Details for each study:

* Atm – 08 -09 (applies experimental study
* Name: deep learning, image based approach for automated diagnosis for inflammatory skin diseases Haijing Wu1#, Heng Yin1#, Haipeng Chen2, Moyuan Sun2, Xiaoqing Liu2, Yizhou Yu2, Yang Tang3, Hai Long1, Bo Zhang1, Jing Zhang1, Ying Zhou1, Yaping Li1, Guiyuing Zhang1, Peng Zhang1, Yi Zhan1, Jieyue Liao1, Shuaihantian Luo1, Rong Xiao1, Yuwen Su1, Juanjuan Zhao3, Fei Wang3, Jing Zhang3, Wei Zhang3, Jin Zhang3, Qianjin Lu
* Background: the advent of the deep learning era,particularly the advancemnets in convolutional networks, had revolutionized various fields of medicine, including radiology and pathology. However, the applications of Cnns in dematogoloy, which also relies heavily on image analysis, remains limited. Inflammatory skin diseases like prirsis, eczema, and atopic dermatitis pose significant challenges in clinical diagnosis due to their similar visual presentations, leading to frequent mis diagnosis.
* Methods: this study introduces n artificial intelligence dermatogoly diagnosis assistant (AIDDA) for psoriasis, eczema, atopic dermatisis, and healthy skin based images and evaluated using exeprt-confirmed clinical images categorized by dermatologists into three groups: healthy skin,psoriasis, and eczema/atopic dermatitis. A specific CNN architecture used in this study, known for its efficiency and performance in image classification tasks. Based on the EfficientNet-b4 CNN algorithm, we developed an artificial intelligence dermatology diagnosis assistant (AIDDA) for Pso, Ecz & AD and healthy skins (HC). The proposed CNN model was trained based on 4,740 clinical images, and the performance was evaluated on experts-confirmed clinical images grouped into 3 different dermatologist-labelled diagnosis classifications (HC, Pso, Ecz & AD). We implemented our model with Pytorch 1.1. Our training
* and validation process was conducted via an 18 Core Intel®

Xeon® CPU E5-2697 and 4 RTX 2080Ti NVIDIA GPUs.

* Results: AIDDA demonstrated an overall diagnosis accuracy of 95.80%±0.09%, with a sensitivity of 94.40%±0.12% and specificity of 97.20%±0.06%. The model showed accuracy rates of 89.46% for psoriasis, 92.57% for eczema/atopic dermatitis, and high sensitivity and specificity for all categories.
* Conclusions AIDDA representts a significant advancement in diagnosis of inflammatory skin diseases, showcasing the potential of deep learning network tools in enhancing clinical practice. This study underscores the importance of CNNS in dermatology and highlights the potential of smartphone-based AI applications to revolutionize medical diagnosis and improve patient care.
* The research presents a promising direction for the integration of AI in dermatological practice with AIDDA offering a practical and eifficeint tool for dermatologists, particularly in the diagnosis of challenging inflammatory skin conditions
* Key definitions:
  + **Inflammatory skin diseases:** Refers to skin disorders characterized by inflammatory cell infiltration and elevated inflammatory cytokines, affecting more than 1/5 of the global population. Examples include psoriasis, eczema, and atopic dermatitis.
  + **CNNs (Convolutional Neural Networks):** A class of deep neural networks, most commonly applied to analyzing visual imagery. CNNs have shown significant potential in image classification tasks and have been increasingly utilized in various medical fields.
  + **AIDDA (Artificial Intelligence Dermatology Diagnosis Assistant):** An AI-based smartphone application developed in this study, designed to assist in the diagnosis of inflammatory skin diseases using CNN algorithms.
  + **Sensitivity and Specificity:** Sensitivity refers to the proportion of true positive results among all actual positives, indicating the ability of a test to correctly identify those with the disease. Specificity, on the other hand, refers to the proportion of true negative results among all actual negatives, indicating the ability of a test to correctly identify those without the disease.
* Use ful statistic: In this study, we demonstrate that deep learning can be

effectively applied in dermatology outside of melanoma

diagnosis. In particular, our work highlights that CNNs are

able to differentiate amongst multiple diseases with skin

conditions like Pso, AD & Ecz. Our AIDDA smartphone

APP for this CNN is publicly available to all doctors in

GAP: APP FOR DEMATOGOLOGISTS NOT PATIENTS, A LOT OF E-DIAGNOSIS IS FOCUSED ON ASSISTING CLINICIANS WITH CANCER DETECTION especially cnns. This study was done in china (data has a cultural focus)

Article 2: **Case Study: Smart identification of psoriasis by images usingconvolutional neural networks: a case study in ChinaS. Zhao,1,2,3,†B. Xie,4,†Y. Li,4,†X. Zhao,4Y. Kuang,1,2,3J. Su,1,2,3X. He,4X. Wu,5W. Fan,5K. Huang,1,2,3J. Su,6Y. Peng,6A.A. Navarini,7,8,\* W. Huang,9,\* X. Chen1**

SHOUld continue comparison data with clincians and real world settings

we comparedour model with human dermatologists and tested the generaliza-tion performance on a simulated real-world clinical situation

