Towards Foundation AI Models for Medical Data
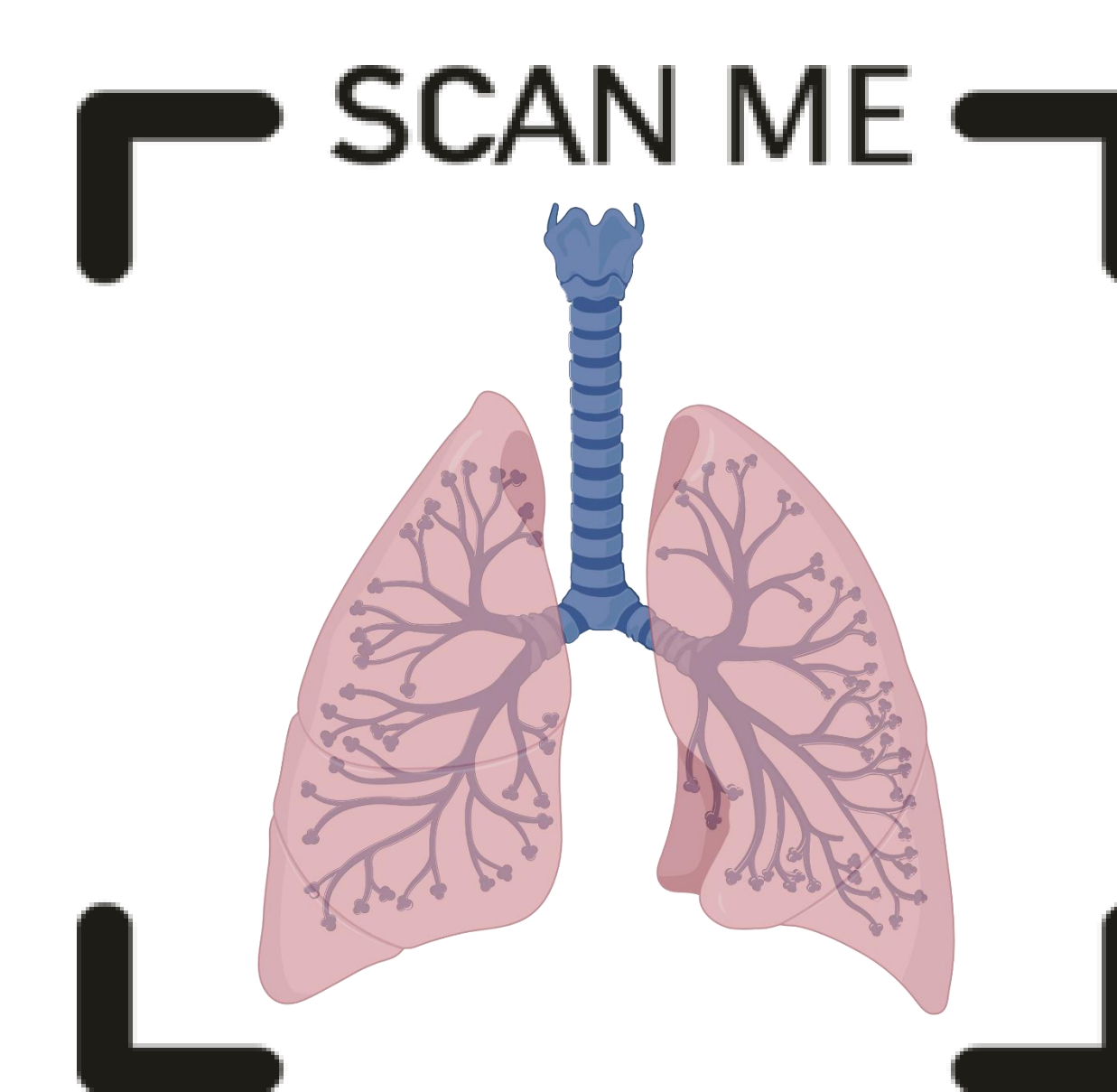
Hazrat Ali, Zubair Shah
Hamad Bin Khalifa University, Doha, Qatar.

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SCAN ME

سدرة للطب
Sidra Medicine

Summary

➤ Recently, neural diffusion models have demonstrated the potential to generate photo-realistic images of objects.
➤ We explore the possibilities of synthesizing medical images using neural diffusion models.
➤ We use a pre-trained DALLE2 model to generate lungs X-Ray and CT images from an input text prompt.
➤ We also train a stable diffusion model with 3165 X-Ray images and generate synthetic images.
➤ We evaluate the quality of the generated images through qualitative analysis by two two independent radiologists
➤ Results demonstrate that images generated with the diffusion model can translate characteristics that are otherwise very specific to certain medical conditions in chest X-Ray or CT images.
➤ This motivates the need of developing more generalized Foundation AI models for medical data.

Methods

We used the OpenAI DALLE2 API to generate images based on the input text.
Using the API, we generated multiple images of lungs CT and X-Ray.
We then presented a randomly selected set of the generated images to two trained radiologists.

