Categorization of Medical Fields & Classification AI Advancement

New AI in Healthcare Categorization

📌 Categorization according to use case of AI

✅ Clinical Decision Support

www.nature.com

https://www.nature.com/articles/s41746-020-0221-y

An overview of clinical decision support systems: benefits, risks, and strategies for success

🧩 Advanced integration of Electronic Health Record (EHR)

> A clinical decision support system (CDSS) is intended to improve healthcare delivery by enhancing medical decisions with targeted clinical knowledge, patient information, and other health information.
> Osheroff, J. et al. *Improving Outcomes with Clinical Decision Support: An Implementer's Guide*. (HIMSS Publishing, 2012).

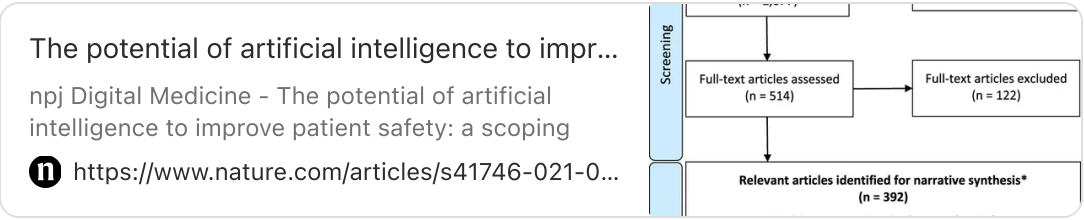
How to Classify the AI Advancement of the technology?

🚫 Difference between knowledge based (IF/THEN) and non-knowledge based (AI Inference)

> A common differentiation is between knowledge-based (IF/THEN) and non-knowledge-based (AI/ML) CDSS'. For simplicity: purely knowledge-based CDSS will be classified between Low and Moderate, whereas non-knowledge based CDSS will be classified between Advanced and Pioneering. The category High will be used if the technology uses multiple modalities for their ML model, but isn't truly non-knowledge based.

Application based subcategories

- **Patient Safety**
  - Drug Control
    - Medication administration errors
    - Drug-drug Interactions (DDI)
  - Hygiene Compliance
  - Sepsis Prediction



- **Clinical Management**
  - Clinical Trial Technology Personalized
    - Finding eligible patients
  - Clinician guideline adherence
  - Patient Management
    - Research/Treatment protocols
  - Healthcare Logistics
    - Tracking and Placing Orders
  - Follow-up referrals
  - Preventative Care
- **Cost Containment**
  - Decreasing patient length-of-stay
  - Clinical Interventions
  - Payment Operations
  - CPOE-integrated systems for suggesting cheaper medication alternatives
  - Reducing test duplication

▼ **Administrative Functions**

- Clinical Workflow Tools
- Documentation Templates
- Patient Triage

▼ **Diagnostics Support**

- Imaging
- Laboratory and Pathology
- Virtual Assistant

▼ **Health Data Interoperability and Integration**

- Secure Data Exchange
- Health Data Platforms

Imaging and Diagnostics

> 💡 The imaging and diagnostics technologies are the end itself.

Technology based subcategories

- Diagnostic Devices
  - ML Enhanced Hardware, e.g. stethoscope
  - ECG
  - EEG
- Diagnostic Imaging Software

  Imaging Technologies:
  - Ultrasound
  - Magnetic Resonance Imaging (MRI)
  - Computed Tomography (CT)
- Biological Diagnostics
  - Rapid Diagnostics
  - Laboratory Diagnostics
    - PCR
    - Bacterial cultures
- Digital Biomarkers

  Technologies used
  - Speech-based
  - Passive Sensing
  - Active Participation based Digital Biomarkers

▼ Drug Discovery

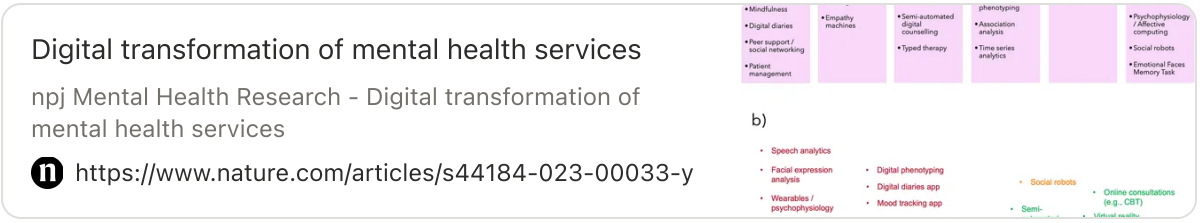
> 💡 Applying AI in the discovery of new drugs. Be it by advance drug target screening, biochemical interactions, in silico trials. Special Highlight on the financial investments into this sector by big Pharma.

