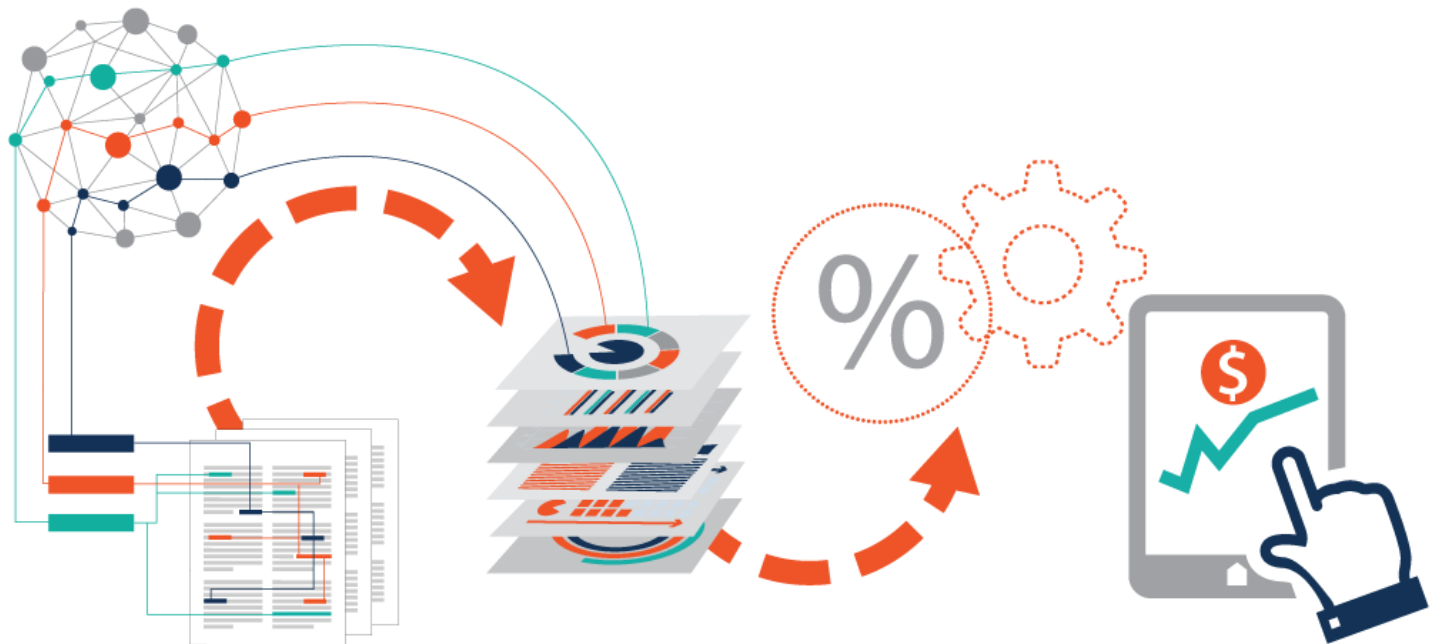


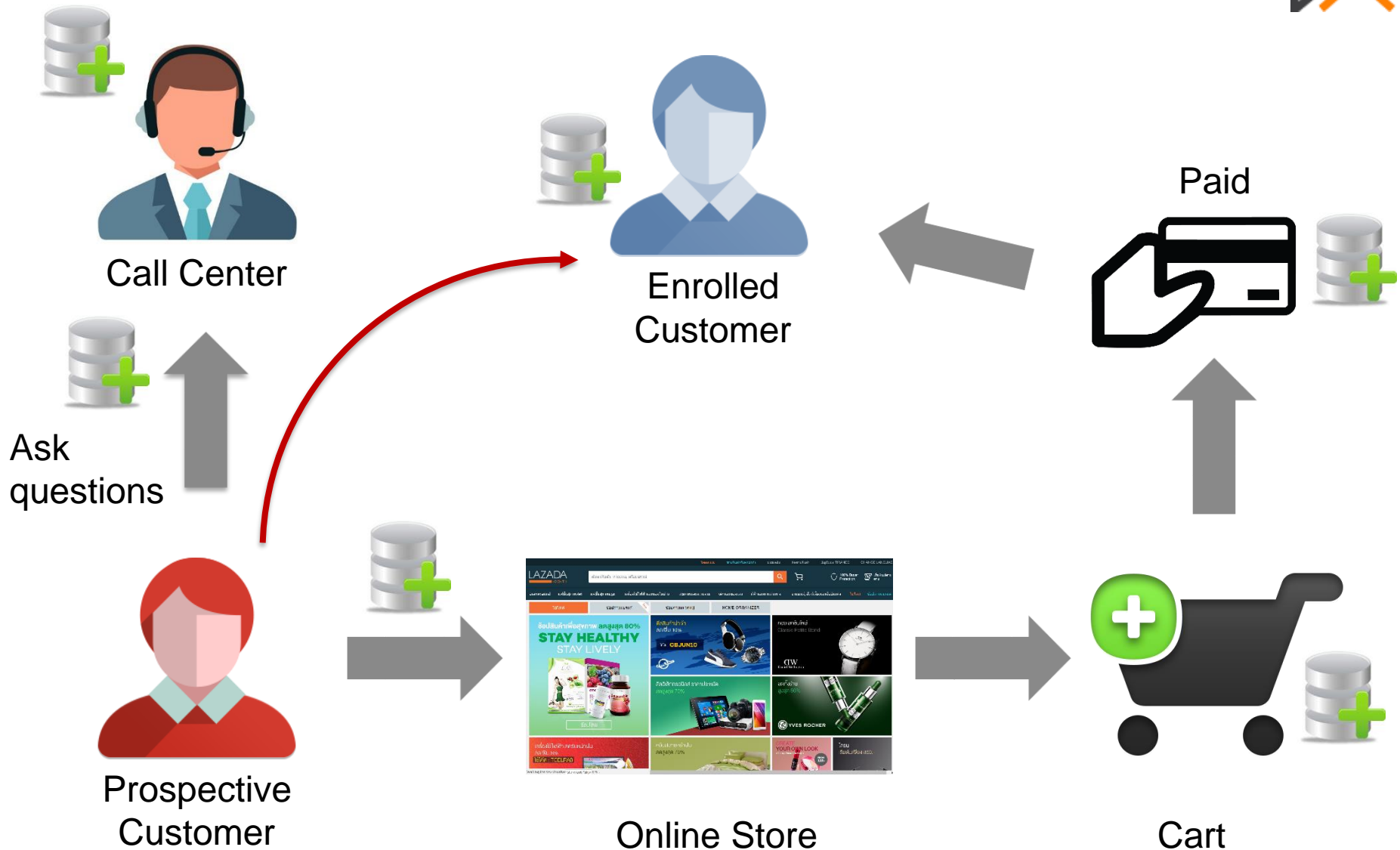
DIGITAL HEALTHCARE

Big data for better living

By Assoc. Prof. Dr. Tiranee Achalakul
Director, Big Data Experience Center



BUYING ONLINE





PERSONALIZED EXPERIENCE

A lot of data must be collected



Shopping cart

Wish list and Previous purchases

Items rated and reviewed

Geo-location

Time-on-site and Duration of views

Links clicked & Text Searched

Telephone inquiries

Responses to marketing materials

Social media posting

BUYING OFFLINE

A blurred background image of an Amazon Go store interior. Shelves are stocked with various products, and a person in an orange shirt is visible in the background.

