Introduction

UNIVERSITY of WASHINGTON

2016-2020

Bachelors of Science

Teaching Assistant

Research Assistant

Full Stack Development Consultant

UCL

2021-2022

Master of Science

Academic Representative

OtoNexus MEDICAL TECHNOLOGIES

2020-2021

Medical Device Design Engineer/Acoustic Engineer

NHS University College London Hospitals NHS Foundation Trust

2022-Present

Band 7 Computational Scientist

Scientific Papers/Conferences

Robotic Arm Kinematics using Trigonometry and Matrix algebra

Sierra Bonilla, Narayani Choudhury
Lake Washington Institute of Technology

Math Conference at Edmonds Community College, Feb. 20, 2016

19th International Symposium of ISTU
5th European Symposium of EUFUS
Barcelona 2019 | 13th-15th June

CONTROLLED BUBBLE-ENHANCED HEATING WITH ADDED MICROBUBBLES

Dingjie Suo, Alicia Clark, Sierra Bonilla, Sara Keller, Mike Averkiou
Department of Bioengineering, University of Washington, Seattle, USA
e-mail: dsuo@uw.edu, maverk@uw.edu

The 25th European symposium on Ultrasound Contrast Imaging

Enhanced Heating with Microbubbles in High Intensity Focused Ultrasound Applications

***Alicia Clark*, Sierra Bonilla, Dingjie Suo, Michalakis Averkiou**
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Ultrasound in Medicine & Biology.
Elsevier Inc.
2021

Microbubble-Enhanced Heating: Exploring the Effect of Microbubble Concentration and Pressure Amplitude on High Intensity Focused Ultrasound Treatments

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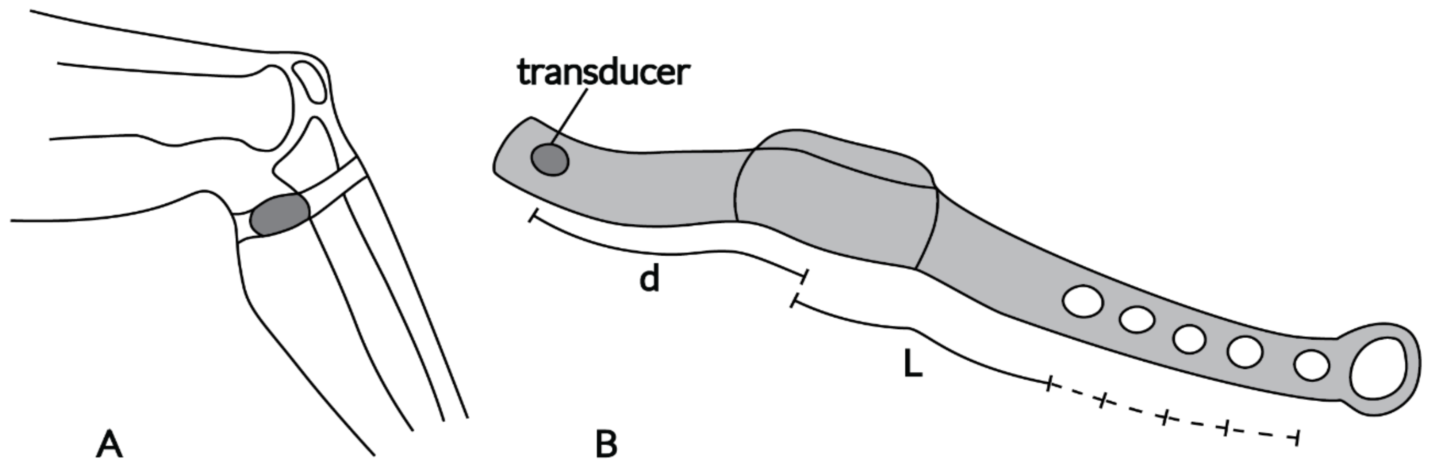
[1]Department of Bioengineering, University of Washington, Seattle
[2]InSightec, Haifa, Israel