Technology based subcategories

- Biotechnology Platform
- Bioinformatics
- Market Analysis (**Application based**)

✅ Mental Health

💡 Using AI in remote and in-person settings to improve therapy outcomes. IMPORTANT: Healthcare provider must be in the loop, otherwise the company will be classified as a Lifestyle and Wellness company, which does not fall under Digital Medicine (i.e. Healthcare).



Digital transformation of mental health services

Application based subcategories

Digital Health Apps

- Mood Tracking
- Psychoeducation
- Mindfulness
- Digital Diaries
- Peer Support
- Social Networking
- Patient management

Surgery

💡 Improving Surgeries through the use of AI.

Application based subcategories

- Surgical Navigation
- Acute Decision Support
- Workflow Optimization

Medical Treatment and Personalized Medicine

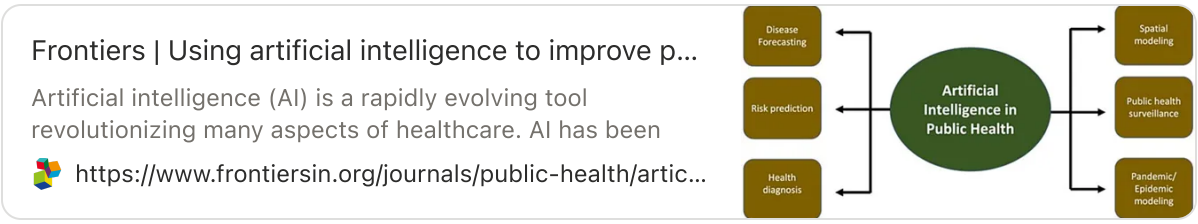
> 💡 Using advanced technologies in genomics, biomedical engineering, robotics and sensing technologies to personalize the treatment of the patient.

Technology based subcategories

- Genomics
  - Genomics
  - Proteomics
  - Epigenomics
  - Multi-omics
- Biomedical Devices
  - Implantable Devices
  - Non-invasive stimulation therapeutic devices
- Regenerative Medicine (Application based)
  - Tissue Engineering
- Reproductive Medicine (Application based)
  - In vitro fertilization technologies

✅ Public Health and Epidemiology

💡 Using AI to understand and impact the big picture in healthcare.



Application based subcategories

- Disease Forecasting
- Risk Prediction
- Health Diagnosis
- Spatial Modeling
- Public Health Surveillance
- Epidemic Modeling
- Infection Prevention and Control

Medical Monitoring

> 💡 Using AI to improve access to healthcare using purely remote healthcare delivery.

Application based subcategories

- Telemedicine
  - General Telemedicine Services
  - Specialized Treatment in Telemedicine
  - Telehealth Platforms and Tools
  - Telerehabilitation
- Digital Biomarkers Monitoring
  - Biomarkers extracted through passive sensing from mobile phones or smartwatches
- Monitoring Devices (**Technology based**)

  Examples:

  Bra monitoring heart health (bloomer health tech)

Using above review, named: **Review of Systematic Reviews in the Field of Telemedicine.** *Categories adapted from it.*

> 💡 Last Point before lunch! Adapt all Categories mentioning Wearables

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✅ Rehabilitation & Assistive Technologies

Review of Recent Research Trends in Assistive Tec...

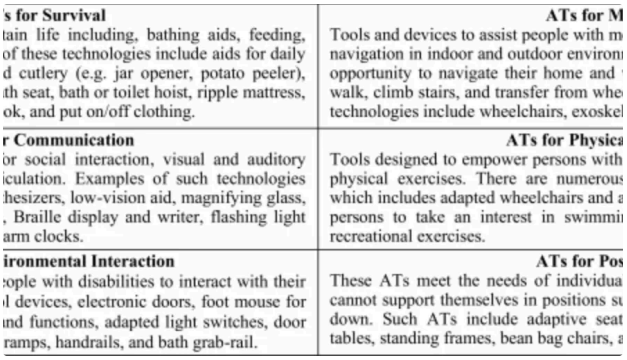
Globally, there is more than half a billion disabled people due to physical, mental, or sensory deficiencies.

https://ieeexplore.ieee.org/document/8925327

Application based subcategories

Assistive Devices (ATs)

- Survival
- Communication
  - Low Vision Aid
- Environmental Interaction
- Mobility
- Physical Education
- Positioning



s for Survival
tain life including, bathing aids, feeding, of these technologies include aids for daily d cutlery (e.g. jar opener, potato peeler), th seat, bath or toilet hoist, ripple mattress, ok, and put on/off clothing.