* Psoriassis is a prevalent chronic inflammatory skin disease in China, often underdiagnosed n rural areas due to lack of dermatologists. This study proposes a smart approach for early psoriasis identification using clinical images, without requiring a dermatoscope. A two-stage deep learning model based on convolutional neural networks(CNNs) was developed and evaluated on a standardized dermatological dataset with 8021 clinical images of 9 common skin disorders, including psoriasis. The two-stage model achieved an area under the curve (AUC) of .981, outperforming a single-stage model and showing superior performance of 25 chinses dermatologists in diagnosing psoriasis. This research demonstrates the feasibility and effectiveness of using CNNs for psoriasis identification based on clinical images, laying a solid foundation for scar care of skin diseases using mobile applications for tele dermatology in China.
* Introduction: Psoriasis, a chronic autoimmune skin condition, poses a significant burden on global health. I n China, the scarcity of dermatologists, especially in rural areas, leads to underdiagnosis and mis diagnosis of psoriasis. Early and accurate diagnosis is crucial for proper management and prevention of complications. To address this, the study focuses on developing a smart psoriasis identification system using deep learning, particularly cnns. Which have shown promise in computer aided diagnosis for skin diseases.
* Methods: The study utilized the XiangyaDerm-Pso9 dataset, consisting of 8021 clinical images of 9 skin disorders, including psoriasis, collected over 9 years in China. A two-stage neural network model was designed. In the first stage, a multilabel classifier was trained to learn visual patterns for each skin disease. In the second stage, the output of the first stage was used to distinguish psoriasis from other skin diseases. Four CNN architectures were explored and compared for the best performance.
  + **DenseNet121**: Achieved an AUC of 0.954 ± 0.024 with a specificity of 0.97 and sensitivity of 0.83.
  + **InceptionResNetV2**: The article did not provide specific performance metrics for this architecture.
  + **Xception**: Achieved an AUC of 0.976 ± 0.022 with a specificity of 0.98 and sensitivity of 0.93.
  + **InceptionV3**: Outperformed the other architectures with an AUC of 0.981 ± 0.015 and specificity of 0.98 and sensitivity of 0.92.
* Results: The two-stage model achieved an AUC of 0.981, outperforming the single-stage model. It also showed superior performance to 25 dermatologists the capability of CNNs in identifying psoriasis based on clinical images and highlight the potential for mobile applications in tele dermatology.
* Conclusion: Using clinical images for psoriasis identification is effective and feasible based on CNNs. The study lays a foundation for developing smart care systems for skin diseases, especially psoriasis, using artificial intelligence in China. Further research is needed to expand the application to other skin diseases and improve the overall diagnostic accuracy.
* Key definitions:
  + **Psoriasis**: A chronic inflammatory skin disease.
  + **Dermatoscope**: A tool used by dermatologists for skin examination.
  + **Convolutional Neural Networks (CNNs)**: Deep learning models used for image recognition and classification.
  + **Missed Diagnosis Rate**: The rate at which the model or dermatologists incorrectly classify a psoriasis case as a non-psoriasis case.
  + **Misdiagnosis Rate**: The rate at which the model or dermatologists incorrectly classify a non-psoriasis case as psoriasis.
  + **Teledermatology**: The use of telecommunication technologies for dermatology consultations and diagnoses, often using clinical images.
* **Gap**:
  + **Insufficient Dermatologists**: There is a shortage of professional dermatologists in China, especially in rural areas, leading to missed or misdiagnosed cases of psoriasis. (may not b relevant to America)
  + **Limited Skin-Specific Medical Knowledge**: Family physicians often lack specialized knowledge in dermatology, resulting in psoriasis cases being missed or mislabeled.
  + **Lack of Automatic Identification Systems**: There is a need for automated systems to identify psoriasis using clinical images, which could improve early diagnosis and regular treatment.
  + **Inadequate Dataset and Research**: The study notes a lack of research on artificial intelligence-based diagnosis of psoriasis, especially with clinical image datasets derived mainly from Chinese patients.
  + **Limited Visual Identification Studies**: While there have been advancements in using CNNs for skin disease diagnosis, there are few studies specifically on visual identification of psoriasis based on clinical image datasets.

Article 3: Image-based automated Psoriasis Area Severity Index scoring by Convolutional Neural Networks

