“Internet + AI” Dermatology Care
(A Case of Skin Disease Smart Care in China)

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P. R. China
Nature (02/2017) published a paper on dermatologist-level skin cancer detection (classification) AI algorithm.

Nature Medicine (01/2019) published 9 papers on AI in healthcare.

Energias Market Research: Global Artificial Intelligence (AI) in Healthcare market is expected to grow significantly from USD 1.12 billion in 2017 to USD 19.9 billion in 2024, at a CAGR of 48.7% from 2018 to 2024.
Thinking about AI and Clinical Practice

Asclepius
God of medicine and physicians

Claude Shannon
Founder of Information Theory

The best part of Clinical practice is not knowing “what” or “how”, but “why”.

Clinical practice is the ultimate way of proving the effectiveness of AI-assisted smart care technologies.
The Way New IT Works in Clinical Practice (in China)

- Real World Requirements
- Application & Evaluation
- Platform for Practices
- Proved Tools & Techniques
- Available Data & Information
1. Requirements (Skin Diseases)

Skin Disease: serious threat to human health

- Account for 1.79% of global diseases burden
- Cutaneous and subcutaneous diseases rank 3rd in disability causes in China

---Globalburden.org

Priority: complicated chronic disease

Skin Diseases

- High mortality: Skin cancer (e.g., Melanoma)
- High incidence: Allergic skin diseases (e.g., Urticaria)
- Very stubborn: Chronic recurrent diseases (e.g., Psoriasis)

Derm. Dept. of Huashan Hospital, China (The biggest clinical department in the world)

21-87% of the world population are affected by skin diseases.

Globalburden.org

2008  820K
2016  1.6M
1. Requirements (Dermatologists)

Stats. on Dermatologists (U.S. vs China)

<table>
<thead>
<tr>
<th></th>
<th>U.S.</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (10m)</td>
<td>32.5</td>
<td>140</td>
</tr>
<tr>
<td>Physicians (100k)</td>
<td>7</td>
<td>33.9</td>
</tr>
<tr>
<td>Dermatologists (k)</td>
<td>8.5</td>
<td>22</td>
</tr>
<tr>
<td>Dem/Pop ratio (1/100k)</td>
<td>2.6</td>
<td>1.57</td>
</tr>
</tbody>
</table>
2. Platform (Licensed Service Platform)

The “Internet + Medicine” (Health & Care) National Strategy, 25 April 2018

The Xiangya Dermatology Internet Hospital established, 4 Nov. 2018

The First Dermatology Internet Hospital licensed to operate over the Internet in China.
2. Platform (Xiangya Medical Big Data Platform)

- **2013**: Initiation of Xiangya Medical Big Data Project
- **2014**: Vice-Premier Yandong Liu inspected this platform in 2014
- **2017**: National Engineering Laboratory of Medical Big Data Technology was approved in 2017

- RMB 310 million of investment from CSU and China Mobile
- Big data institute and medical data center established
- “Xiangya Medical Big Data Dataset Standards” (covering 700+ diseases)
- Collected 57 million patient data from Xiangya and collaborating hospitals
Supported by Various Key Research Projects/Funds

- National Key Project Support
- The Largest Skin Health/Disease Queue in China

- A cohort of people with skin diseases (20 thousand)
  - SLE/Melanoma/Rosacea/Psoriasis/Urticaria

- A cohort of high-risk groups for skin diseases (25 thousand)
  - Heavy metal contaminated areas
  - Non-occupational Exposure Population

- Natural population cohort with healthy skin (50 thousand)
  - College Students/National Public Officials/Elderly People
### 3. Datasets (from Xiangya Medical Big Data Platform)

<table>
<thead>
<tr>
<th>Hospital</th>
<th>CIS system</th>
<th>Data from</th>
<th>Data to</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Xiangya Hospital</strong></td>
<td>HIS</td>
<td>2011-01-01</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>EMR</td>
<td>2008-12-01</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>PACS</td>
<td>2009-01-01</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>LIS</td>
<td>2006-01-27</td>
<td>Present</td>
</tr>
<tr>
<td><strong>Xiangya 2nd Hospital</strong></td>
<td>HIS</td>
<td>2009-09-01</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>EMR</td>
<td>2009-09-25</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>EMR textfiles</td>
<td>2011</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>LIS</td>
<td>2002-01-01</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>RIS</td>
<td>2013-02-01</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>PACS</td>
<td>2012-01-31</td>
<td>Present</td>
</tr>
<tr>
<td><strong>Xiangya 3rd Hospital</strong></td>
<td>HIS</td>
<td>2002-04-08</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>EMR</td>
<td>2002-04-08</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>EMR text files</td>
<td>2014-05-16</td>
<td>Present</td>
</tr>
</tbody>
</table>

#### Data accumulation of Xiangya Hospitals (10,000+ beds in total) in the past 20 years

- **Patients records** (14.947M)
- **Outpatients** (2.9419M)
- **Inpatients** (3.787M)
- **Medical records** (27.67M)
- **Test records** (13.957M)
- **Exam Records** (46.345M)
- **Exam results** (542.95M)
- **Operation records** (3.307M)
- **Outpatient prescriptions** (177.81M)
- **Inpatient diagnosis** (27.663M)
- **In patient prescriptions** (3亿9716万条)
### 3. Datasets (from Xiangya Medical Big Data Platform)