ATs for M
Tools and devices to assist people with m navigation in indoor and outdoor environ opportunity to navigate their home and walk, climb stairs, and transfer from whe technologies include wheelchairs, exoske

r Communication
or social interaction, visual and auditory iculation. Examples of such technologies hesizers, low-vision aid, magnifying glass, , Braille display and writer, flashing light arm clocks.

ATs for Physica
Tools designed to empower persons with physical exercises. There are numerous which includes adapted wheelchairs and persons to take an interest in swimmi recreational exercises.

ironmental Interaction
ople with disabilities to interact with their l devices, electronic doors, foot mouse for nd functions, adapted light switches, door ramps, handrails, and bath grab-rail.

ATs for Pos
These ATs meet the needs of individua cannot support themselves in positions s down. Such ATs include adaptive seat tables, standing frames, bean bag chairs,

Fall out categories

CDS

- **Patient-facing decision support** Participatory
  - Patient controls EHR data

Technology Column

4 categories will be used, which are the following:

- Machine Learning
- Computer Vision
  - Image recognition and classification
  - Object detection
  - Object tracking
  - Facial recognition
  - Content-based image retrieval

  Source below:

  Types of Artificial Intelligence | IBM
  Early iterations of the AI applications we interact with most today were built on
  https://www.ibm.com/think/topics/a...
- Natural Language Processing
- Bayesian Predictive Modeling

Judging AI Advancement

Each category will have a slightly different approach. Let's provide a general framework.

Given that currently the vast majority of

Questions to filter:

1. Do they have an in-house data science team or are they using their models from third parties?
   a. if not clearly findable, look for keyword matching, e.g. proprietary, own model, finetuning → inhouse is higher level implementation, outsourcing lower.
2. Compare inhouse/outsource to funding of the startup (idea).

Evaluate the governance style of the company, is it centralized or decentralized?

- Breaking down the AI implementation into measurable dimensions. Following examples:
  - inhouse/outsource
  - what kind of models are they using? complexity level of these models.
  - List

🤖 Categories for Technologies used

Fall Out Categories

▼ Virtual Assistant

Lifestyle & Wellness

(Non-)clinical technologies that aim to improve the user's life by influencing habits, be it through coaching, monitoring, informing or other means.

- Fitness
- Nutrition
- Sleep Monitoring
- Physiotherapy
- Consumer Health

  Consumer Health refers to the active participation of individuals in making informed decisions about their own health or the health of their loved ones, often by accessing and evaluating health information available online.

  www.sciencedirect.com

  https://www.sciencedirect.com/topics/social-sciences/consumer-health

  Reference to Call-out (reference AI generated)

▼ Virtual Assistant (Telemedicine)

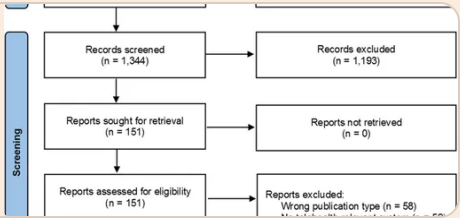
- Disease Management
- ▶ Monitoring
- ▶ Consultation
- ▶ Triage and Appointment Making
- ▶ Diagnosis
- ▶ Clinical Care
- ▶ Follow-Up
- ▶ Medical Education or Training
- ▶ Clinical Trial Support
- ▶ Knowledge Dissemination
- ▶ Drug Delivery

Review on Chinese Telemedicine

Implications for implementation and adoption of tel...

npj Digital Medicine - Implications for implementation and adoption of telehealth in developing countries: a systematic

https://www.nature.com/articles/s41746-023-00908-...



Medical Domains

Can be very many different ones. Focus on the existing medical domain list as in the following link:

Specialty Profiles | Careers in Medicine

Browse the profiles of the more than 160 specialties in the United States and nearly 40

How to calculate a (rough) score of AI integration and maturity in these startups?

Figure out a system by calculating some score from scratch. What kind of algorithms is the company using? For