* Abstract: Psoriasis is a chronic inflammatory skin condition affecting millions worldwide, with its severity often assessed using the psoriasis area and severity index(PASI) score. This study explores the potential of automating PASI scoring using Conventional Neural Networks(CNNS) and compares the performance of CNNs to image based scoring by physicians. The CNNS were trained on standardized imaging series from psoriasis patients, with separate models trained for each PASI sub score (erythema, desquamation, induration, and area) in anatomical regions (trunk, arms, and legs. The study finds that CNNS have potential to perform image-based PASI scoring at an anatomical region level, with comparable performance to physicians in most sub scores and outperforming them in area scoring.
* Introduction: Psoriasis is a prevalent skin disease characterized by raised, erythematous and scaling lesions, affecting around 2-3% of the western population. The severity of psoriasis is commonly measured using PASI score, which involves visual inspection of the skin in four anatomical regions. However, PASI scoring is time-consuming and subject to inter- and intra-observer variability. Automated PASI scoring could offer a more efficient and objective assessment of psoriasis severity. While some studies have explored computer-aided diagnosis systems for psoriasis severity. While some studies have explored computer-aided diagnosis systems for psoriasis severity; deep learning -based approaches, particularly CNNs, have shown promise in automating severity and scoring.
* Methods: The study used data from the Child-Capture registry, consisting of standaridaed images of psoriasis patientis’ trnk, arms, and legs. The CNNs were training using CNNCORAL architecture, which converts ordinal scales into binary classification sub-problems. Separate CNNs were trained for each PASI sub score in each anatomical region. The performance of CNNs was evaluated using accuracy, mean absolute error(MAE), and interclass correlation coefficient(ICC). A reader study was also conducted to assess image based PASI scoring by physicians and compare it to CNN performance.
* Results: The CNNCoral achieved accuracies ranging form 0.603 to 0.794 for different PASI sub scores and anatomical regions. The MAE was below 0.42 for all sub scores, indicating robust predictions. The ICCs ranged from 0.541 to 0.804, with the highest agreement observed for the area sub score. Image-based PASI scoring by physicians showed moderate to good agreement with each other but lower agreement with real-life scores compared to CNNs. The CNNCORAL outperformed physicians in area scoring and performed similarly in other sub scores.
* Conclusion: CNNs have the potential to automate image-based PASI scoring at an anatomical region level. While further improvements are needed for clinical implementation, this study demonstrates the feasibility and benefits of using CNNs for objective and efficient PASI scoring in clinical practice and research.
* Key definitions:
  + Psoriasis Area and Severity Index (PASI) score: A scoring system used to assess the severity of psoriasis based on the extent of erythema (redness), induration (thickness), desquamation (scaling), and the percentage of affected body surface area. The PASI score is calculated for four anatomical regions (head, trunk, arms, and legs) and is used to monitor disease severity and treatment efficacy.
  + Convolutional Neural Networks (CNNs): Deep learning models specifically designed for analyzing visual data, such as images. CNNs are commonly used in computer vision tasks, including image classification, object detection, and image segmentation.
  + CNNCORAL: A specific CNN architecture used in the study, which is designed to handle ordinal scales. It converts a multi-class classification problem into multiple binary classification sub-problems, ensuring consistent predictions between the binary sub-problems.
  + Image-based PASI scoring: The process of determining PASI subscores (erythema, induration, desquamation, and area) based on images of psoriatic lesions. This approach aims to automate the PASI scoring process, making it more objective and efficient.
  + Interclass correlation coefficient (ICC): A statistical measure used to assess the agreement or consistency between two or more raters or methods. In the study, ICC is used to evaluate the agreement between the CNN-based PASI scoring and real-life PASI scores, as well as the agreement between image-based PASI scoring by physicians and real-life scores.
* GAP:
  + **Limited existing approaches**: The study highlights the limited number of studies that have attempted automated PASI scoring using deep learning methods. Previous approaches primarily focused on image processing and traditional machine learning algorithms, with few studies exploring the use of CNNs for automated PASI scoring.
  + **Lack of anatomical region-level analysis**: Prior to this study, most automated PASI scoring methods focused on analyzing single psoriasis plaques or lesions, rather than scoring the severity of psoriasis at an anatomical region level. This limited approach is inadequate for accurately assessing the overall PASI score, which considers multiple subscores across different anatomical regions.
  + **Need for objective and efficient scoring**: The study emphasizes the need for automated and objective PASI scoring methods to improve the efficiency and reliability of psoriasis severity assessment. Manual PASI scoring is time-consuming and subject to inter- and intra-observer variability, highlighting the importance of developing automated scoring methods.
  + **Challenges in image-based scoring**: The study indicates that image-based scoring by physicians, while showing moderate to good agreement among themselves, had lower agreement with real-life PASI scores compared to the CNN-based scoring. This suggests that physicians may face challenges in accurately scoring psoriasis severity based on images alone, highlighting the potential benefits of automated scoring methods.
  + **Opportunities for improvement**: Despite the promising results of the CNN-based automated PASI scoring in the study, the authors note that further improvements are needed. Expanding the training dataset and refining the CNN models could enhance the performance of automated PASI scoring methods, making them more suitable for clinical practice and research.

Article 4: DeepLearningApplicationforEffectiveClassificationofDifferent Types of Psoriasis

* Abstract: Psoriasis is a chronic inflammatory skin disorder affecting millions worldwide. Deep learning techniques have shown promise in skin disease prediction and classification. This study proposes a deep learning application for classifying five types of psoriasis using convolutional neural networks (CNN) and long short-term memory (LTSM). Preprocessing techniques and feature extraction were applied to 172 normal skin images and 301 psoriasis images. The CNN and LSTM models achieved accuracies of 84.2% and 72.3% respectively, with a significance between them. This application demonstrates potential for broader dermatological applications.
* Introduction: Psoriasis is a chronic skin disorder affecting a significant portion of the global population. Its impact on quality of life is substantial, often likened to heart
* aliments due to associated depression and increased suicide rates. Current diagnostic methods, relying on observation and biopsies, have limitations in accurately diagnosing the different types of psoriasis. Machine learning and deep learning approaches have shown success in various medical fields, including dermatology.
* Related Works: Previous studies have utilized deep learning for skin lesion prediction and classification, achieving high accuracies. However, no study has classified the five types of psoriasis using learning techniques. Various skin analysis algorithms and dataset have been used, but non have focused on the Dermnet and NTU databases.
* Methods: The study used 172 normal skin mages from the NTU data set and 201 psoriasis images from the Dermnet dataset. Processing involved data augmentation, enhancement, and segmentation, followed by feature extraction of color, texture, and shape. CNN and LSTM models were training with 8-% of the images achieving accuracies of 84.2% and 72.3%.
* Result and analysis: The CNN model showed higher accuracy and lower loss compared to the LSTM model. The confusion matrices and indicated the CNN model outperformed the LSTM model in classifying the six groups. Sensitivity, specificity, and accuracy metric were used to evaluate the models, showing better performance for CNN
* Discussion: The CNN model’s performance highlights its effectiveness in classifying psoriasis types and normal skin. The study’s novelty lies in its focus on classifying five different types of psoriasis, which has no been done before using deep learning. Limitations include the use of publicly available datasets without clinical data, suggestion potential for future research.
* Conclusion: This study presets a novel deep learning application for classifying different types of psoriasis, demonstrating the potential of CNN in dermatological diagnosis. Future research can explore clinical data integration and other deep learning methods for improved classification performance.
* Definitions:
  + In the context of a study on algorithms and recurrence relations, the study might not have explicitly defined LSTM (Long Short-Term Memory) networks unless it was specifically relevant to the research.LSTM is a type of recurrent neural network (RNN) architecture designed to overcome the vanishing gradient problem in traditional RNNs. It is commonly used in machine learning and natural language processing tasks for its ability to capture long-term dependencies in sequential data. It can effiectibely model an d predic sequences.
* Gap:
  + **Classification of Five Types of Psoriasis**: The study proposes a deep learning-based application for the effective classification of five types of psoriasis (plaque, guttate, inverse, pustular, and erythrodermic) as well as the prediction of normal skin. Previous methods have not classified these types of psoriasis using deep learning techniques.
  + **Use of Deep Learning Algorithms**: While machine learning and deep learning approaches have been used in dermatology, previous studies have not applied both convolutional neural networks (CNN) and long short-term memory (LSTM) algorithms for the classification of psoriasis.
  + **Dataset Utilization**: The study uses specific datasets (BFL NTU dataset and Dermnet dataset) for the classification of psoriasis, which have not been used in previous studies for this specific purpose.
  + **Accuracy Comparison and Performance Evaluation**: The study compares the accuracies of CNN and LSTM models for psoriasis classification and provides a detailed performance evaluation using confusion matrices, sensitivity, specificity, and accuracy metrics.
  + **Potential Applications**: The study demonstrates the potential of deep learning applications in dermatology beyond psoriasis, suggesting that similar approaches could be applied to other areas for better prediction and classification.
* **CNN architecures**:
  + r **esidual Networks (ResNet)**: ResNet was a significant advancement in CNN architecture, featuring skip connections that helped in training very deep networks (e.g., ResNet-50, ResNet-101).
  + **Inception Networks**: Inception v3 and Inception v4 were popular choices. These networks used inception modules that helped in capturing features at multiple scales.
  + **DenseNet**: DenseNet had a unique architecture where each layer was connected to every other layer in a feed-forward fashion. This architecture helped in feature reuse and gradient flow.
  + **VGGNet**: Although VGGNet was an older architecture compared to the others, it was still used in some instances due to its simplicity and effectiveness.
  + **Ensemble Methods**: Many participants used ensemble methods, where predictions from multiple models were combined to improve performance.
* **Keywords:**  
  Artificial intelligence, Psoriasis Area and Severity Index, Psoriasis, Deep learning system, Mobile app, Dermatology, Chronic disease, Severity assessment

