编号(学号)：2022150048

深圳大学

本科毕业论文(设计)任务书

（2026 届）

题目：基于 Transformer-UNet 的直肠肿瘤辅助诊断系统

学　　院：计算机与软件学院 **专　　业：**计算机科学与技术

班　　级：1 班 **学　　号：**2022150048

学生姓名：陈星 **指导教师：**梁正平

本科生毕业论文（设计）须知

1．认真学习理解《深圳大学本科生毕业论文（设计）工作规定》和《深圳大学本科生毕业论文(设计)撰写规范及要求》。

2．努力学习、勤于实践、勇于创新，保质保量地完成任务书规定的内容。

3．独立完成规定的工作任务，不弄虚作假，不抄袭别人的工作内容。

4．实验时，爱护仪器设备，节约材料，严格遵守操作规程及实验室有关制度。

5．毕业论文（设计）必须符合《深圳大学毕业论文（设计）撰写规范与要求》，否则不能取得考核成绩。

6．毕业论文（设计）成果、资料应于答辩结束后及时交给学院收存，学生不得擅自带离学校。经指导教师推荐可作为论文发表。

7．妥善保存《深圳大学毕业论文（设计）任务书》。

题目名称：基于 Transformer-UNet 的直肠肿瘤辅助诊断系统

一、毕业论文(设计)基本内容与要求：

背景：

随着深度学习技术在医学影像分析中的广泛应用，人工智能辅助诊断系统成为提升医疗效率与诊断准确率的重要方向。直肠肿瘤是常见的消化系统恶性肿瘤，早期诊断对患者预后至关重要。传统影像诊断依赖医生人工判读，存在效率低、主观性强等问题。

基于上述背景，本课题旨在构建一个基于改进 U-Net 网络的直肠肿瘤辅助诊断系统。系统通过集成注意力门控机制对 MRI 或 CT 图像的自动分析，增强网络对肿瘤区域的聚焦能力，抑制背景噪声干扰；同时提取肿瘤的几何特征（面积、周长、形态学指标）与纹理特征（灰度共生矩阵特征），实现肿瘤区域的智能识别与可视化，为临床诊断提供技术支持。

基本内容与要求：

设计并开发一个基于 Transformer-UNet 混合架构的直肠肿瘤智能辅助诊断系统。系统将 Transformer 的全局上下文建模能力与 U-Net 的局部细节捕获优势相结合，通过自注意力机制增强肿瘤区域的特征表达，并融合注意力门控与深度监督策略，对 CT 医学影像实现高精度自动分割与多维特征提取。系统支持肿瘤几何特征（面积、周长、形态学指标）、灰度统计特征及纹理特征的量化计算，并通过可视化界面与历史数据对比分析，为临床医生提供客观、高效、可追溯的诊断依据,从而提升直肠肿瘤的早期筛查能力、疗效评估准确性与预后判断的可靠性。

功能：

1) 技术
   - 深度学习框架：PyTorch、nnU-Net 框架、Transformer+U-Net
   - 前端框架：Vue + ElementUI
   - 后端框架：Flask
   - 图像处理库：OpenCV、SimpleITK
   - 数据管理：TensorRT 加速与 CT 影像数据归一化预处理

2) 系统功能：
   1. 肿瘤 CT 图像上传与管理。
   2. 模型推理与肿瘤分割结果生成。
   3. 肿瘤区域特征计算与展示（面积、周长、强度等）。
   4. 历史病例特征对比分析。
   5. 医生登录、管理及病例记录查询功能。
   6. 前端结果可视化展示与下载。

二、进度安排：

2025.10.25~2025.10.31	课题调研与需求分析
2025.11.01~2025.11.15	收集资料与系统总体设计
2025.11.16~2025.12.10	深度学习模型训练与验证
2025.12.11~2026.01.10	后端开发与 API 设计
2026.01.11~2026.02.10	前端开发与界面优化
2026.02.11~2026.03.10	系统集成与测试
2026.03.11~2026.03.31	撰写论文
2026.04.01~2026.04.20	修改论文与准备答辩

三、需收集的资料和指导性参考文献：

[1] Rouet-Leduc, B., Hulbert, C. Automatic detection of methane emissions in multi spectral satellite imagery using a vision transformer. Nat Commun **15**, 3801 (2024). https://doi.org/10.1038/s41467-024-47754-y

[2] P. Harsh, R. Chakraborty, S. Tripathi and K. Sharma, "Attention U-Net Architecture for Dental Image Segmentation," 2021 International Conference on Intelligent Technologies (CONIT), Hubli, India, 2021, pp. 1-5, doi: 10.1109/CONIT51480.2021.9498422.

[3] X. Yan, H. Tang, S. Sun, H. Ma, D. Kong and X. Xie, "AFTer-UNet: Axial Fusion Transformer UNet for Medical Image Segmentation," 2022 IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), Waikoloa, HI, USA, 2022, pp. 3270-3280, doi: 10.1109/WACV51458.2022.00333.

