Research Practices - CCE1 Literature Survey

Team code: TY9-3A
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Title: Applications of Artificial Intelligence and Machine Learning in Healthcare Diagnostics
Domain: AIML in Healthcare

Sub Domain: Medical Image Analysis using Deep Learning
Objective Description: Medical Image Analysis using Deep Learning
Team Member1: Mansi Vaishya

PICO 1
PAPER TITLE: Brain Tumor Segmentation from 3D MRI Scans Using U-Net (BraTS-2020)
Authors of paper: Sidratul Montaha,Sami Azam,A.K.M Rakibul Haque, Rafid.Md Zahid Hasan
Paper Description: This paper applies U-Net to 3D MRI brain scans for tumor segmentation. It demonstrates strong performance with high Dice scores on BraTS datasets. The approach reduces manual segmentation time while maintaining accuracy. The study highlights U-Net's suitability for clinical use in neuroimaging.
Link: https://link.springer.com/article/10.1007/s42979-023-01854-6

PICO 2
PAPER TITLE: Improved U-Net3+ with Stage Residual for Brain Tumor Segmentation
Authors of paper: Chuanbo Qin,Yujie,Wenbin Liao,Junying Zeng,Shfen and Xiaozhi Zhang
Paper Description: The research improves U-Net3+ by adding stage residual connections for better feature extraction. This enhances segmentation quality in brain tumor MRI datasets. The method outperforms baseline U-Net architectures on accuracy and robustness. It shows potential for clinical adoption in radiology.
Link: https://link.springer.com/content/pdf/10.1186/s12880-022-00738-0.pdf

PICO 3
PAPER TITLE: Detection and Classification of COVID-19 by Using Faster/Mask R-CNN on CT
Authors of paper:M.Emin Sahin,Hasan Ulutus,Esra Yuce,Mustafa Faith Erkoc
Paper Description: This study explores the use of Faster R-CNN and Mask R-CNN on CT scans for COVID-19 detection. The models achieved high sensitivity and specificity compared to radiologists. They also reduced the diagnostic time for large CT datasets.

The paper demonstrates the broader utility of DL in infectious disease imaging. Link: https://link.springer.com/article/10.1007/s00521-023-08450-y

PICO 4
PAPER TITLE: Deep Learning for Image Enhancement and Correction in MRI
Authors of paper: Zhaolin Chen,Kamlesh Pawar,Mevan Ekanayake,Cameron,Shenjun Zhong,Gary F.Egan
Paper Description: This paper presents DL methods for improving low-contrast and noisy MRI scans. Enhanced images allow radiologists to better identify abnormalities. The study shows significant improvements in structural clarity compared to conventional enhancement. It validates DL's role in improving medical imaging quality.
Link: https://link.springer.com/article/10.1007/s10278-022-00721-9

PICO 5
PAPER TITLE: Low-contrast Lesion Detection in Neck CT: Multireader Study with Deep Learning Reconstruction
Authors of paper: Quirin Bellman,Yang Peng,Ulrich Genske,Li Yan,Moritz Wagner **Paper Description:** This study investigates DL-based reconstruction techniques for identifying low-contrast lesions in CT scans. Results demonstrate improved detection accuracy compared to standard reconstruction. The method proved effective across multiple radiologists, reducing inter-observer variability. It emphasizes DL's strength in challenging low-contrast diagnostic cases.
Link: https://link.springer.com/content/pdf/10.1186/s41747-024-00486-6.pdf

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Sub Domain:Pathology Slide Analysis using Deep Learning
Objective Description:To apply DL techniques on pathology slides to identify tissue abnormalities and support precise, scalable, and efficient diagnosis.
Team Member2:Pooja Yadav