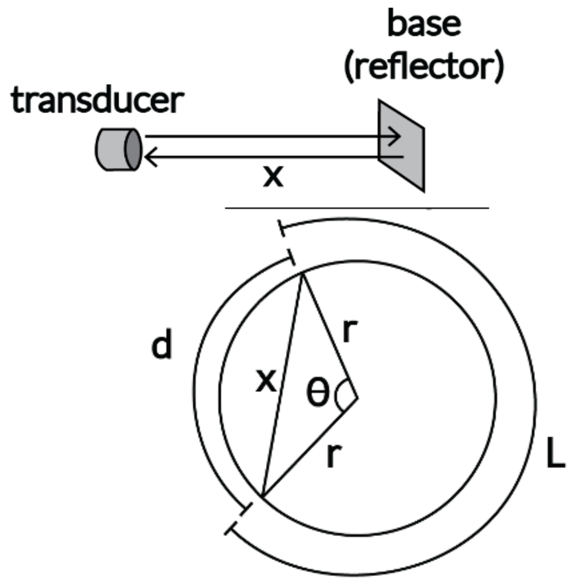
Abstract

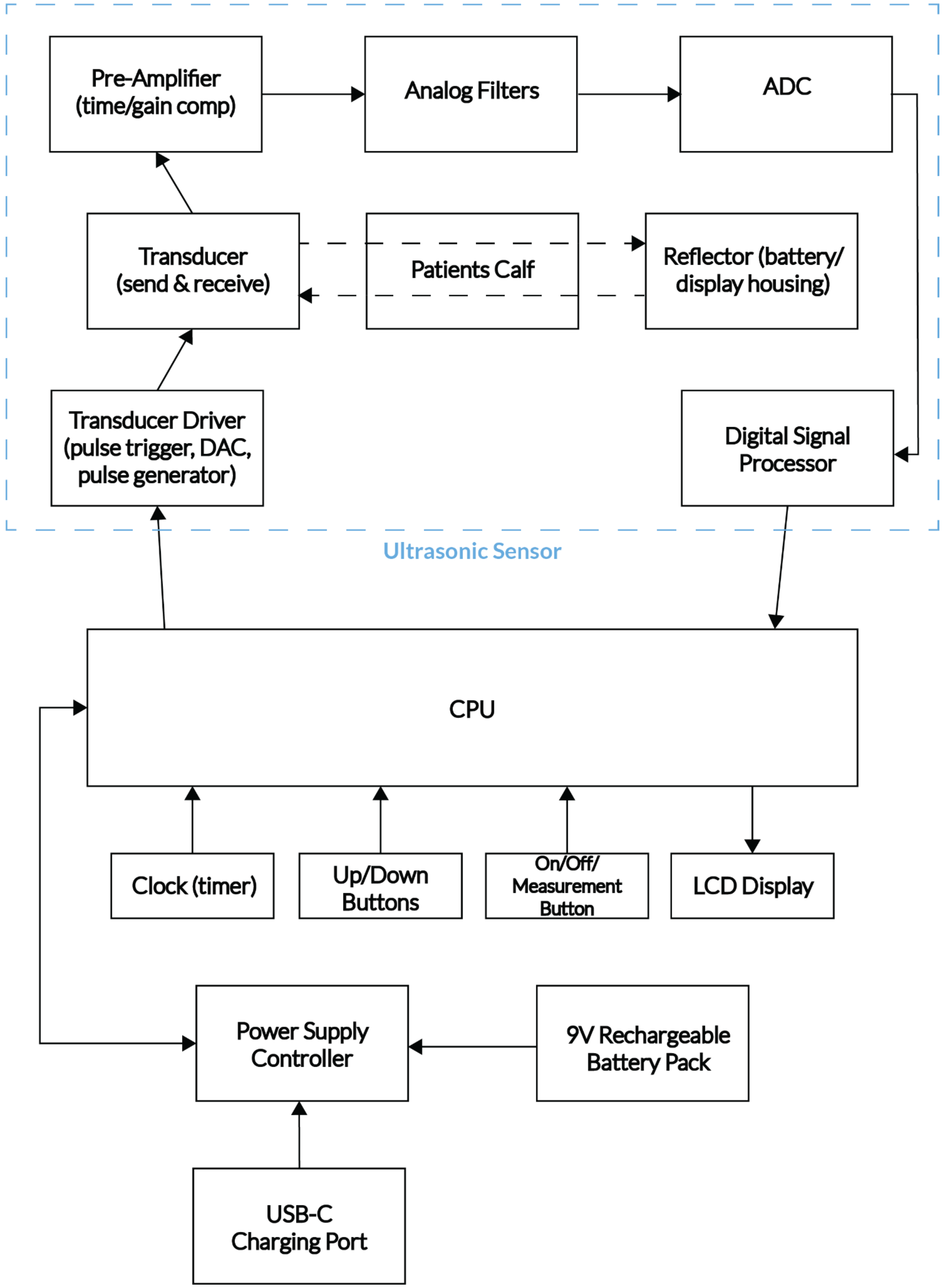
High intensity focused ultrasound (HIFU) is a noninvasive tool that can be used for targeted thermal ablation treatments. Currently, HIFU is clinically approved for treatment of uterine fibroids, various cancers, and certain brain applications. However, for brain applications such as essential tremors, HIFU can only be used to treat limited areas confined to the center of the brain due to geometrical limitations (shape of the transducer and skull). A major obstacle for advancing this technology is the inability to treat non-central brain locations without causing damage to the skin and/or skull. Previous research has shown that cavitation-induced bubbles or microbubble contrast agents can be used to enhance HIFU treatments by increasing ablation regions and shortening acoustic exposures at lower acoustic pressures. However, there has been little research done to explore the interplay between microbubble concentration and pressure amplitude on HIFU treatments. We developed an *in-vitro* experimental setup to study lesion formation at three different acoustic pressures and three microbubble concentrations. Real-time ultrasound imaging was integrated to monitor initial microbubble concentration and subsequent behavior during the HIFU treatments. Depending on the pressure used for the HIFU treatment, there was an optimal concentration of microbubbles that led to enhanced heating in the focal area. If the concentration of microbubbles was too high, the treatment was detrimentally affected due to nonlinear attenuation by the pre-focal microbubbles. Additionally, the real-time ultrasound imaging provided a reliable method to monitor microbubble activity during the HIFU treatments, which is important for translation to *in vivo* HIFU applications with microbubbles.

Projects: Engineering

QUENCHBAND
wearable that estimates hydration







$$C(i) = d + L(i)$$ [m]

$$r(i) = \frac{C(i)}{2\pi}$$ [m]

$$d = C(i) \cdot \frac{\theta}{360°}$$ [m]

$$\theta = \frac{d \cdot 360°}{C(i)}$$ [arc degree]

$$x(i) = 2 \cdot r(i) \cdot sin(\frac{\theta}{2})$$ [m]