Article 5: **Title: Image-AI-Based System for Psoriasis Severity Assessment: A Review**

* Abstract Psoriasis, a chronic inflammatory skin condition affecting millions word wise, often requires long-term management. The current standard, Psoriasis Area and Severity Index (PASI, suffers from subjectivity and limited real-world use. This study aimed to develop a validated image-AI-based system, for objective PASI score estimation to aid psoriasis management. A deep learning model training on 14,046 images from 2367 patients achieved a mean absolute error (MAE) of 2.05, outperforming 43 dermatologists by 3.2% in overall PASI scoring. The system was deployed as the Skin Teller app, used 3369 times for PASI scoring in 1497 patient, with positive feedback from 43 dermatologists.
* Introduction: Psoriasis is a chronic, immune-mediated disease with significant global impact. Its management requires precise severity assessment for personalized treatment. The current stand, psoriasis area and severity Index PASI, is information by subjective, hindering its widespread use in clinical practice. Existing Ai-based solutions for psoriasis focus on diagnosis, with limited work on severity assessment. This study addresses these limitations by developing a deep learning system for objective PASI score estimation and integrating it into the SkinTeller app for real-world use.
* Methods: The study collected a dataset of 14,094 images from 2367 patients with psoriasis. A deep learning model was trained on 1962 patients and validated on 405 patients. A novel Multiview feature enhancement block combined visual features from different perspectives, mimicking clinical practice. The model outperformed 43 dermatologists, achieving a MAE of 2.05. The Skin Teller app, integrated with the model, was used for PASI scoring in 1497 patients.
  + The model consisted of an image-processing block, a multiview feature enhancement block, and a cross-revise output block.
  + The image-processing block conducted random cropping and resizing of input images before passing them through a convolutional neural network (CNN) encoder. A special attention branch generated attention features for regions of interest (ROIs) in the images, which were combined with visual features to suppress features unrelated to ROIs.
  + The multiview feature enhancement block merged features from multiple input images to combine vision features from different perspectives. Patient-level features were obtained by calculating the maximum and average values of image-level features.
  + The cross-revise output block included a regression header with a smooth L1 loss, a classification header with a softmax cross-entropy loss, and an extra cross-teacher header. The cross-teacher header revised the output of the regression and classification headers based on prior knowledge from severity scores annotated by dermatologists.
  + Overall, this deep learning model was designed to simulate how dermatologists calculate PASI scores in clinical practice, aiming to provide an efficient, objective, and accurate method for psoriasis severity assessment.
* The image-ai based model surpassed dermatologists in overall PASI scoring by 33.2%. Ablation studies showed that using three input images per body part yielded the smallest MAE. The skin teller app, used in 18 hospitals, received positive feedback from 43 dermatologists, with 91% finding it helpful.
* Conclusions: The study demonstrates the effectiveness of an image-AI -based system for objective PASI scoreing in psoriasis management. The SkinTeller app shows promise for accurate assessment and self-management of psoriasis, offering a reliable alternative to subjective PASI scoring. Future work includes expanding the system’s applicability to different populations and enhancing its user-friendly features.
* Definition:
  + **Psoriasis**: A chronic, immune-mediated disease that causes pain, disfigurement, and disability, characterized by erythematous plaques covered by white scales.
  + **Psoriasis Area and Severity Index (PASI)**: The most widely accepted metric for measuring psoriasis severity, comprising four components: skin area, erythema, desquamation, and induration, scored on a scale of 0 to 4 for each body part.
  + **Deep Learning System**: A type of artificial intelligence (AI) that uses neural networks with many layers to learn representations of data, used in this study to estimate PASI scores from images.
  + **Multiview Feature Enhancement Block**: A component of the deep learning model that merges features from multiple input images to simulate the clinical process of PASI calculation by dermatologists.
  + **Mean Average Error (MAE)**: A metric used to evaluate the accuracy of the predicted PASI scores, measuring the average difference between predicted and actual PASI scores.
* **Gaps**:
  + **Subjectivity and Lack of Objectivity in PASI Scoring**: The Psoriasis Area and Severity Index (PASI) is the most widely accepted metric for measuring psoriasis severity but suffers from a prominent level of subjectivity and poor intra- and interobserver consistency. The study proposes an image-AI–based system to provide more objective and accurate assessments.
  + **Limited Application of AI in Psoriasis Severity Rating**: While AI has been explored for diagnosing skin diseases, few studies have focused on using AI for psoriasis severity rating. This study fills that gap by developing a deep learning system specifically for estimating PASI scores.
  + **Lack of Real-World Application and Comparison with Dermatologists**: Previous studies on AI for psoriasis severity have often been limited to offline evaluations and lacked comparison with experienced dermatologists. This study addresses this gap by validating the model with a prospective analysis and comparing its performance with 43 dermatologists.
  + **Need for Efficient Tools for Long-Term Management**: Psoriasis requires precision therapy and long-term management, necessitating reliable tools for severity assessment. The study proposes the SkinTeller app as a promising alternative for accurate assessment and chronic disease self-management in patients with psoriasis.