PICO 1
PAPER TITLE: Stain Normalization of Histopathology Images Based on Deep Learning A Review
Authors of paper: Chuanyun Xu,Yisha Sun,Yang Zhang,Tianqi Liu,Xiao Wang,Die Hu,Shuaiye Huang,Junjie Li,Fanghong Zhang and Gang Li
Paper Description: This paper proposes a deep learning method for stain normalization that preserves tissue structures while standardizing color variations across labs. The technique improves model generalizability by ensuring consistent input slides for training and testing. Results show that CNN classifiers trained on normalized images achieve higher accuracy compared to raw images. This method enhances robustness in multi-institutional pathology datasets and supports scalable diagnostic AI

systems.
Link**:** https://link.springer.com/chapter/10.1007/978-3-030-59722-1_30

PICO 2
PAPER TITLE: Slideflow: Deep Learning for Digital Histopathology with Real-Whole-slide visualization
Authors of paper: James M.Dolezal,Sara Kochanny,Emma Dyer,Siddhi Ramesh,Andrew Srisuwananananukorn,Matteo Sacco,Frederick M.Howard,Anran Li,Prajval Mohan and Alexander T.Pearson
Paper Description: Slideflow is introduced as a framework for large-scale WSI analysis, providing tools for preprocessing, stain normalization, and visualization. It emphasizes robustness across different scanners and laboratories, addressing a key limitation in pathology AI models. The study demonstrates improved cancer classification and survival prediction performance using Slideflow. Overall, it offers a practical and reliable pathway toward clinical adoption of AI in pathology.
Link: https://link.springer.com/content/pdf/10.1186/s12859-024-05758-x.pdf

PICO 3
PAPER TITLE: Deep Learning in Cancer Genomics and Histopathology
Authors of paper: Michaela Unger and Jakob Nikolas Kather
Paper Description: This review paper discusses the integration of genomics and histopathology using deep learning. It highlights how multimodal models combining clinical data with pathology images can improve cancer diagnosis and prognosis. The paper also explores challenges in data variability and interpretability. The authors conclude that multimodal AI can offer a more comprehensive view of patient health compared to single-data models.
Link: https://link.springer.com/content/pdf/10.1186/s13073-024-01315-6.pdf

PICO 4
PAPER TITLE: Histopathological Image Deep Feature Representation for CBIR in Smart PACS
Authors of paper: Cristian Tommasino,Franceso Merolla,Cristiano Russo,Stefania Stafania Staibano,Antonio Maria Rinaldi
Paper Description: This study applies deep learning to extract meaningful features from prostate cancer slides for grading purposes. The model outperformed traditional manual scoring by reducing variability among pathologists. It demonstrates the potential of CNN-based approaches in supporting precise cancer grading. The findings suggest DL can complement human expertise for faster and more accurate diagnoses.
Link: https://link.springer.com/article/10.1007/s10278-023-00832-x

PICO 5

PAPER TITLE: A Novel DL-based Algorithm Combining Tissue Areas with tissues areas to predict colorectal cancer survival from whol-slide images

Authors of paper: Yan-Jun,Hsin-Hung Chou,Peng-Chan Lin,Meng-Ru Shen and Sun-Yuan Hsieh

Paper Description: The paper presents a survival prediction model that integrates tissue segmentation with deep learning-based histopathological feature extraction. Results show that combining tissue-level and image-level data significantly improves prognosis accuracy. The model supports oncologists by offering better risk stratification for patients. This demonstrates the value of DL in predictive oncology beyond diagnosis alone.

Link: https://link.springer.com/content/pdf/10.1186/s12967-023-04530-8.pdf

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Sub Domain:

Disease Prediction using Machine Learning

Objective Description:

To develop ML models that predict chronic diseases early from patient health data for improved prevention and treatment.

Team Member3: Neha Palvi

PICO 1

Paper Title: Chronic Diseases Prediction And Detection Using Machine Learning

Authors of Paper: Abhinandan Katoch, Nitin Choudhary, Oshin Sharma

Paper Description:

This study develops machine learning models on structured clinical and demographic data to predict chronic diseases such as diabetes, hypertension, and heart disease. Models including Gradient Boosting and Random Forest were compared with traditional statistical methods, demonstrating higher prediction accuracy and earlier detection of chronic illnesses. The research highlights the importance of standardized clinical data and ML-driven automation for preventive healthcare analytics.