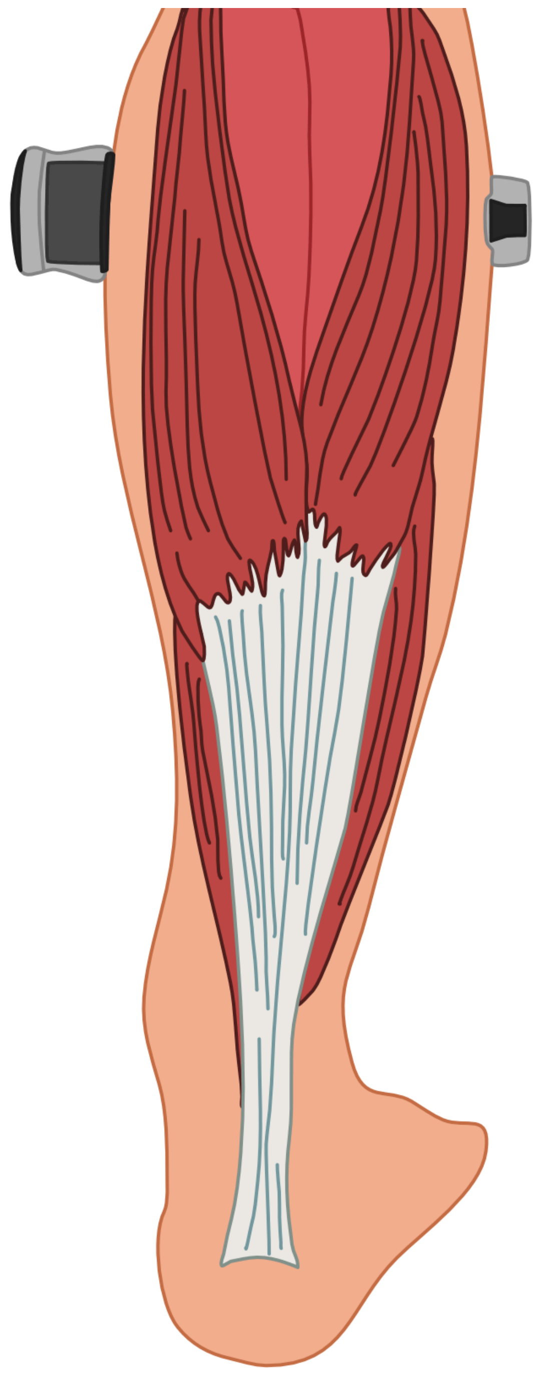
$$x(i) = (\frac{d + L(i)}{\pi}) \cdot sin(\frac{d \cdot 360°}{2(d + L(i))})$$ [m]

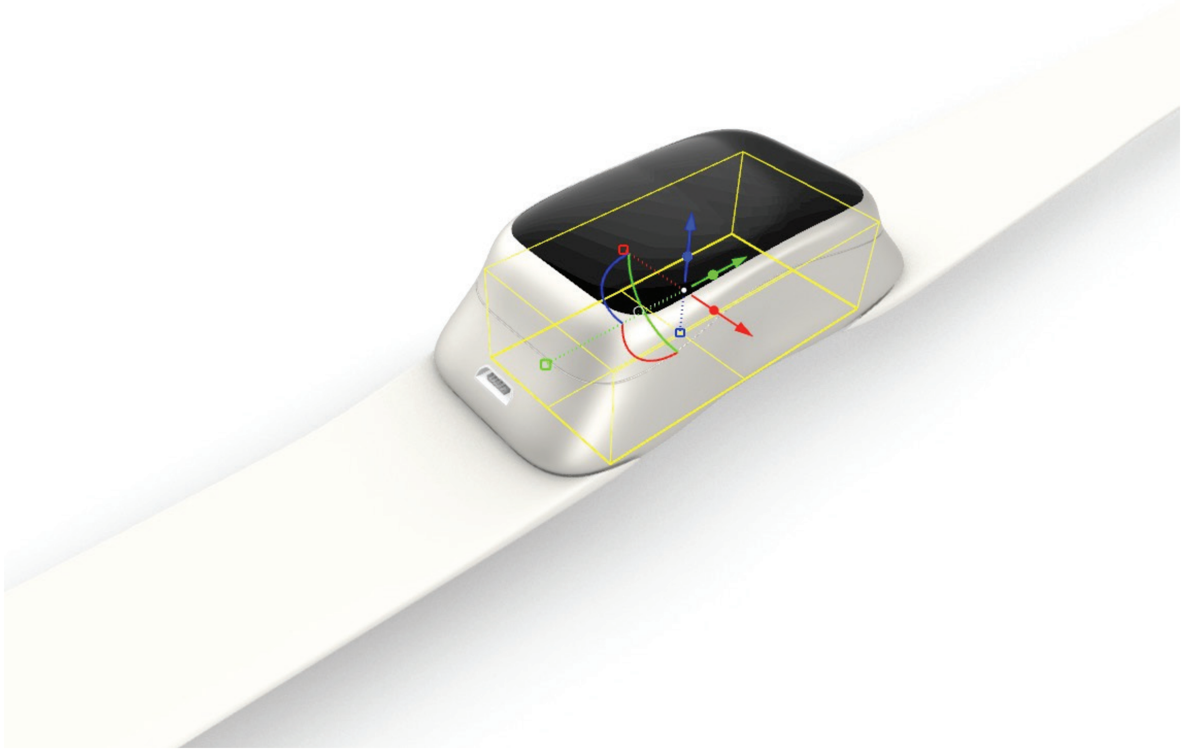
$$c = x(i) \cdot \frac{2}{t}$$ [m/s]