DALLE2 is available from https://openai.com/
Graphics from: Studio4rt on freepik

Contact

Hazrat Ali
Email: haali2@hbku.edu.qa, hazrat.ali@live.com
www.alihazrat.weebly.com

Dataset link

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Present to radiologist

➤ We asked the radiologists for two key tasks.
➤ Radiologists were requested to:
  ➤ Labels: Real, Fake, Uncertain about
  ➤ Provide brief description (lungs condition)
➤ The radiologists did not have prior information on the labels.
➤ The radiologists did not know each other
➤ The radiologists performed the task independently.
➤ One radiologist had prior knowledge of artificial intelligence and generative models.

X-Ray labels
Fake (4)
Unsure (2)
Real (13)

CT labels
Unsure
Real (3)
Fake (17)
(0)
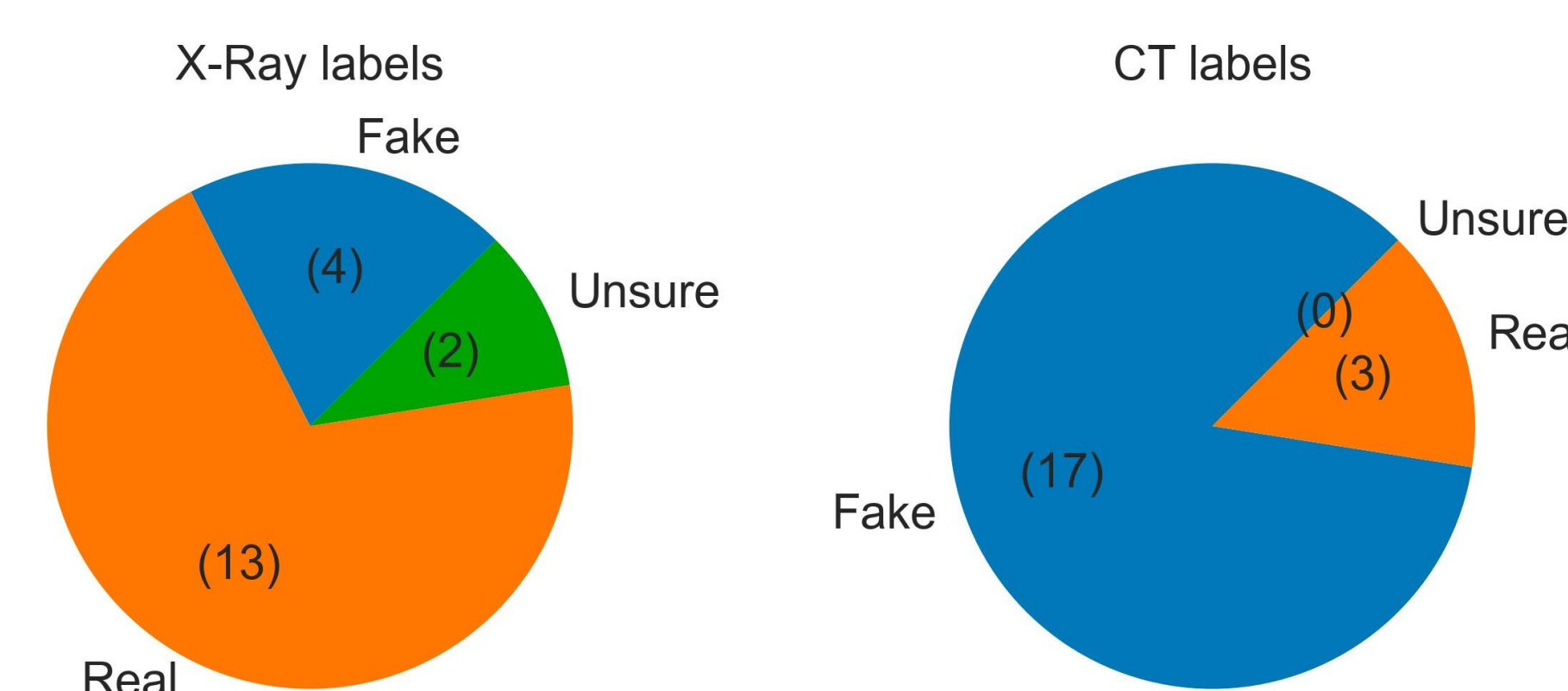
Results

