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## The Use of AI in Pediatric Congenital Heart Disease: How Far Have We Come?

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OBJECTIVES/GOALS: Artificial Intelligence (AI) is gaining popularity in a variety of disciplines. While clinical applications for AI have increased in recent years, the use of AI in pediatric congenital heart disease (CHD) is limited. The goal of this systematic review was to assess how AI is currently used in this patient population and to describe knowledge gaps. METHODS/STUDY POPULATION: A systematic search was performed up to July 2023 using PubMed and Scopus databases and revealed 814 articles. Upon initial screening, 161 duplicates, 76 non-AI articles, and an additional 318 irrelevant articles were removed. A total of 259 full-text articles were reviewed for relevance. Articles that did not include a retrospective or prospective review of human subject data were excluded. Articles that had only results in the adult, prenatal, or non-CHD population were excluded. The remaining 68 articles were included in this review. RESULTS/ANTICIPATED RESULTS: Of the 68 articles in this review, 19 were performed within cardiac surgery, 41 were within cardiology, and the remaining 8 included articles were combined cardiac surgery and cardiology. Upon initial review, 24 used AI for diagnostic purposes, 40 for predicting survival or adverse outcomes, 2 for developing training tools, and 2 for surveillance of CHD trends. We anticipate that upon further review of these 68 articles, there will be a wide variety in the types of AI models that were used. The results will reveal a multitude of challenges and limitations that future studies will need to further address. DISCUSSION/SIGNIFICANCE: While technical innovations in pediatric CHD have dramatically improved survival rates, we have hit a plateau in improving the complications of these patients. AI has created an opportunity to build new diagnostic, predictive, teaching, and surveillance tools for advancing CHD care, but it seems we still have a long way to go.

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## Exploring the Iterative Clustering for Subtype Discovery (iKCAT) Algorithm for Robust Computer-Aided Diagnosis of Lung Cancer

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OBJECTIVES/GOALS: With a growing interest in tailoring disease diagnosis to each individual as opposed to a "one-size-fits-all" approach, our aim is to enhance the robustness of the Iterative Clustering for Subtype Discovery (iKCAT) algorithm in characterizing lung cancer subtypes for individualized treatment. METHODS/STUDY POPULATION: Our method explores the robustness of the previously developed iKCAT algorithm. This iterative clustering method finds robust—homogeneous and differentiable—subtypes of lung nodules through iterative K-means clustering that helps classify them and leaves some data unclustered. This set of unclustered or "hard" data represents images that cannot confidently be assigned to any subtypes and may require more resources (e.g., time or radiologists) to diagnose. We explore the robustness of iKCAT across multiple feature spaces, including designed image features (which are engineered to capture some properties such as level of elongation, eccentricity and circularity), reduced designed image features using Principal Component Analysis (PCA) and Uniform Manifold Approximation and Projection (UMAP). RESULTS/ANTICIPATED RESULTS: When running our experiment on the 64 image features, our results consistently carved out a single pure, homogeneous cluster over the course of 30 iKCAT runs. From an initial dataset of 1490 data points, 1430 points were left unclustered in this feature space. When conducting the 30 iKCAT runs on the PCA feature space with 10 components, we found it did not produce any distinct cluster above the defined homogeneity threshold. The 2D UMAP feature space consistently generated 8 clusters with an average homogeneity of 87. 22% over 30 runs, and only left 9 points unclustered. Over 30 iKCAT runs, we identified 8 persistent clusters or subtypes, 3 mostly malignant and 5 mostly benign clusters. DISCUSSION/SIGNIFICANCE: Through our experiment using the iKCAT algorithm, we found that iKCAT's clustering functionality produced the most persistent results on the 2D UMAP feature space due to its high average homogeneity scores and consistency in identifying clusters/subtypes, helping improve tailored disease diagnosis.

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## Applying MeSH Tree Structures and Condition-to-MeSH Mapping to Catalog and Characterize Clinical Trials Research Focus Areas

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OBJECTIVES/GOALS: Characterizing and analyzing research studies presents several challenges given the various ways studies may be labeled or organized. The Medical Subject Headings (MeSH) thesaurus is a hierarchical vocabulary that can index and organize research foci using common business intelligence tools to enable rapid exploration of research portfolios. METHODS/STUDY POPULATION: Metadata from ClinicalTrials.gov on 455,437 trials were downloaded and all MeSH terms associated with trials in the condition_browse section were loaded into a database. The corresponding MeSH trees for each term were then identified and mapped to their ancestor terms within the tree. Trials were then indexed based on top four hierarchical levels for each associated MeSH term. Trials performed at the University of Miami (UM) were identified based on locations associated with the trial as well as matching National Clinical Trial

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