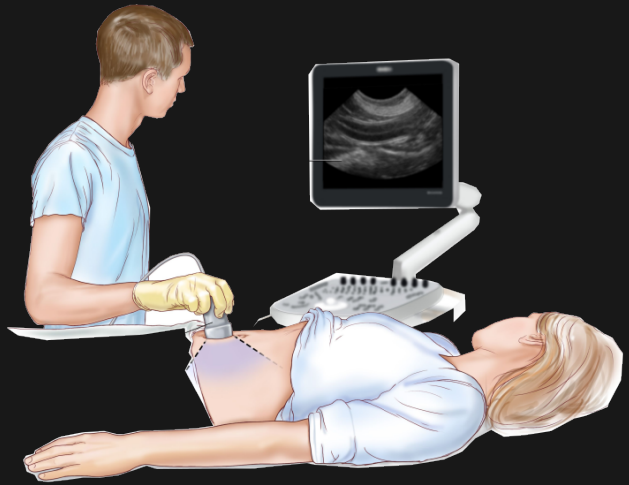




[de Bakker et al. 2016 in Science http://3datlas.3dembryo.nl/; https://www.whattoexpect.com/pregnancy/]

Do you know what type of healthcare profesional helps to monitor fetal development?

The role of a Sonographer



- Prepare Exam Room & Equipment
- Use Sonography Equipment
- Friendly Disposition & Good Patient Care
- Maintain Confidence

[Wright-Gilbertson M. 2014 in PhD thesis]

Do you know
how clinicians can actually see fetal development?

Computational Tomography

CT

+ high image quality

- non-real-time

Computational Tomography

[W https://en.wikipedia.org/wiki/Medical_imaging_in_pregnancy]

Magnetic Resonance Imaging

MRI

+ high image quality

- non-real-time

Magnetic Resonance Imaging

[W https://en.wikipedia.org/wiki/Medical_imaging_in_pregnancy]

Ultrasound

US

Ultrasound

+real-time - poor-image quality

[W https://en.wikipedia.org/wiki/Medical_imaging_in_pregnancy]

Medical Imaging in Pregnancy

CT

+ high image quality

- non-real-time

MRI

+ high image quality

- non-real-time

US

+real-time

- poor-image quality

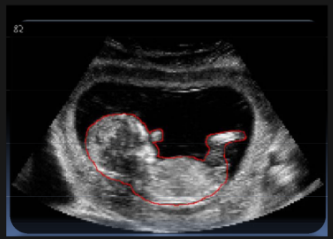
[W https://en.wikipedia.org/wiki/Medical_imaging_in_pregnancy]

How a Biomedical Engineer would help Sonographers?

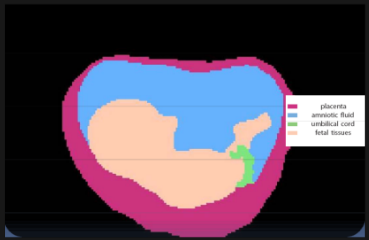
What skills do you think a Biomedical Engineer needs to have?

Modelling US imaging

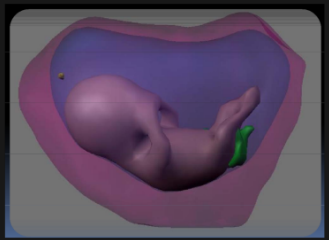
Segmentation on 3D US data



Tissue Labelling

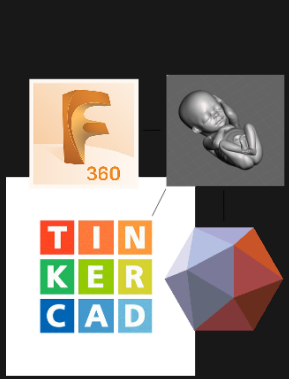


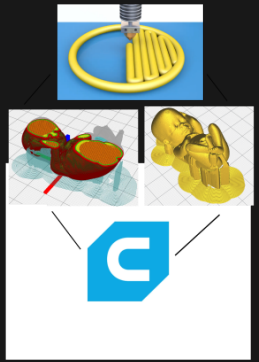
Surface Reconstruction

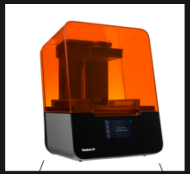


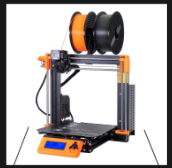
Does anybody know anything about 3D printing?

