AI in Periodontology: A Scoping Review

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The application of Artificial Intelligence is burgeoning within the health science sector. This poster highlights the current use of this tool within the fields of Periodontology and Implantology since the advent of the CNN.

Background

There has been an explosion in the utilization of Artificial intelligence (AI) in health science over the last five years. Artificial intelligence (AI) aims to mimic human behaviour using machines. Science fiction presents AI to us as a comprehensive overarching intelligence; however, this is far from the truth. AI was developed to solve problems in specific areas by learning distinct thinking mechanisms and perceptions that can provide complex regression analysis. This specific problem-solving capability lends itself to big data analysis through the medium of software-type algorithms, most employed as Convolutional Neural Networks (CNNs).

Focused question and study eligibility

"What are current clinical applications of Machine Learning or Artificial Intellegence in the field of Periodontics?"

Inclusion

1. English language
2. Using AI architecture as the central tool to assess data
3. Involving aspects affecting the diagnosis, treatment or evaluation of periodontal conditions or implantology

Exclusion

1. Non-English language
2. Using computer science technology
3. Does not include a periodontal/implant aspect to the research

Search Flowchart
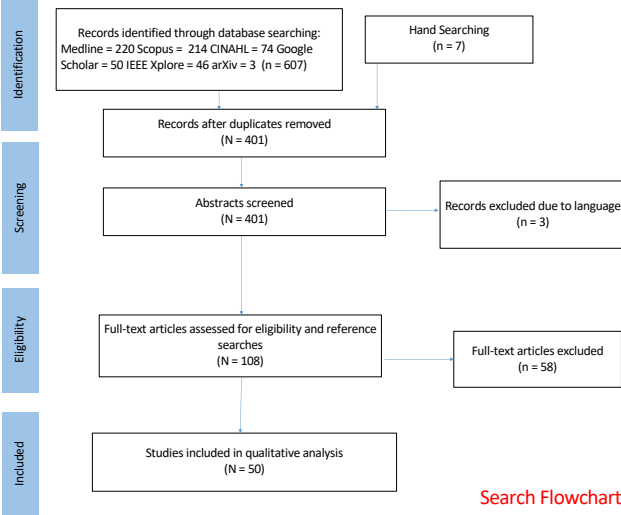
Methods

Extensive searches were performed of Medline, Scopus, CINAHL, Google, IEEE Explore and arXiv. Individual review search strategies based on the PICO question were used for each database. Collated titles abstracts were screened by a single author with a broad initial inclusion criteria to allow for maximal hand-searching of relevant literature review articles (ie Review articles were included at this stage and solely used for hand-searching relevant titles). Articles included for qualitative assessment were solely an AI/ML technology (ie algorithms that can learn independently) were utilised as the dependent variable in the study. Included articles were qualitatively analysed for relevant metrics to be tabulated and assessed.

Results

Year of Study Publication

Study Content Data

LOCATION OF RESEARCH

CNN ARCHTIECTURE
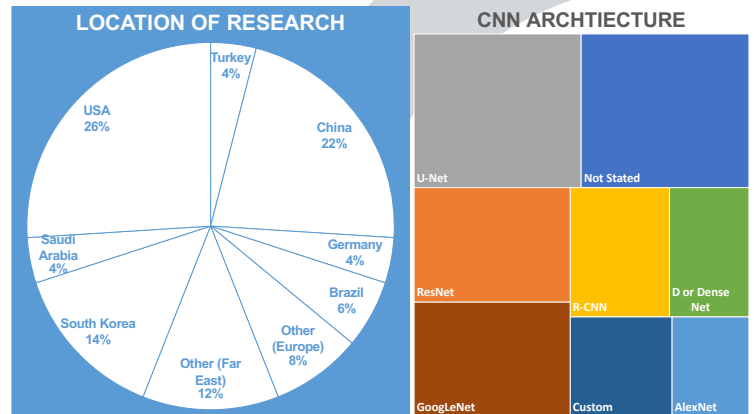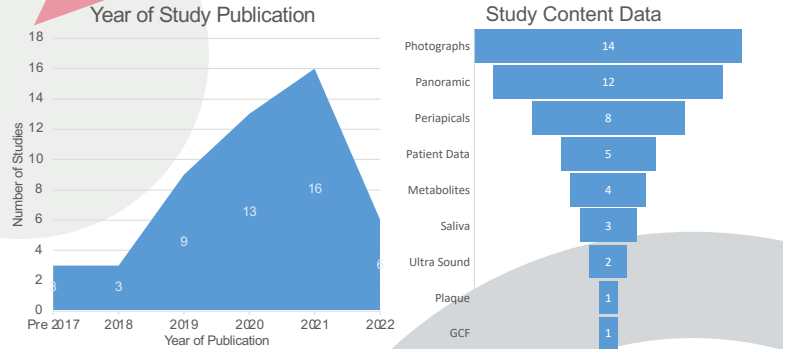
Discussion

The number of research projects now using CNNs as a powerful tool for data analysis has increased in a linear fashion over the last four years. This lags behind the general trend in medical science, which is moving at a more logarithmic rate, highlighting the opportunity for the dental research world to harvest potentially powerful data from study findings unseen today.

However, where CNN's were used as regression tools (notably when looking at patient data or immunological assays) to find and assess trends in data, limited novel outcomes have been found in the periodontal field.

Conversely, in the field of image recognition, accuracy in anatomical recognition has advanced over time. Anatomical segmentation has been reported with an accuracy of up to 0.98. This is likely due to three factors:

1) training set size has increased
2) a progression in computing power has occurred; SHARC or HPCS computing hardware has increased in accessibility
3) algorithm power has increased with more hybrid and bespoke dental programs available.

This level of precision has now taken us to a point where the limitations of imaging data are now increasingly the major limiting factors

Conclusions

AI, through CNN architecture, should be considered a mainstream tool for all studies where data analysis is performed. Future studies should now focus on digital solutions for inherent limitations with in the data.

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Sheffield Teaching Hospitals NHS Foundation Trust