Article 6: **A Comparative Performance Study of PCA-Based CADx System for Psoriasis Risk Stratification and Image Classification"**

**Computer-aided diagnosis of psoriasis skin images with HOS, texture and color features: A first comparative study of its kind**

**- Abstract: Psoriasis is a widespread autoimmune skin disease affecting millions worldwide. Diagnosis and monitoring are currently reliant on visual and tactile methods, leading to subjective assessments. This study introduces a novel CADx system utilizing principal component analysis (PCA) for psoriasis risk stratification and image classification. The system incorporates higher-order spectra (HOS), texture, and color features, individually and in combinations, processed through machine learning with support vector machines (SVM). The system achieves optimal performance when all three feature sets are combined, demonstrating high accuracy, sensitivity, and specificity.**

**- Introduction: Psoriasis is a chronic skin disease impacting a significant portion of the global population, with plaque psoriasis being the most common form. Current diagnostic methods rely on visual and tactile examination, which are subjective and labor-intensive. Computer-aided diagnosis (CADx) systems have shown promise in automating and improving the accuracy of skin disease diagnosis.** .

- Methods: The study collected psoriasis image data from Indian ethnic origin patients, resulting in a database of 540 subjects. Images were processed and prepared for analysis by cropping healthy and diseased skin samples. The study compares the performance of the CADx system using different feature sets: HOS, texture, color, and their combinations. Feaure are extracted and processed using PCA and SVM to classify psoriasis images. The system is divided into offline and online components for feature extraction and classification.

Results: The study evaluates the performance of the CADx system using different feature combinations through three sets of experiments. It concluded that the combination of HOS, texture, and color features yields the highest classification accuracy of 100% demonstrating the effectiveness of the proposed system.

Conclusion: The study discusses the experimental results, highlighting the dominant behavior of HOSE features in psoriasis classification. It also validates the proposed CADx system on facial skin image database, confirming its efficacy and reliability.

**Overall Evaluation:** The paper provides a comprehensive analysis of CADx systems for psoriasis classification, offering valuable insights into the effectiveness of different feature sets. The study's methodology is well-structured, and the results are clearly presented and discussed. However, further validation on larger datasets and clinical translation are suggested for future research.

Definitions:   
The paper discusses several key definitions related to its methodology and analysis. Here are some of them:

1. **Psoriasis**: A chronic autoimmune skin disease characterized by red, scaly plaques on the skin, affecting approximately 125 million people worldwide.
2. **CADx System**: Computer-aided diagnosis system, a software-based system that assists healthcare professionals in the diagnosis of diseases, in this case, psoriasis.
3. **Principal Component Analysis (PCA)**: A statistical technique used to reduce the dimensionality of data while preserving important information. It is used in this study for dominant feature selection.
4. **Higher Order Spectra (HOS)**: Features that analyze the nonlinear and dynamic nature of signals. In this study, HOS features are used to analyze psoriasis images.
5. **Texture Features**: Features that quantify the texture present in an image, distinguishing one pattern from another. Various techniques, such as Gray-Level Co-occurrence Matrix (GLCM) and Gray Level Run Length Matrix (GLRLM), are used to extract texture features in this study.
6. **Color Features**: Features that provide information about the colors present in an image. In this study, an exhaustive color feature space consisting of 14 color spaces is considered.
7. **Support Vector Machine (SVM)**: A machine learning algorithm used for classification and regression tasks. In this study, SVM is used as a classifier for psoriasis image classification.
8. **Data Size (N)**: The number of samples in the dataset. The study analyzes the effect of changing data size on the performance of the CADx system.
9. **Reliability Index**: A measure of the reliability of the CADx system, indicating its consistency and accuracy in classifying psoriasis images.

Higher order spectra are used to analyze the nonlinear and dynamic nature of signals. They are a set of techniques that go beyond traditional power spectrum analysis (which looks at signal power distribution across different frequencies) to capture more complex signal characteristics.

In the paper's context of psoriasis image analysis, HOS features are likely used to extract information about the texture and patterns present in the images that may not be easily captured by simpler methods. This helps in distinguishing between healthy skin and psoriatic lesions, aiding in the diagnosis and classification of psoriasis.

1. Gaps in thefeild: **Subjectivity and Reliability**: Current methods for diagnosing psoriasis rely on visual and haptic (sense of touch) examination by dermatologists, which can be subjective and lead to variability in diagnosis. The CADx system aims to provide an automated and objective method for diagnosis, reducing reliance on subjective assessments.
2. **Complexity in Monitoring**: Existing diagnostic tools add complexity during monitoring and follow-up phases, potentially making it challenging to track the progression of the disease accurately. The CADx system seeks to simplify this process by providing a reliable and automated method for monitoring psoriasis.
3. **Risk Stratification and Lesion Stage Assessment**: Current methods do not effectively stratify the risk or assess the stage of psoriatic lesions, which are crucial for determining appropriate treatment strategies. The CADx system aims to improve risk stratification and lesion stage assessment through its image classification capabilities.
4. **Limited Public Databases**: There is a lack of prevalent psoriasis databases in the public domain, which limits the development and validation of CADx systems for psoriasis diagnosis. The paper highlights the need for larger, more diverse datasets to validate and improve the proposed CADx system.
5. **Inter-Observer Variability**: The paper suggests that there may be inter-observer variability in grading psoriasis data by different pathologists, indicating a need for more automated and objective methods to assess psoriasis severity.

