ResNet-IoT-Based solution for Lung Cancer Diagnosis

There's a "U Can" in Lung Cancer

Submitted for MTH2175 project

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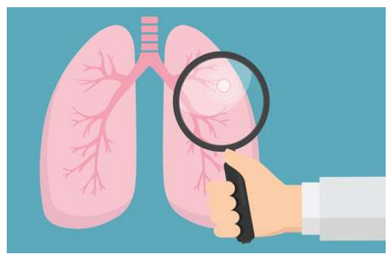
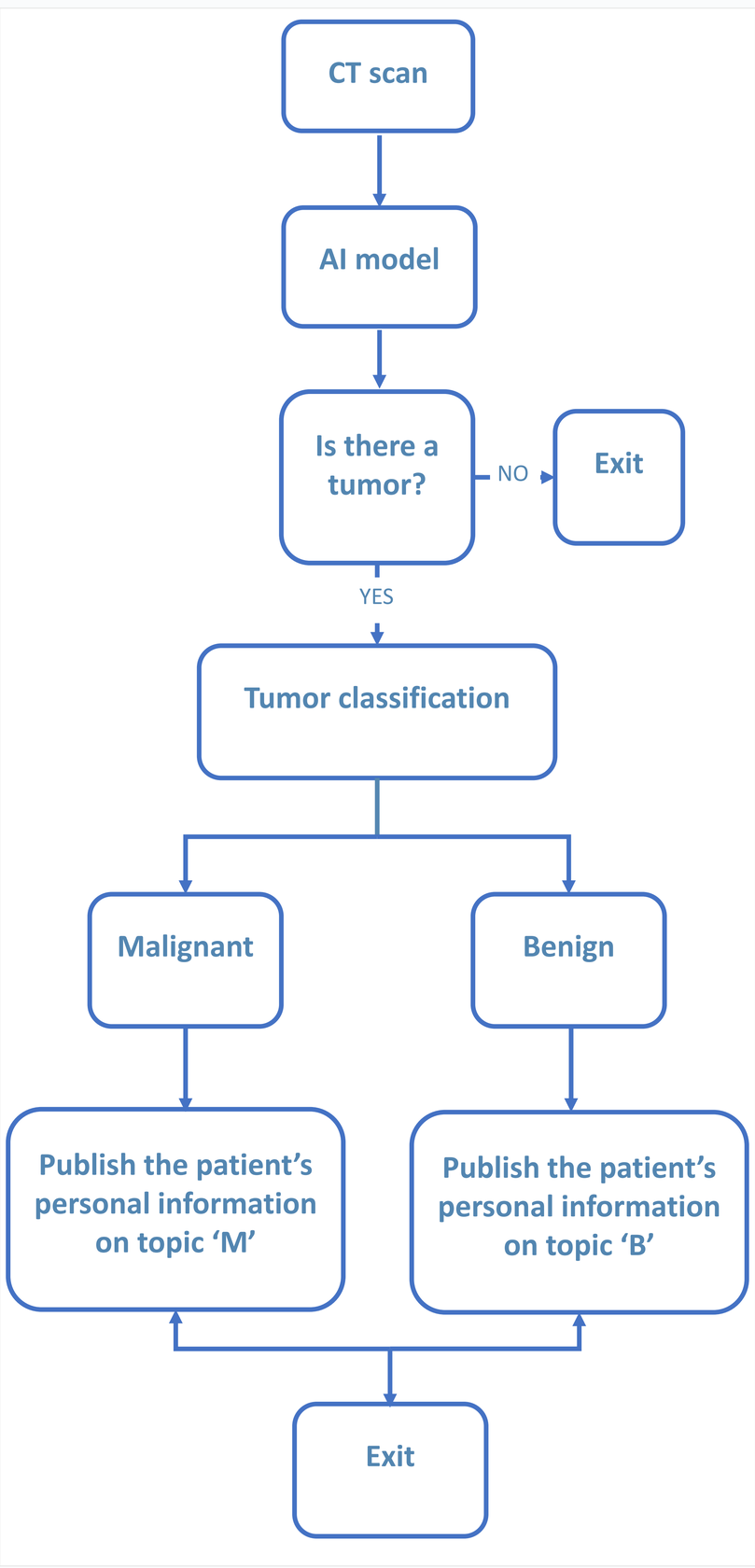
LUNGEVITY

1 Abstract



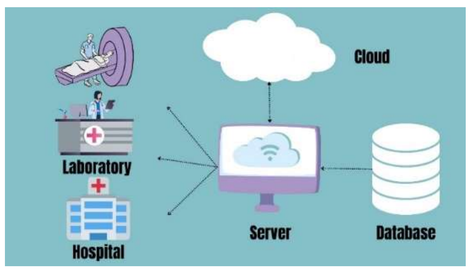
Lung cancer is a significant public health concern, emphasizing the importance of early detection, treatment and prevention to enhance survival rates.This motivated us to establish a software tool to speed up the diagnosis process. In our AI-IoT based solution, the patient is required to input their CT scans to the model and it detects the presence of a tumor and its nature, whether malignant or benign. The patient info then will be published on a server connecting laboratories with hospitals and cancer treatment centers.

