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| **Abstract:** | This submission is in response to the ITU-T Focus Group on Artificial Intelligence for Health (AI4H)’s call for proposal on use cases and data. It presents an initial feasibility analysis of establishing an AI skin diseases detection system. Working experiences in general medical big data platform and image library of skin diseases for AI was introduced. With the cooperative network connecting hundreds of primary care units and low level secondary care hospitals across China, this AI skin diseases detection project is feasible. |

# Overview

Clinical practice is the ultimate way of proving the effectiveness of AI-assisted smart care technologies. It is known that skin disease is the most common health problem that could happen to everyone on earth, which has drawn great attention of scientists. China has the largest population with the most valuable clinical data source and potential beneficial group of modern healthcare technologies. Xiangya Hospital introduces its systematic recent research and development work in general medical big data platform with standard terminology systems, clinical speciality datasets including biological sample bank and image library of skin diseases for AI processing, and successful real world health, big data and even smart care practices in a cooperative network connecting hundreds of primary care units and low level secondary care hospitals across China.

Related standardization work is to consider specialty and diversity in clinical care including standard terms, dataset, process (clinical pathway), quality and outcome (evaluation) in smart care contexts. Xiangya group could contribute in the following standardization work:

* skin disease big data platform (terms for medical records, data processes, etc.)
* skin disease clinical paths and management in new smart care contexts
* skin disease basic dataset construction including biobank and image bank for common and critical skin diseases
* skin disease smart care requirement classification and corresponding criteria
* skin disease smart care results clinical evaluation criteria and benchmark
* skin disease smart care real world solution and quality assessment framework.

# Impact

Clinical Dermatology is a discipline involving over two thousand diseases, with incidence rate reaching almost 100%. There are about 21%-87% population in the world has skin problems in different area and skin diseases have become a major public health and social problem in our country. Currently in China, the number of hospitals from which the outpatient number of departments of dermatology per year over one million is five. There is great and urgent need to have more dermatologists. However, the outpatient waiting areas of dermatology clinics in provincial hospitals are always overcrowded, and the medical staffs are always working overtime. While the dermatology training of basic-level practitioners, including rural practitioners, community general practitioners, and county dermatologists is not enough.

China is a large country with a population of 1.3 billion, while, the number of Chinese dermatologists is only 22000. There is an urgent need for a change of medical-seeking pattern in dermatology to improve the deficiency in number of dermatologists. Thus, it is imperative to standardize the Medical Big Data and “Internet + Medicine”, explore the area of artificial intelligence and promote the new medical-seeking pattern.

# Existing Work

The “Internet + Medicine” platform was established. The Medical Combination Platform for dermatological health and disease of CSU has integrated the good resources from three dermatology departments in Chinese medical system. It is the first platform which combined clinics, science, education and prevention of dermatology in China.

With this platform, the remote, dual referral, online subsequent visit, E-prescription, remote drug delivery has been realized. From October 2017 until now, we have accomplished over 100 cases of remote consultations and dual referrals. This platform covering 54 county and municipal hospitals, 24 community health service centers in Changsha and 5037 remote medical networks. In November 2018, we have received the official license of operating based on the Internet under the name of Xiangya Internet Hospital (Skin Disease), which is the first Internet Hospital license of Hunan Province with a population of over 65 million. Since then we have over 300 telemedicine cases successfully operated with complete data.

We focus on skin health of general populations, and investigate the epidemiology and risk factors of common skin diseases, and establishing three population-based cohorts: the Hunan Resident Health Cohort in Heavy Metal Pollution Areas, the Central China Chronic Disease Cohort, and the China College Student Skin Health Promotion Program. The cohorts comprise of 150,000 participants nationwide, and are the largest cohorts that focus on skin health in China. The baseline survey of the cohorts has already completed and preliminary findings have been published. Follow-up survey is being conducted in field. 12 high quality papers about this research have been published in peer-reviewed journals, one of the journals has impact factor about 12.

# Feasibility

The market demand for skin diseases is huge. AI and the “Internet +” platform are integrated into the whole medical process, including intelligent self-diagnosis, triage, guidance, registration and follow-up, etc., to provide convenient, efficient and high-quality services for patients and doctors. At the same time, the data need to build a unified standard. By virtue of the platform of the health committee, provincial medical information will be collected. At the same time, we cooperate and co-construct with relevant enterprises. And under the leadership of government and hospital, we carry out the promotion and application of big data mining, AI and medical.

The establishment of the platform of dermal health and disease medical big data and “Internet + Medicine” should be based on the requirement of patients and serve in the whole medical course. Combination of artificial intelligence, Internet and medical will provide many functions for this platform. Every procedure should have standardized protocol and set of medical terms. The cooperation with government and companies and supports from university and hospitals are also the success of key in application and promotion.