Article 7: Artificial intelligence in psoriasis: Where we are and where we are going

* Abstract: Artificial Intelligence (AI) has emerged as a transformative technology in dermatology, particularly in the diagnosis and treatment of psoriasis. This paper provides an overview of current AI applications in psoriasis, including diagnosis, treatment prediction, and management. Key challenges and future prospects of AI in psoriasis are also discussed.
* Introduction: AI, a field of computer science aimed at replicating human cognitive processes, has shown great promise in various medical fields, including dermatology. Dermatology, being a visually-based diagnostic field, is well-suited for AI applications, especially in diseases like psoriasis. Psoriasis, a chronic autoimmune skin disease, presents challenges in accurate diagnosis and effective treatment due to its complex pathogenesis and varied clinical features. AI can play a crucial role in improving the diagnosis, treatment decision-making, and management of psoriasis. Basic Concept of AI AI encompasses machine learning (ML), natural language processing (NLP), and computer vision (CV). ML, a subset of AI, involves training computers with data to automatically extract patterns and make predictions. Deep Learning (DL), a subset of ML, uses artificial neural networks (ANNs) to process data and make predictions, mimicking human neural networks.
* AI Applications in Psoriasis
  + **Diagnosis** AI has been applied to detect skin lesions, identify and classify psoriasis, and differentiate it from other skin diseases. Various ML techniques, such as SVM classifiers and CNNs, have shown high accuracy in identifying psoriatic lesions.
  + **Treatment** AI has been used to predict treatment efficiency and identify candidate drugs for psoriasis. ML models have been developed to predict patient responses to specific treatments, aiding in personalized treatment plans.
  + **Management** AI applications in psoriasis management include e-health tools and preventive medicine. Mobile applications and teledermatology services have been developed to assist in remote monitoring and management of psoriasis patients.
* Challenges and Future Directions: Challenges in implementing AI in psoriasis include data quality and quantity, standardization of imaging techniques, and validation of AI models in clinical settings. Future research should focus on developing comprehensive algorithms for psoriasis diagnosis and treatment recommendation, integrating clinical signs and patient-specific factors.
* Conclusion: AI has the potential to revolutionize psoriasis healthcare by improving diagnostic accuracy, predicting disease progression, and identifying novel treatment targets. Despite facing challenges, continued development of AI technology holds promise for enhancing dermatological care and improving patient outcomes.
* Key definitions:
  + **Artificial Intelligence (AI)**: AI is defined as a field of computer science that involves the development of programs designed to replicate human cognitive processes and the analysis of complex data.
  + **Machine Learning (ML)**: ML is a subset of AI that involves the study of algorithms and statistical models that enable computers to perform tasks by learning from data. Deep learning (DL) is a subset of ML that uses artificial neural networks (ANNs) to make predictions.
  + **Natural Language Processing (NLP)**: NLP is a subfield of AI that uses computers to analyze and process human languages, enabling tasks such as speech recognition, speech synthesis, and automatic translation.
  + **Computer Vision (CV)**: CV is a type of AI that enables computers to understand and process images and videos, achieving tasks such as image recognition, object detection, and facial recognition.
  + **Psoriasis**: Psoriasis is defined as a chronic autoimmune skin disease that affects millions of people worldwide, characterized by erythematous scaly patches, papules, and plaques that are often pruritic and sometimes painful.
  + **Psoriasis Area and Severity Index (PASI)**: PASI is a composite score based on the clinical assessment of the body surface area (BSA), erythema, induration, and scaling of psoriasis on different areas of the body by dermatologists. It is used to assess the severity of psoriasis and guide treatment decisions.
  + **Teledermatology**: Teledermatology refers to the use of digital, mobile, and wireless technologies for accessing health-related information, resources, and services in dermatology. It includes services such as remote consultations and monitoring of skin conditions using digital images.
* **Key methods**
  + **Machine Learning (ML)**: ML is a key method used in dermatology to develop algorithms and statistical models that enable computers to analyze and process data related to skin conditions. ML techniques are used for tasks such as lesion identification, classification, and severity scoring in psoriasis.
  + **Deep Learning (DL)**: DL is a subset of ML that uses artificial neural networks (ANNs) with multiple layers to process and analyze data. DL, particularly convolutional neural networks (CNNs), is used for image recognition and segmentation in dermatology, including the identification and classification of psoriatic lesions.
  + **Computer Vision (CV)**: CV techniques are used to enable computers to understand and interpret visual information, such as images of skin lesions. CV methods, including CNNs, are used for tasks such as lesion segmentation and severity scoring in psoriasis.
  + **Image Segmentation**: Image segmentation is a technique used to partition an image into multiple segments to simplify the representation of objects within the image. In dermatology, image segmentation is used to identify and isolate psoriatic lesions from surrounding skin for further analysis.
  + **Lesion Severity and Area Scoring**: Methods have been developed to automatically assess the severity of psoriatic lesions and the affected area on the body surface. These methods use algorithms to analyze images of psoriasis patients and quantify the extent and severity of the disease.
  + **Treatment Prediction**: AI methods, including ML and DL, are used to predict the effectiveness of different treatments for psoriasis based on factors such as patient characteristics, disease severity, and genetic markers. These predictions can help personalize treatment plans for psoriasis patients.
  + **E-Health and Telemedicine**: E-health technologies, including mobile applications and telemedicine platforms, are used to facilitate remote monitoring, diagnosis, and management of psoriasis. These technologies enable patients to receive care from dermatologists without the need for in-person visits.
* **Gaps**:
  + **Data Quality and Standardization**: The quality and standardization of data, particularly in skin images, are crucial for the accuracy of AI algorithms. Variations in imaging parameters and protocols can lead to differences in captured lesions, making it difficult for AI algorithms to differentiate between real and artificial differences.
  + **Dataset Size and Diversity**: AI algorithms, particularly deep neural networks (DNNs), require large and diverse datasets to produce generalizable outputs. Small or unrepresentative datasets can lead to errors, especially for underrepresented groups.
  + **Clinical Validation and Utility**: Many AI algorithms developed for psoriasis have not been clinically validated or evaluated for important clinical metrics. Their utility in clinical practice remains to be determined, and further validation is necessary to ensure their effectiveness.
  + **Holistic Diagnosis Algorithm**: There is a lack of a comprehensive algorithm for psoriasis diagnosis that integrates clinical signs from a single patient. An effective algorithm should consider various factors, such as the type of lesions and the patient's response to previous treatments.
  + **Automation of Clinical Sign Evaluation**: Automating the evaluation of clinical signs, such as scoring two-dimensional images for three-dimensional characteristics like induration, presents a significant challenge. AI algorithms need to be able to accurately distinguish between active lesions and post-treatment pigmentation abnormalities.
  + **Personalized Treatment Planning**: While AI has the potential to facilitate personalized treatment plans based on clinical phenotypes, developing suitable algorithms to achieve this remains a challenge. Factors such as treatment history, patient preferences, and medication experience need to be considered in treatment decisions.
  + **Future Development and Refinement**: The development and refinement of AI algorithms for dermatology, particularly in e-health and telemedicine applications, require ongoing research and development. Improvements in software and technology are needed to enhance the accuracy and effectiveness of AI in dermatological practice.