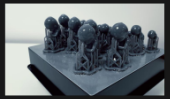
3D printing fetuses











Many thanks to

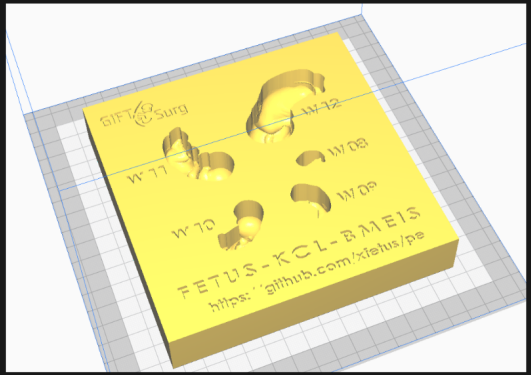

Guilherme Gomes De Figueiredo

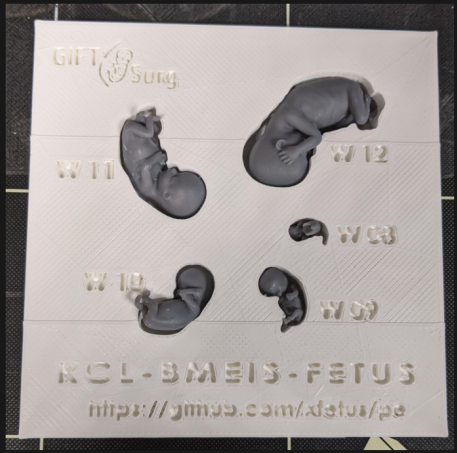

Maleeha Al-Hamadani


Carlo Seneci

[CADs of cavities and 3D printing by Maleeha Al-Hamadani]

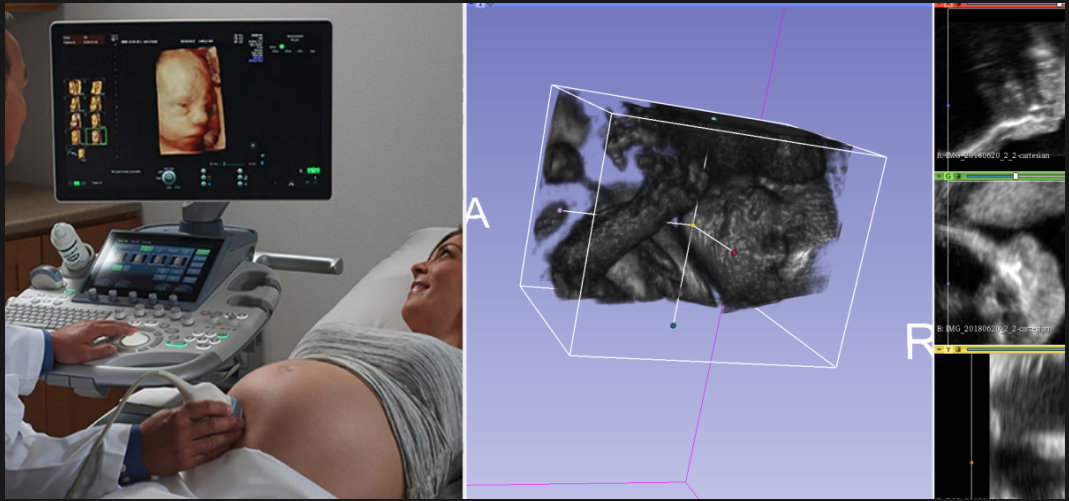
[ACTIVITY]: Fetal growth of 3D printed fetuses





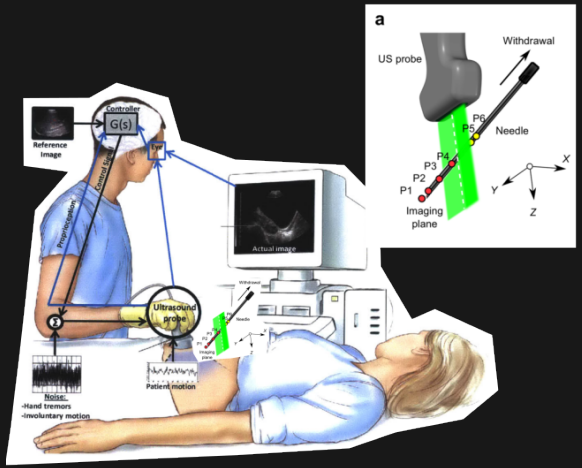
Can you identify body parts of a fetus with Ultrasound?