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Time span</th>
<th>Quantities</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data size</td>
<td>&gt;15 years</td>
<td>40 billion</td>
<td></td>
</tr>
<tr>
<td>Medical records</td>
<td>&gt;7 years</td>
<td>1.8 million</td>
<td></td>
</tr>
<tr>
<td>Examinations</td>
<td>&gt;10 years</td>
<td>&gt;250 million</td>
<td></td>
</tr>
<tr>
<td>Imaging reports</td>
<td>&gt;6 years</td>
<td>180T</td>
<td></td>
</tr>
<tr>
<td>Lab results</td>
<td>&gt;10 years</td>
<td>&gt;400 million</td>
<td></td>
</tr>
<tr>
<td>Medical orders</td>
<td>&gt;15 years</td>
<td>20 billion</td>
<td></td>
</tr>
<tr>
<td>Drug information</td>
<td>&gt;15 years</td>
<td>30 billion</td>
<td></td>
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<td>......</td>
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</tbody>
</table>

Medical data of all diseases including skin diseases
3. Datasets (Skin Diseases)

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Sources</td>
<td>From over 200 hospital across 30 provinces in China</td>
</tr>
<tr>
<td>Data Volume</td>
<td>Over 50,000 patients, over 200,000 clinical images, skin cancer database with over 5000 cases</td>
</tr>
<tr>
<td>Purpose of Datasets</td>
<td>For AI assisted decision support, full structured EMR for clinical research</td>
</tr>
<tr>
<td>Application Scope</td>
<td>Skin disease image identification, decision support, pathology diagnosis, support for Internet + medical network</td>
</tr>
<tr>
<td>Classification of Database</td>
<td>Clinical images, dermatoscope images, skin pathology images, skin cancer full dataset</td>
</tr>
</tbody>
</table>
4. Tool & Techniques (Xiangya Medical Big Data Standards)

Standard Basic Information & Clinical Service Dataset of Xiangya Medical Big Data Project
4. Tool & Techniques (Xiangya Medical Big Data Standards)

10 standard datasets, 92 sub-datasets (including skin diseases);
4. Tool & Techniques (Xiangya Skin Disease Big Data Standards)
Skin Disease Biological Sample Bank

Key R & D programs of the Ministry of science and technology

"Distributed Human Genetic Resource Bank Construction and Application"

The largest national rosacea, lupus and skin cancer biological sample bank

- 100 Ultra low temperature freezers
- Over 500m²
- Over 60,000 skin health and diseases-related biological sample
Resection and picture collection

Tissue pretreatment and packing

Blood pretreatment and packing

Sample quality control and storage

Reference: IARC and TCGA
4. Tool & Techniques (Xiangya Skin Disease Image Library)

Skin Disease Image/picture Library

**Dermatopathology picture library**  
(1 million pics)

**Standardized skin disease picture library**  
(0.4 million pics)

**Tagged picture library**  
(20,000 pics)
4. Tool & Techniques (Xiangya Skin Disease Data Collection)

Xiangya Skin Disease Data Collection Platform using cloud/mobile smart apps

- Skin disease big data acquisition platform
- Collected data of over 50,000 dermatology patients from 200 different hospitals
- Expanded to over 100 hospitals
- Acquired 5 software copyrights
## Skin Cancer Data Work

**Platform**

The first big data acquisition platform of skin cancer in China

http://122.207.81.240:8084/FormParser

**Standard**

Lead to develop the Melanoma Biological Sample Collection Standard

**Sample database**

Established the biggest biological sample bank of skin cancer in China

**Collaboration network**

Constructed the first national skin cancer collaborative network

(covering over 100 hospitals in 30 provinces)
4. Tool & Techniques (Xiangya Skin Disease Data Collection)

- Patient: collect
- Doctor: label
- Medical history record
- Pathological examination
- Referred
4. Tool & Techniques (Xiangya Skin Disease Smart Diagnosis)

Skin-Net System

The raw dataset:
4. Tool & Techniques (Xiangya Skin Disease Smart Diagnosis)

A practical skin disease classification tool covering 6 common skin diseases: psoriasis, seborrheic keratosis, eczema, basal cell carcinoma, lupus erythematosus, pemphigus

![Data distribution chart]

- Psoriasis: 1,005 cases
- Seborrheic Keratosis: 568 cases
- Eczema: 491 cases
- Basal Cell Carcinoma: 387 cases
- Lupus Erythematosus: 285 cases
- Pemphigus: 235 cases
5. Application: Skin Care Network and Academic Influences

2013
National Skin Cancer Research Center
National Rosacea Research Center
3 sub-centers and 12 members

2014

2015
124 members

2016
225 members
5. Application: Skin Care Network and Academic Influences

643 Network Hospitals from 30 provinces across China
5. Application: Medical Network Platform of Skin Diseases

Supported by the National Engineering Laboratory for Medical Big Data Technology, Central South University

- Test run for 8 months
- 53 collaboration hospitals, 225 registered account
- 106 teleconsultation and 2-way referral cases
- 33 Online revisits, online drug purchase and delivery (in the last month)
- 120480 website visitors, 1269 downloads of our app

Multifunctional platform
Consultation, patient referral, patient education, epidemiological investigation, online inquiry, distance learning etc.

http://xypf.csu.edu.cn:8089/
5. Application: Medical Network Platform of Skin Diseases

- Skin Disease Network Press Conference
- Mobile learning using social network apps
- Clinical networking activities in unban counties of China
- Clinical Networking activities in difference places across China
Work of “AI for Healthcare” is always on the way.

Thanks for Listening!