From fermatogoly article: Artificial intelligence in dermatology and healthcare: An overview

Current state of psoriasis :

Psoriasis Artificial intelligence has been working on many aspects of psoriasis. Various computer aided diagnostic systems have been designed for image classification and psoriasis risk stratification.91,100 Also machine learning prediction models have been designed to determine the treatment response of psoriasis to biologics and to differentiate psoriasis from psoriatic arthritis using genetic markers.101,102 Correa da Rosa et al. showed that the gene-expression profiles of psoriasis skin lesions, taken in the first 4 weeks on patients who are on treatment with a biological agent, can be used to accurately predict (>80% area under the ROC curve) the clinical endpoint at 12 weeks using machine learning techniques thereby reducing the assessment gap by 2 months.103 Emam et al. studied whether machine learning could aid in predicting long-term responses to biologics in psoriasis through analysis of data of 681 psoriasis patients from the Danish registry cohort using various modelling techniques.

Patients with early diagnosis and early initiation of treatment, without psoriatic arthritis, had 90% chance of continuing treatment as per the study.104 Foulkes et al. noted that signals of response to therapy in patients with severe psoriasis treated with the etanercept may be systemically detectable in lesional skin, non lesional skin, and blood at baseline, before the commencement of therapy.105 Automated diagnosis of other erythemato-squamous diseases such as seborrheic dermatitis, atopic dermatitis, lichen planus, pityriasis rosea and pityriasis rubra pilaris has been studied using various clinical and histopathological features.106,107

Article 8:  **Title: The Influence of Internet Information on Parental Trust in Pediatric Diagnoses and Likelihood of Seeking Second Opinions: A Survey Study**

**Abstract:** This study examines how parental trust in pediatric diagnoses and the likelihood of seeking second opinions are impacted by Internet sources. A survey was conducted with 1374 parents of minors who were presented with a vignette describing their child's symptoms followed by Internet search results either supporting or contradicting the pediatrician's diagnosis. Participants rated their trust in the diagnosis and likelihood of seeking a second opinion on a Likert-type scale. The results indicate that Internet information significantly affects parental trust and decision-making. Parents were more likely to trust the diagnosis and less likely to seek a second opinion when Internet results supported the pediatrician's assessment, and vice versa when the results contradicted it. Demographic differences in trust and decision-making were also observed. The findings underscore the importance of understanding the influence of online information on medical decision-making and the need for physicians to address patients' concerns in the era of Internet-driven health information.

**Keywords:** Internet, online health information, pediatrician, trust, diagnosis, second opinion, differential diagnosis, search results

**Introduction:** With the proliferation of the Internet, patients have increasingly turned to online sources for medical information, including parents seeking guidance on their children's health. However, the reliability of online health information varies, raising concerns about its impact on medical decision-making. This study aims to investigate how parental trust in pediatric diagnoses and the likelihood of seeking second opinions are affected by Internet search results.

**Methods:** The study recruited 1374 parents through an anonymous online survey, employing Amazon's Mechanical Turk platform. Participants were presented with a vignette describing their child's symptoms and were then shown Internet search results either supporting or contradicting the pediatrician's diagnosis. They rated their trust in the diagnosis and likelihood of seeking a second opinion on a Likert-type scale. Demographic information was also collected and analyzed.

**Results:** The analysis revealed significant differences in parental trust and likelihood of seeking second opinions across the three groups (Supporting Internet Research, Conflicting Internet Research, Control). Participants were more likely to trust the diagnosis and less likely to seek a second opinion when Internet results supported the pediatrician's diagnosis, and vice versa when the results contradicted it. Demographic factors such as gender, race, education level, and number of children also influenced trust and decision-making.

**Discussion:** The study highlights the substantial impact of online information on parental trust and decision-making regarding pediatric diagnoses. It underscores the need for patients to critically evaluate online health information and for physicians to engage in shared decision-making with patients, addressing their concerns and providing reliable sources of information. The findings suggest potential strategies for improving patient-physician communication and trust in the era of Internet-driven health information.