[4] Pan, P., Zhang, C., Sun, J. *et al.* Multi-scale conv-attention U-Net for medical image segmentation. *Sci Rep* **15**, 12041 (2025). https://doi.org/10.1038/s41598-025-96101-8

[5] Xiao Liu, Peng Gao, Tao Yu, Fei Wang, and Ru-Yue Yuan. 2025. CSWin-UNet: Transformer UNet with cross-shaped windows for medical image segmentation. Inf. Fusion 113, C (Jan 2025). https://doi.org/10.1016/j.inffus.2024.102634

[6] D. Ruth Edeokoh, M. Maktab Dar Oghaz and S. Raj Pandey, "Brain Tumour Segmentation in MRI Scans using Enhanced 3D U-Net Model," 2025 International Aegean Conference on Electrical Machines and Power Electronics (ACEMP) & 2025 International Conference on Optimization of Electrical and Electronic Equipment (OPTIM), Timisoara, Romania,2025, pp. 1-6, doi: 10.1109/OPTIM-ACEMP62776.2025.11075228.

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[8] T. P. T. Armand, S. Bhattacharjee, H. -K. Choi and H. -C. Kim, "Transformers Effectiveness in Medical Image Segmentation: A Comparative Analysis of UNet-Based Architectures," 2024 International Conference on Artificial Intelligence in Information and Communication (ICAIIC), Osaka, Japan, 2024, pp. 238-242, doi: 10.1109/ICAIIC60209.2024.10463435.

[9] Y. Shi et al., "VmambaIR: Visual State Space Model for Image Restoration," in IEEE Transactions on Circuits and Systems for Video Technology, vol. 35, no. 6, pp. 5560-5574, June 2025, doi: 10.1109/TCSVT.2025.3530090.

[10] T. -H. Pham, X. Li and K. -D. Nguyen, "seUNet-Trans: A Simple Yet Effective UNet-Transformer Model for Medical Image Segmentation," in IEEE Access, vol. 12, pp. 122139-122154, 2024, doi: 10.1109/ACCESS.2024.3451304.

[11] H. Wu, Z. Zhao and Z. Wang, "META-Unet: Multi-Scale Efficient Transformer Attention Unet for Fast and High-Accuracy Polyp Segmentation," in IEEE Transactions on Automation Science and Engineering, vol. 21, no. 3, pp. 4117-4128, July 2024, doi: 10.1109/TASE.2023.3292373.

[12] T. P. T. Armand, S. Bhattacharjee, H. -K. Choi and H. -C. Kim, "Transformers Effectiveness in Medical Image Segmentation: A Comparative Analysis of UNet-Based Architectures," 2024 International Conference on Artificial Intelligence in Information and Communication (ICAIIC), Osaka, Japan, 2024, pp. 238-242, doi: 10.1109/ICAIIC60209.2024.10463435.

[13] J. K R and V. Jacob, "A Transformer-Based Hybrid Framework for Breast Tumor Segmentation Using CAS-UNet and ViT," 2025 Advanced Computing and Communication Technologies for High Performance Applications (ACCTHPA), Ernakulam, India, 2025, pp. 1-7, doi: 10.1109/ACCTHPA65749.2025.11168587.

[14] M. Naderi, M. Givkashi, F. Piri, B. Mirmahboub, N. Karimi and S. Samavi, "Focal-Unet: Unet-like Focal Modulation for Medical Image Segmentation," in 2025 IEEE World AI IoT Congress(AIIoT),Seattle,WA,USA,2025,pp.0820-0825, doi: 10.1109/AIIoT65859.2025.11105308.

[15] H. R. Kanan, A. Adelöw and M. Colarieti-Tosti, "Cross-Domain Reconstruction Network Incorporating Sinogram Sinusoidal-Structure Transformer Denoiser and UNet for Low-Dose/Low-Count Sinograms," in IEEE Transactions on Radiation and Plasma Medical Sciences, doi: 10.1109/TRPMS.2025.3571281.

[16] S. Zhu, Y. Li, X. Dai, T. Mao, L. Wei and Y. Yan, "A Multi-Resolution Hybrid CNN-Transformer Network With Scale-Guided Attention for Medical Image Segmentation," in IEEE Journal of Biomedical and Health Informatics, doi: 10.1109/JBHI.2025.3578625.

[17] Y. Chen et al., "SCUNet++: Swin-UNet and CNN Bottleneck Hybrid Architecture with Multi-Fusion Dense Skip Connection for Pulmonary Embolism CT Image Segmentation*," 2024 IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), Waikoloa, HI, USA, 2024, pp. 7744-7752, doi: 10.1109/WACV57701.2024.00758.

四、选题信息：

选题性质：设计■　　论文□

选题来源：科研项目　国家级□　省部级□　其他：_____

项目编号：_____

教师自拟□

学生自拟□

师生共拟■

指导教师签名：_____

院系领导意见：

签名：

_____年___月___

日