Population: Patients at risk of chronic diseases (e.g., heart disease, diabetes, cancer)
Intervention: ML models trained on structured clinical and demographic data
Comparison: Traditional statistical scoring systems or manual assessment
Outcome: Higher prediction accuracy and earlier detection

Link: https://ijcrt.org/viewfull.php?p_id=IJCRT2305501

PICO 2

Paper Title: Preventive machine learning models incorporating health checkup data and hair mineral analysis for low bone mass identification

Authors of Paper: Su Jeong Kang , Joung Ouk (Ryan) Kim , Moon Jong Kim , Yang-Im Hur , Ji-Hee Haam , Kunhee Han & Young-Sang Kim .

Paper Description:

The explores the use of **AI and ML** to predict low bone mass, a key sign of osteoporosis. It combines **health checkup data** and **hair mineral analysis** to build accurate predictive models. The study identifies important health and mineral factors affecting bone density. Results show that ML-based approaches can effectively detect early signs of bone loss. This research highlights the potential of **data-driven preventive healthcare** using machine learning for early diagnosis and personalized treatment.

Population: Adults undergoing routine health check-ups
Intervention: Gradient Boosting, Random Forest-based prediction systems
Comparison: Logistic regression or rule-based systems
Outcome: Better sensitivity and specificity in predictions

Link: https://www.nature.com/articles/s41598-024-69090-3

PICO 3

Paper Title: Missing Values and Imputation in Healthcare Data: Can Interpretable Machine Learning Help?

Authors of Paper: Zhi Chen, Sarah Tan, Urszula Chajewska, Cynthia Rudin, Rich Caruana

Paper Description:

The research focuses on addressing incomplete patient medical histories using imputation and feature engineering. Various ML-based imputation techniques were tested to restore missing clinical values, followed by training predictive models for disease classification. Results reveal that imputation significantly improves accuracy and robustness compared to manually ignoring missing records. The study highlights the importance of handling data sparsity effectively for reliable medical predictions.

Population: Patients with incomplete medical histories
Intervention: ML models using imputation and feature engineering for missing data
Comparison: Manual filling of gaps or ignoring missing records
Outcome: Robust predictions despite incomplete records

Link: https://proceedings.mlr.press/v209/chen23a/chen23a.pdf

PICO 4

Paper Title: Investigation into Application of AI and Telemedicine in Rural Communities: A Systematic Literature Review

Authors of Paper: Kinalyne Perez , Daniela Wisniewski , Arzu Ari , Kim Lee , Cristian Lieneck , and Zo Ramamonjiarivelo

Paper Description:

This study proposes lightweight ML models optimized for deployment in rural and low-resource healthcare centers. Using Random Forest and Logistic Regression on minimal patient data, the models provide reliable disease predictions without the need for high-end computational devices. The approach supports early diagnosis at primary health centers, reducing the need for referrals to tertiary hospitals and promoting accessible healthcare.

Population: At-risk populations in rural healthcare settings
Intervention: Lightweight ML models deployable on low-resource devices
Comparison: Referral to tertiary hospitals for full diagnostic workup
Outcome: Early detection at primary health centers

Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC11816903/pdf/healthcare-13-00324.pdf

PICO 5

Paper Title: PREDICTING GENETIC DISORDER USING MACHINE LEARNING APPROACHES

Authors of Paper: Garg M., et al.

Paper Description:

The paper introduces an ensemble ML framework that integrates genomic and phenotypic data to predict disease risks in patients with rare genetic disorders. The model shows superior performance over conventional pedigree-based and statistical methods. It demonstrates how multi-omics integration and ML can identify high-risk individuals earlier, supporting preventive genetic counseling and precision medicine initiatives.

Population: Patients with rare genetic disorders
Intervention: ML models trained using genomic and phenotypic data for prediction of disease risk
Comparison: Traditional statistical risk calculators or pedigree-based manual analysis
Outcome: Improved identification of high-risk individuals, leading to earlier preventive measures and genetic counselling

Link: **Predicting Genetic Disorder Using Machine Learning Approaches**

Github Link: https://github.com/poojagovindprasadyadav/RP