Agreement between radiologists:
CT images: Of the 20 CT images, only **three images** were labeled as real by both radiologists.
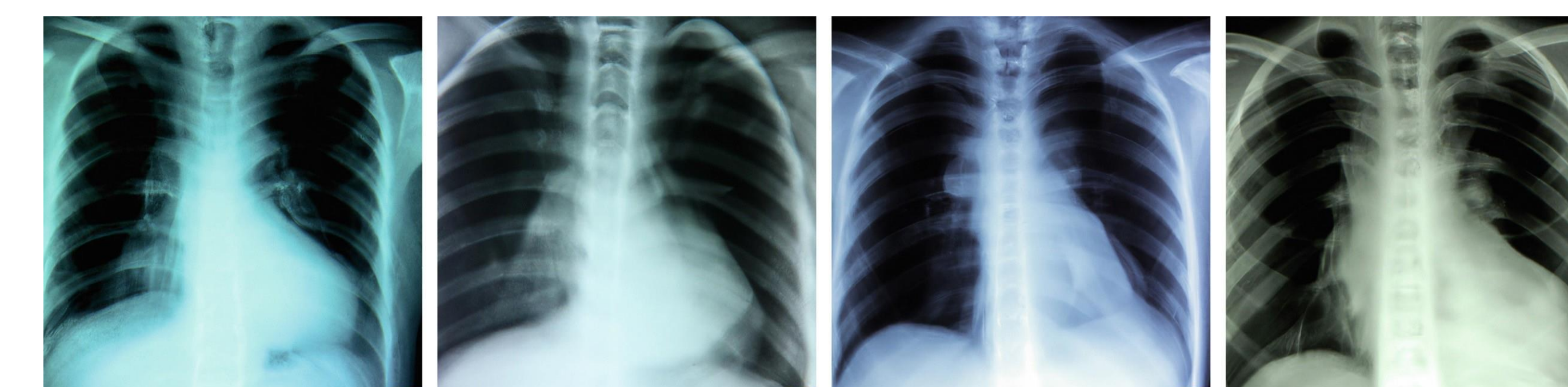X Ray images: **Five X-Ray** images were marked as real by both radiologists.
There were two X-Ray and two CT images for which both the radiologists were uncertain.

X ray   CT

☐ Left lower lobe effusions   ☐ Possible effusion

☐ Possibility of pneumonia   ☐ Possible pneumonia

☐ Bilateral infection

Samples of lung X Ray generated with diffusion model

Samples of lung CT generated with diffusion model
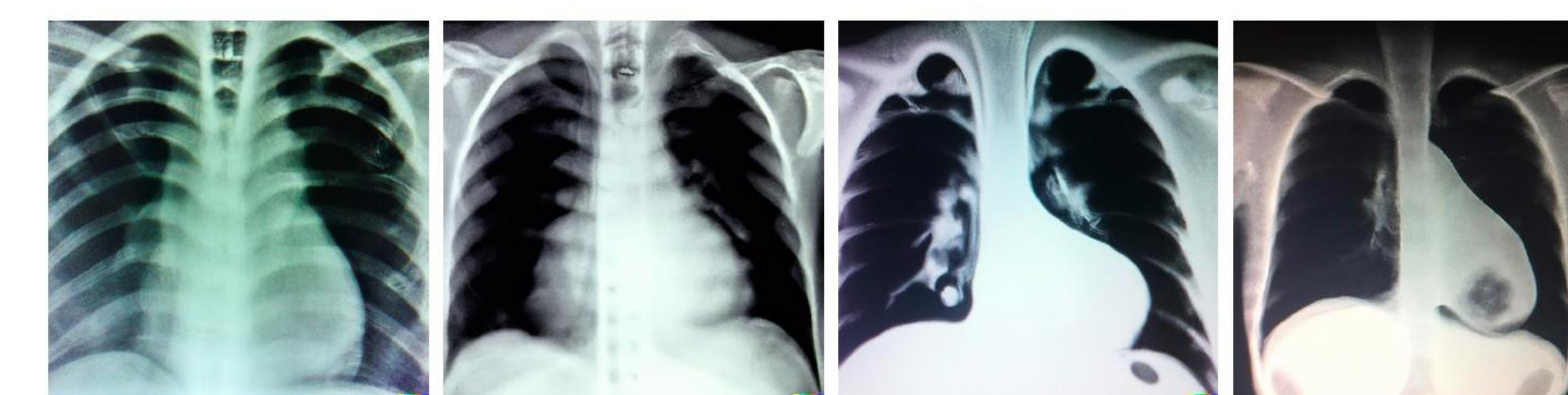
Identified as fake by at least two radiologists

References

1 J. Ho, A. Jain, and P. Abbeel, "Denoising diffusion probabilistic models," Advances in Neural Information Processing Systems, vol. 33, pp. 6840–6851, 2020.
2 P. Dhariwal and A. Nichol, "Diffusion models beat gans on image synthesis," Advances in Neural Information Processing Systems, vol. 34, pp. 8780–8794, 2021.
3 Hazrat Ali, Shafaq Murad, Zubair Shah, Spot the fake lungs: Generating Synthetic Medical Images using Neural Diffusion Models, 30th Irish Conference on Artificial Intelligence and Cognitive Science, December 2022, Cork, Ireland.

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Don't forget to turn up the volume on your device for an explanation. During the networking breaks, feel free to connect with the presenters to discuss the topic further.

Thanks for joining us!