2 Pathway to registry



3 IoT

- **Database:** personal and contact information of the patient besides its prognosis.



IOT all scenario

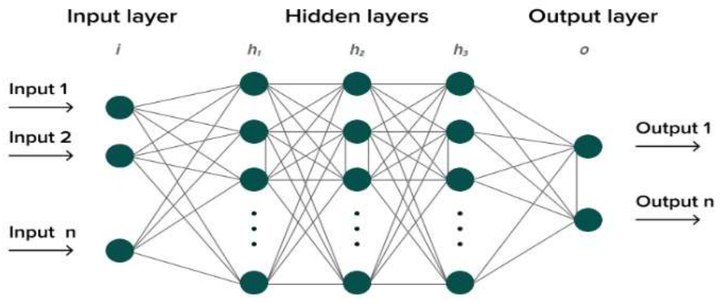
- **Server:** MQTT broker.
- **Relevant authorities:** our model is the publisher and the specialized hospitals are the subscribers.

4 Methodological Symphony

Math behind CNN

The training process consists of a sequence of three fundamental stages:

➢ **Forward propagation and backpropagation**

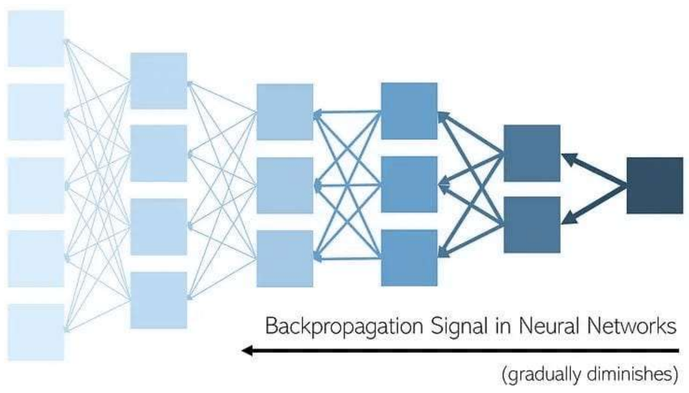


➢ **Updating weights & bias**

$$\omega_{ijk}^{new} = \omega_{ijk}^{old} - \alpha \cdot \frac{\partial E}{\partial \omega_{ijk}}$$

$$b_j^{new} = b_j^{old} - \alpha \cdot \frac{\partial E}{\partial b_j}$$

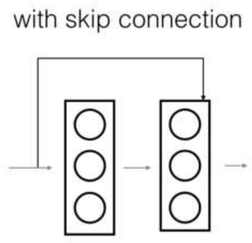
The problem of Vanishing Gradients



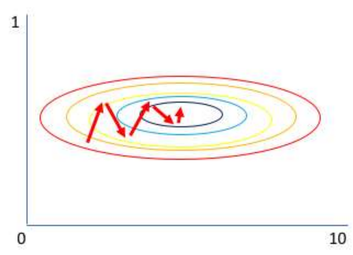
ResNet50 solves this issue using two different techniques:

➢ **Residual connections**

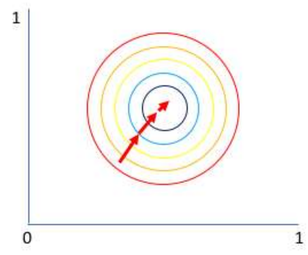
$$\frac{\partial E}{\partial x} = \frac{\partial E}{\partial y} \cdot \frac{\partial (F(x)+x)}{\partial x} = \frac{\partial E}{\partial y} \cdot F'(x) + \frac{\partial E}{\partial y}$$



➢ **Batch Normalization**



- Gradient of larger parameter dominates the update



- Both parameters can be updated in equal proportions

5 Dataset

Evaluation our Model for Lung Cancer Diagnosis we used Two Datasets:

Dataset 1

- 364 CT scan images
- 238 lung cancer cases,126 healthy cases

Collected from an Iranian hospital

Dataset 2

- 1097 CT scan images
- 120 benign cases, 561 malignant cases ,416 normal

Collected from two specialist hospitals in Iraq

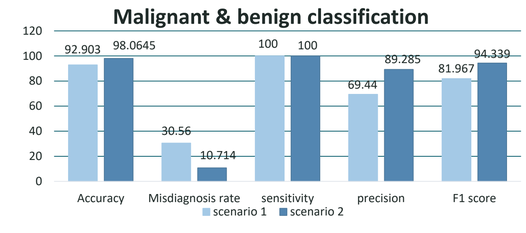
Reference

[1] K. He, X. Zhang, S. Ren and J. Sun, "Deep residual learning for image recognition," in Proceedings of the IEEE conference on computer vision and pattern recognition, 2016

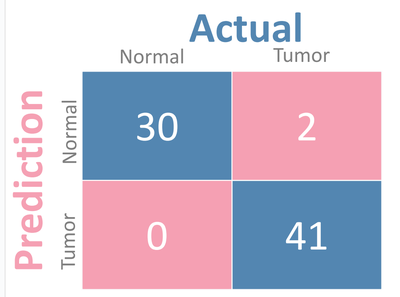
6 Results & Analysis

➢ **Evaluation criteria:**

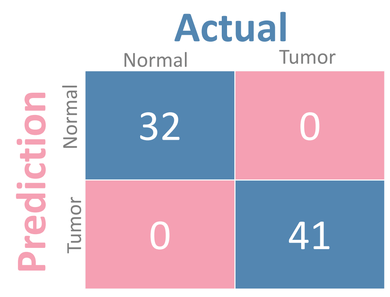
- Accuracy.
- Misdiagnosis rate.
- Sensitivity or recall.
- Precision.
- F1 score.



➢ **normal and tumor classification**

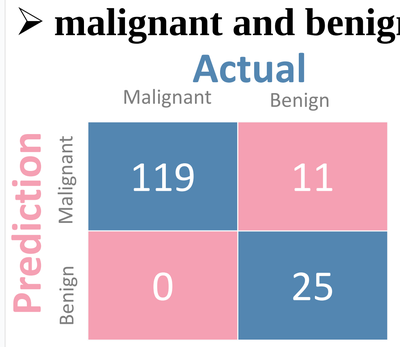


Epochs = 10

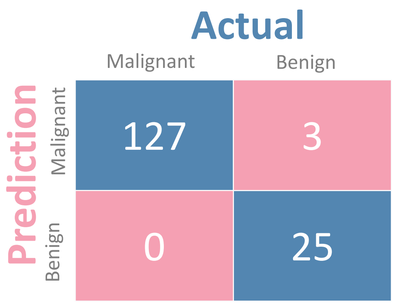


Epochs = 50

➢ **malignant and benign classification**

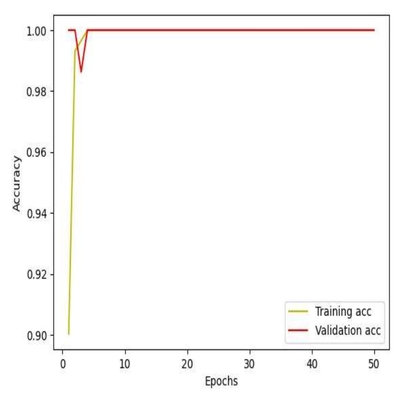


Epochs = 10

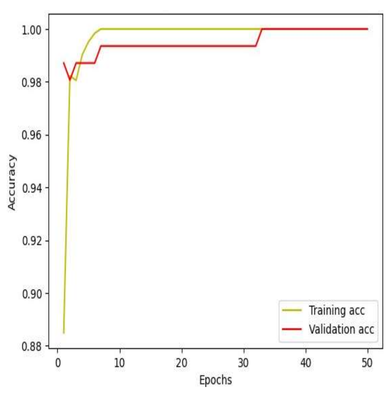


Epochs = 50

➢ **Training, validation accuracy vs epochs**



For normal and tumor classification



For malignant and benign classification

- we can observe that as the number of epochs increases , both the validation and training accuracy increases.

7 Conclusion

- Our study presents a novel approach for lung cancer diagnosis using the ResNet-50 architecture.
- We confirmed higher accuracy with more training epochs. Our model effectively detects whether tumors are malignant or benign.
- Adding the part of IoT, we established a network connecting patients with specialized hospitals to speed-up the registration process.

8 Future work

1. Perform a comparative analysis of ResNet-50 against competing models
2. Evaluate the adaptability of our ResNet-50 model across diverse datasets
3. Employ a one-level multi-class classification approach.
4. Enable Palestinian cancer patients to access our IoT platform and publish their info on the server to get notified about empty places.

Team members:

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