C - the circumference of the circle, in m
d - the distance from the base of the battery housing (known constant), in m
$L(i)$ - the length of adjustable band (discrete variable) where i is the index of the insert chosen, in m
$r(i)$ - the radius of the circle given the index of the insert chosen, in m
t - the time of arrival of the acoustic wave, in s
c - the speed of sound of the soft tissue, which is proportional to whole body hydration, in m/s
θ - the angle of the acoustic path, in degrees °

Projects: Engineering

QUENCHBAND
wearable that estimates hydration



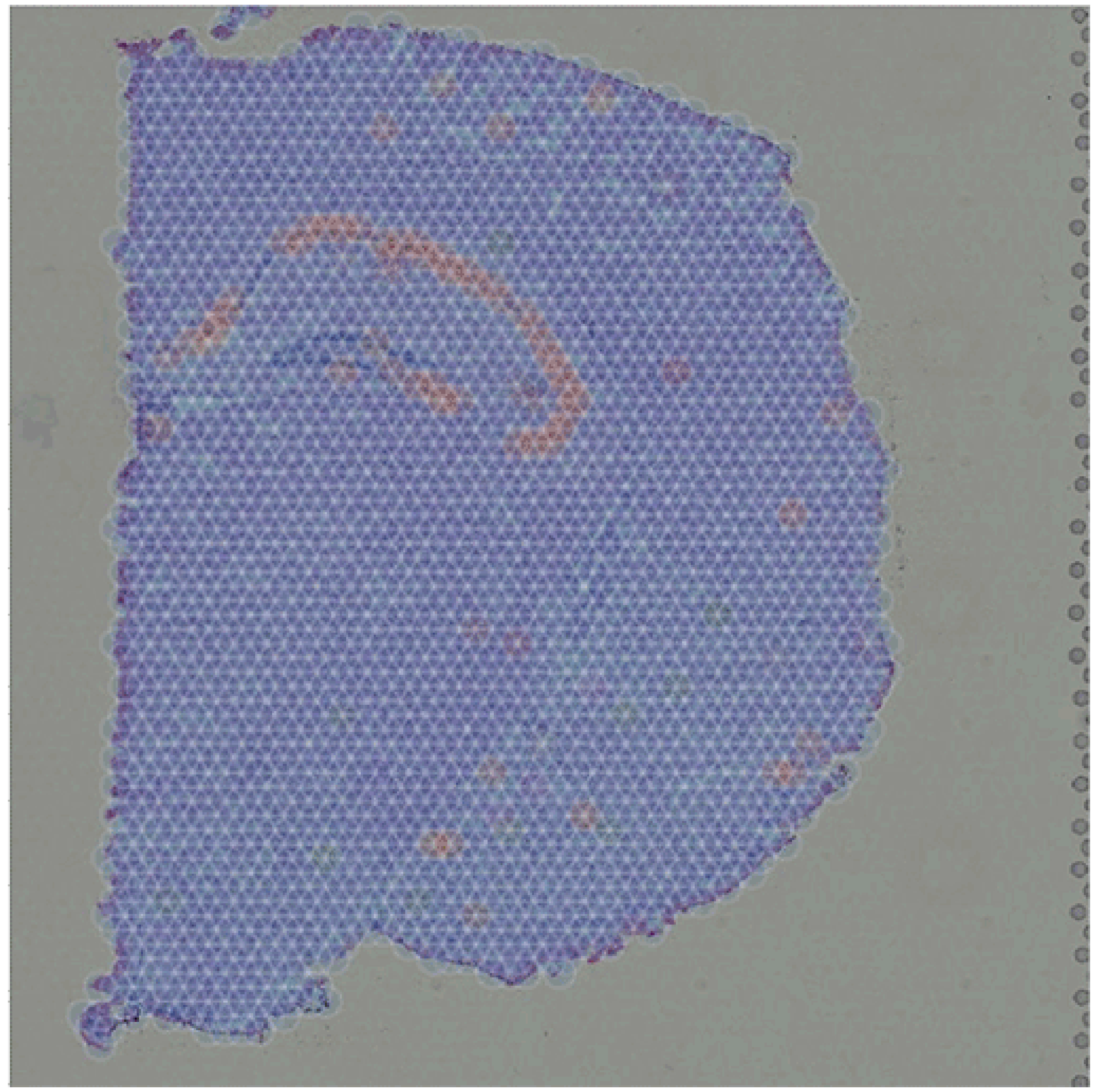


Projects: ML

BRAIN SPACE

exploring the spatial cell-type composition within the mouse brain

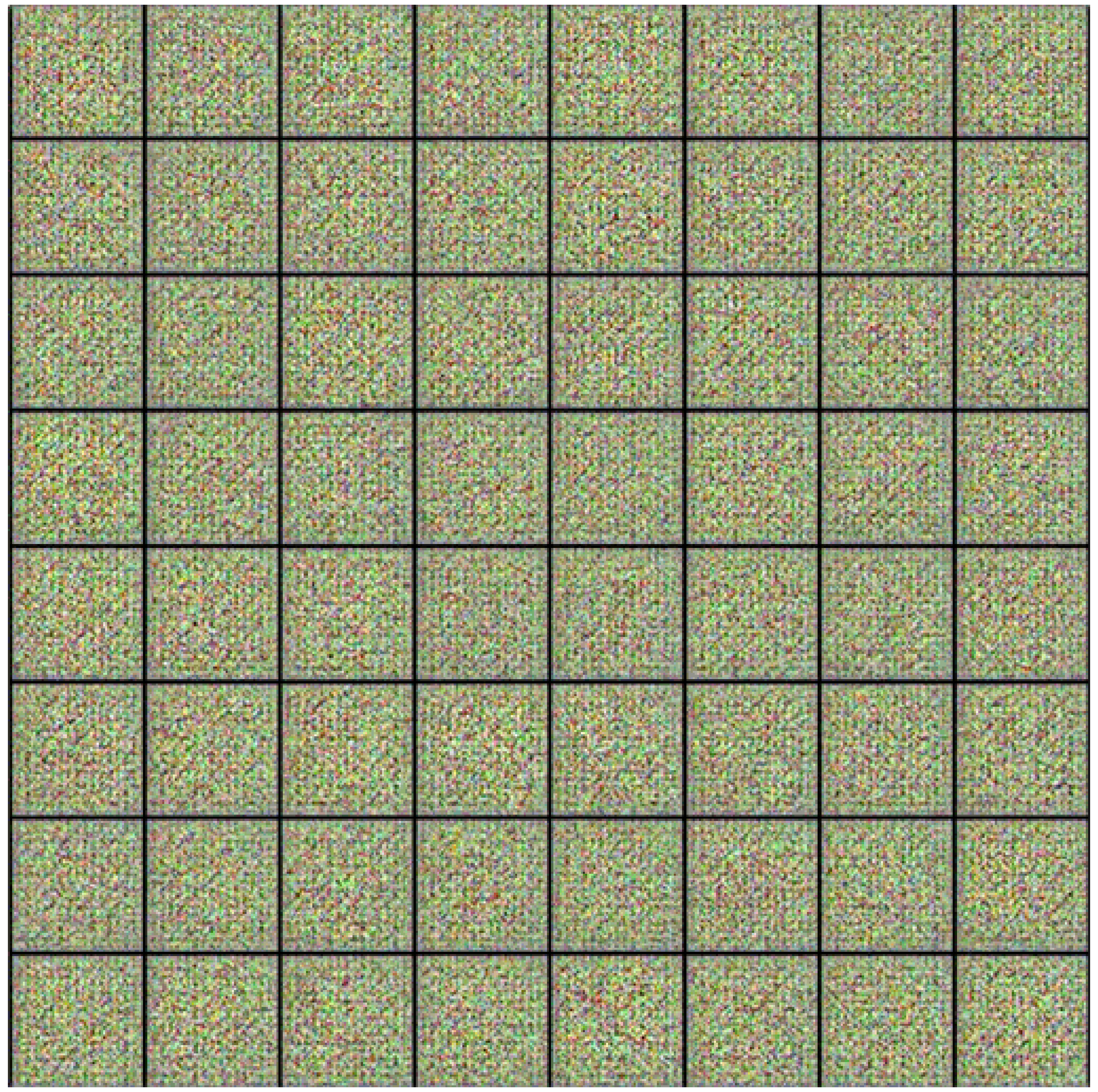
```
PSUEDO-CODE:

//Prepare Data---------------------------------------------------------------
cellDF = load(//Pre-Processed DataFrame)
[//split data] = train_test_split(cellDF[Gene Expression], cellDF[Cell ID])

//Define Model---------------------------------------------------------------
model = DecisionTreeClassifier()