It is also essential to build up a comprehensive quality control and evaluation framework for mobile health, telemedicine, and AI-assisted care for skin disease. This kind of work will be scientifically helpful to enhance, prove and even assure the feasibility and effectiveness of technology-assisted smart care. Our next priorities are as follows:

## Standardization

i. User requirement standardization: We will make the standardized set of terms for users from the aspect of clinics and patients depending on the real requirements of patients, operability and applicability in clinics.

ii. Clinical therapeutic standardized protocol: We will complete our standardized set of clinical terms and promote it to more hospitals. We will also build protocols for consultation, referral, triage and subsequent visit and dermatological surgery procedure.

iii. Evaluation criteria and quality assurance framework: we will continue our systematic work on building up a close loop for smart care of skin disease using evidence-based approach. Trackable data will be collected from different groups of users including doctors, nurses, patients and their family members on new technology and system from different perspectives including feasibility, reliability, usability, effectiveness, and so on.

## Dataset

i. Standardized biobank: We will standardize the management pattern of our biobank for skin disease depending on the platform of the hospital biobank.

ii. Make great efforts to build a national dermatology big data center: We will rely on the existing platform, increase promotion efforts, and cooperate with the government to gradually promote the standardization and unification of national dermatology data.

## Platform

i. Group of experts: We will optimize our group of experts by introducing academicians in dermatology and computer depending on the existed group of experts from Information Security and Big Data Research Institute.

ii. Interconnected device and data exchange platform using universal standards and compatible to various terminals for daily operations of practitioners and patients.

# Data Availability

Experts have accomplished the first phase of establishment of Internet Data Center (IDC) and the development of electronic medical record (EMR) system covering different hospitals. We started building Medical Big Data of Skin Diseases from 2014 and our system has connected over 200 hospitals. It is the biggest public platform of medical big data of skin diseases in China. We have stored about fifty thousand records of six kinds of skin diseases which are common or have high mortality: cutaneous tumor, psoriasis, urticaria, acne rosacea, alopecia and SLE. The data includes clinical images, pathology images, patients’ information and the medical history. With the analysis of data from this platform, we have already published twelve papers with high impact factor and applied for five patents.

We have established the largest standardized image library of AI in China with over 10 years’ efforts and image data from 39 hospitals, furthermore, we also have the largest image library of psoriasis in the world. In this library, each case has its own images, patient’s information, medical history and most importantly with pathology images and diagnosis, which made the case data extremely valuable for multidimensional analysis and AI processing.

We have also built up a database of skin cancer with over 5000 cases sourced from many hospitals around China. There are about 500 melanoma cases, and 5 different types of omics including exon sequencing, RNA-Seq, epigenomics, proteomics and metabolomics. 6 high quality papers about this research have been published in peer-reviewed journals.

With the cooperation of experts from Information Security and Big Data Research Institute, we built CNN network for skin diseases. We have published two articles and applied for nine software copyrights in this area.

# Benchmarking

We are leading the process of standardizing Medical Big Data. Dermatologists write the first standardized set of dermatological terms in China, actively promote the establishment of Medical Combination Platform for dermatological health and disease, and establish standards of Medical Combination Platform for dermatological health and disease and standards of Medical Big Data of Skin Diseases. In 2013, Central South University (CSU) took the lead in the construction of Medical Big Data. Huge investments have been made by CSU. We have spent one hundred million supporting 103 projects and finished the first standardized set of terms for medical big data.

# Organizer Details

Central South University Xiangya Hospital is located in Changsha, a famous historical and cultural city in China. It was founded in 1906 by the Yale University Yale-China Association. It was originally named Yali Hospital and was one of the earliest Western hospitals in China. After more than 100 years of development, Xiangya Hospital has become a national large-scale comprehensive hospital integrating medical, teaching, scientific research, prevention, health care and rehabilitation. It is now directly under the National Health Commission and is also affiliated to the Ministry of Education. Central South University. It is an important medical diagnosis and treatment center, medical education and medical research center in China.

Xiangya Hospita built the “Mobile Health” Ministry of Education-China Mobile with China Mobile and the Information Security and Big Data Research Institute. The Medical Big Data Application Technology National Engineering Laboratory has been approved by National Development and Reform Commission.

Xiangya Hospital now has 3,500 beds, 88 clinical medical and technical departments, 6 national key disciplines, and 25 national clinical key specialist construction projects (the number is the fifth in the national hospital); the annual emergency department has more than 2.4 million person-times. The number of patients discharged from the hospital was 100,000, and the number of large and medium-sized operations was 60,000. The Xiangya New Medical Building, which has a construction area of 280,000 square meters, was put into use in 2010 and is one of the largest single medical buildings in Asia.

Both Central South University and Xiangya Hospital are fully committed to invest in the research and development of AI skin disease detection. Supported by the three high-profile research labs and local government, it is determined to develop a new practical and systematic AI skin care solution.

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