**Conclusion:** Parents' trust in pediatric diagnoses and their likelihood of seeking second opinions are significantly influenced by Internet search results. While online information can empower patients, it also poses challenges in decision-making and trust in medical professionals. Physicians must be aware of the influence of the Internet on patient behavior and take proactive measures to address patients' concerns and promote informed decision-making.

key findings and statistics from the study:

1. **Impact of Internet Information on Trust:**
   * Participants who viewed Internet search results supporting the pediatrician's diagnosis reported significantly higher levels of trust in the diagnosis compared to those who did not view Internet results.
   * Conversely, participants who viewed Internet search results contradicting the pediatrician's diagnosis reported significantly lower levels of trust in the diagnosis.
   * Overall, the study found a significant influence of Internet information on parental trust in pediatric diagnoses.
2. **Likelihood of Seeking Second Opinions:**
   * Participants who viewed Internet search results supporting the pediatrician's diagnosis were significantly less likely to seek a second opinion compared to those who did not view Internet results.
   * Conversely, participants who viewed Internet search results contradicting the pediatrician's diagnosis were significantly more likely to seek a second opinion.
   * The study suggests that the alignment between Internet information and the pediatrician's diagnosis affects parental decision-making regarding seeking second opinions.
3. **Demographic Differences:**
   * Trust in the pediatrician's diagnosis and likelihood of seeking second opinions varied across demographic factors.
   * Women tended to report higher levels of trust in the pediatrician's diagnosis compared to men.
   * Caucasian respondents were generally more trusting of the pediatrician compared to Asian and African American respondents.
   * Participants with lower levels of education tended to report higher levels of trust in the pediatrician compared to those with higher levels of education.
   * Parents with only one child at home were more likely to seek a second opinion compared to those with multiple children.
4. **Importance of Physician-Patient Communication:**
   * The study underscores the importance of physician-patient communication, particularly in addressing concerns related to online health information.
   * Shared decision-making and providing reliable sources of information are suggested strategies for improving patient trust and decision-making in the context of Internet-driven health information.

These key findings highlight the significant role of Internet information in shaping parental trust and decision-making regarding pediatric diagnoses, as well as the importance of addressing demographic differences and promoting effective communication between physicians and patients.

Article 9:

**Literature Revie**

The intersection of information literacy, domain expertise, and online health information seeking behavior has become increasingly relevant in the information age. This literature review aims to explore existing research in this domain and highlight key findings and insights.

**1. Information Literacy and Health Information Seeking Behavior:** Studies have shown that information literacy, defined as the ability to effectively find, evaluate, and use information, plays a crucial role in the search for health-related information online. Doyle (Year) outlines the criteria for information literacy, emphasizing the importance of accurate information retrieval and critical judgment. In particular, research by Beutelspacher (Year) and others (cite other relevant studies) has investigated the information literacy levels among different demographic groups, highlighting disparities in research skills, especially concerning health-related information.

**2. Domain Expertise and Online Diagnosis:** Medical expertise significantly influences the search for health-related information online. Professionals possess the necessary knowledge to navigate complex medical information and evaluate its reliability effectively. Research by Ivanitskaya, O’Boyle, and Casey (Year) specifically examined the impact of domain expertise on online health information seeking behavior, demonstrating that individuals with medical backgrounds outperform others in practical tasks related to online diagnosis.

**3. Trustworthiness of Online Information:** Trust in online health information varies among different demographic groups. While medical professionals tend to trust such information more readily due to their expertise, the general public exhibits greater skepticism. Studies have highlighted the importance of distinguishing between trustworthy and unreliable sources, as well as the need to promote awareness of quality seals and credible websites.

**4. Search Behavior and Strategies:** Search behavior varies based on information literacy levels and domain expertise. Individuals with higher information literacy tend to use more sophisticated search strategies, relying on scientific sources such as databases and journals. However, the success of online diagnosis does not necessarily correlate with research skills, as many users engage in superficial searches. Structured presentation of health-related information, such as through health portals, proves to be effective in catering to diverse information needs.

**5. Future Directions:** Future research should explore the information literacy levels among diverse demographic groups and investigate the impact of education and socioeconomic status on health information seeking behavior. Additionally, studies could delve deeper into the influence of search behavior on the accuracy of online diagnoses and examine ways to improve the accessibility and reliability of online health information for all users.

In summary, understanding the interplay between information literacy, domain expertise, and online health information seeking behavior is crucial for promoting informed decision-making and improving healthcare outcomes in the digital age. Further research in this field will contribute to enhancing health literacy and empowering individuals to make well-informed choices regarding their health.

key statistics and findings from the study:

**Frequency of Online Health Information Searches:** Every twentieth search on Google is related to health information, indicating a significant demand for online health-related content.

**Participant Demographics:** The study involved 114 participants, predominantly young adults aged 22-26, with a bias towards students due to the study's university setting.

**Reasons for Health Information Searches:** The most common reasons for conducting health-related searches included wanting to be informed before a doctor's appointment, deciding whether to make a medical appointment, and a general desire to stay informed about health.

**Trust in Online Information:** Participants expressed uncertainty about trusting online health information, with a significant portion (around 40%) disagreeing to some degree with the trustworthiness of health-related information found online.

**Sources of Health Information:** Health portals were the most frequently accessed type of source, followed by online news magazines and encyclopedias. Despite some participants rating forums as unreliable, they remained among the most popular sources.

**Impact of Domain Expertise:** Medical professionals displayed greater trust in online health information and were more successful in online diagnosis tasks compared to other groups, indicating the influence of domain expertise on information evaluation and decision-making.

**Information Literacy and Search Behavior:** Participants with higher levels of information literacy tended to use more sophisticated search strategies, such as accessing scientific sources like databases and journals. However, this did not necessarily lead to more accurate diagnoses.

**Perception of Online Information:** Health-related information was viewed more critically than general information, with participants with higher information literacy levels exhibiting greater skepticism towards online health information.