[ACTIVITY]: Interactive Ultrasound Imaging



[3D Slicer in https://www.slicer.org/]

Ultrasound-guided intervention



Challenges:

- Skillfullness of sonographers
- Anatomical view changes
- Tracking needles

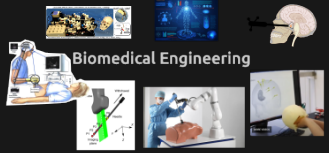
[Xia et al., 2017 in Scientific Reports, Wright-Gilbertson M. 2014 in PhD thesis]

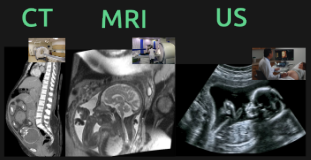
Takeaway messages

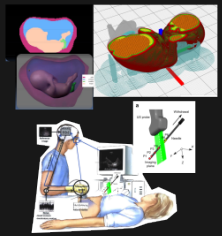
- **Biomedical Engineers**
  - Maths and Physics
  - Biology and Chemistry
  - Computer Science

- **Medical Imaging**
  - Computational Tomography
  - Magnetide Resonance
  - Ultrasound imaging

- **Applications of US**
  - Modelling US
  - 3D printing
  - US-guided Interventions

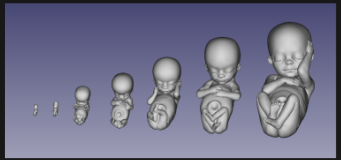


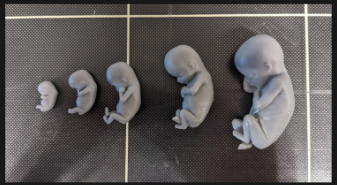


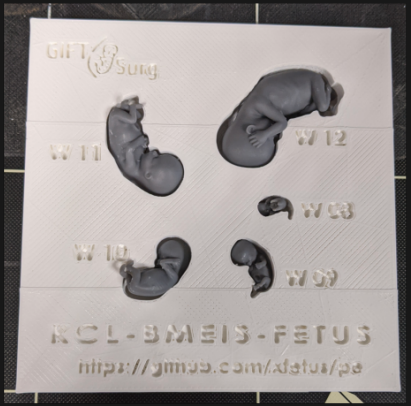


[ACTIVITY]: Pop Quiz and Souvenirs

Souvenirs







[ACTIVITY]: Pop Quiz and Souvenirs

* Q1. What is the most common imaging technique to see a fetus in a mother's womb?
* Q2. Can you name the person's job who performs the imaging of fetus?
* Q3. Can you name one of the other imaging techniques to diagnose and to monitor fetus in a mother's womb?

Extra Questions

* Share an emoji that reflects how you feel about this workshop
* What was your favourite part of the workshop?
* What was your least favourite part of the workshop?
* What would you change about today's workshop?

Acknowledgements

Research Students


Shu Wang


Ou Zhanchong


Tareen Dawood


Guilherme Gomes De Figueiredo


Amal Hussein

Research Scientists


Miguel Xochicale


Christian Baker


Francois Joubert


Sunish Mathews


Fang-Yu Lin


Richard Miles


Dzhoshkun Shakir

Public Engagement Officers


Bella Spencer


Melissa Bovis

Clinical Fellows


Yada Kunpalin


Brian Dromey

Quality Management


Jacqueline Beddoe-Rosendo


Clare Heaysman

Operations Managers


Alima Rahman


Valentina Vitiello

Investigators


Anna David


Tom Vercauteren


Wenfeng Xia


Sebastien Ourselin

Finding a fETus with UltraSound (FETUS)

Westminster Enterprise Week **#WEW2021**

10th November 2021

Tareen Dawood, Guilherme Gomes De Figueiredo, Shu Wang, and **Miguel Xochicale**

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