//Train Model----------------------------------------------------------------
model.fit(//train data)

//Test Model-----------------------------------------------------------------
prediction = model.predict(//test data)
accuracy_score(//prediction ID vs real ID)
```



Projects: DL

BUTTERFLIES
exploring DCGAN structures

```
PSUEDO-CODE:

//Define Hyperparameters------------------------------------------------------
imageSize, batchSize, epochs, learningRate = x1, x2, x3, x4

//Prepare Data----------------------------------------------------------------
download(//Kaggle Butterfly Dataset)
butterflyDataLoader = DataLoader(//transformed images in batches)

//Define Models---------------------------------------------------------------
model_1 = discriminatorModel()
model_2 = generatorModel()

//Train Models----------------------------------------------------------------
for (//All epochs):
   model_1.trainDiscriminator(//discriminator Optimizer)
   model_2.trainGenerator(//generator Optimizer)

//Test Model-----------------------------------------------------------------
fakeImage = model_2()
```



PhD Research

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Scene Reconstruction in Endoscopic Imaging Using Neural Rendering Frameworks

– Supervisor: Dr. Sophia Bano (sophia.bano@ucl.ac.uk)

Research Proposal

Fetoscopy and cystoscopy are both minimally invasive endoscopic medical procedures used to view the fetus and the bladder, respectively. These procedures regularly involve the insertion of a thin, flexible tube containing a monocular camera and a light source and are performed for surgical procedural guidance or diagnosis [1]. Compared with open surgery, they have many advantages including shorter hospital stays, less trauma to the patient, and smaller skin scars. However, they are limited in their field-of-view and maneuverability [2]. These limitations in fields-of-view and low image quality of the camera make it difficult to accurately understand the anatomy. However in recent years, there has been a surge of research in the domains of computer graphics and computer vision that is rapidly changing the field of endoscopic imaging [3].