amazon go

Welcome to Amazon Go.

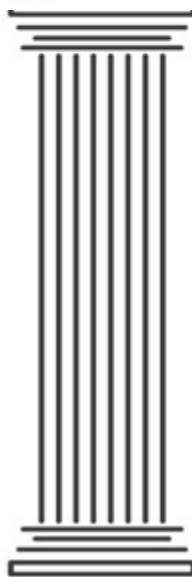
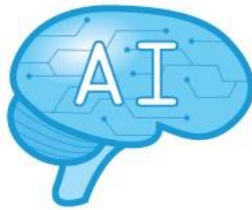
BUYING INSURANCE

- Personalized, value-added insurance packages
- Premiums based on fitness habits
- Regular exam/consultations based on past data



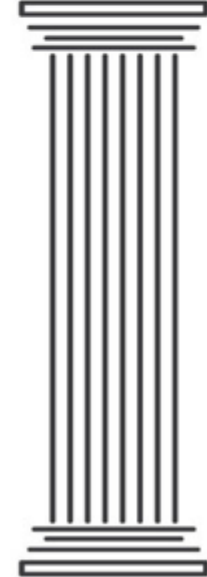
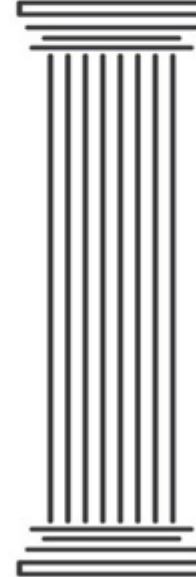
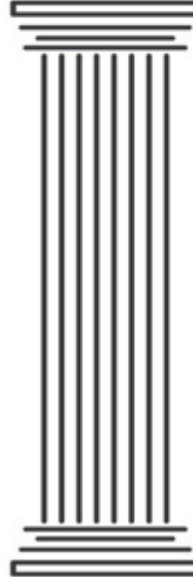
- Heart rate, blood pressure, blood sugar, weight, and etc.
- Nutrition tracking (refrigerator connected)
- Fitness Social Network





BIG Data

0010101101101010001010110
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0010101101101010001010110



Digital technologies that change our way of lives

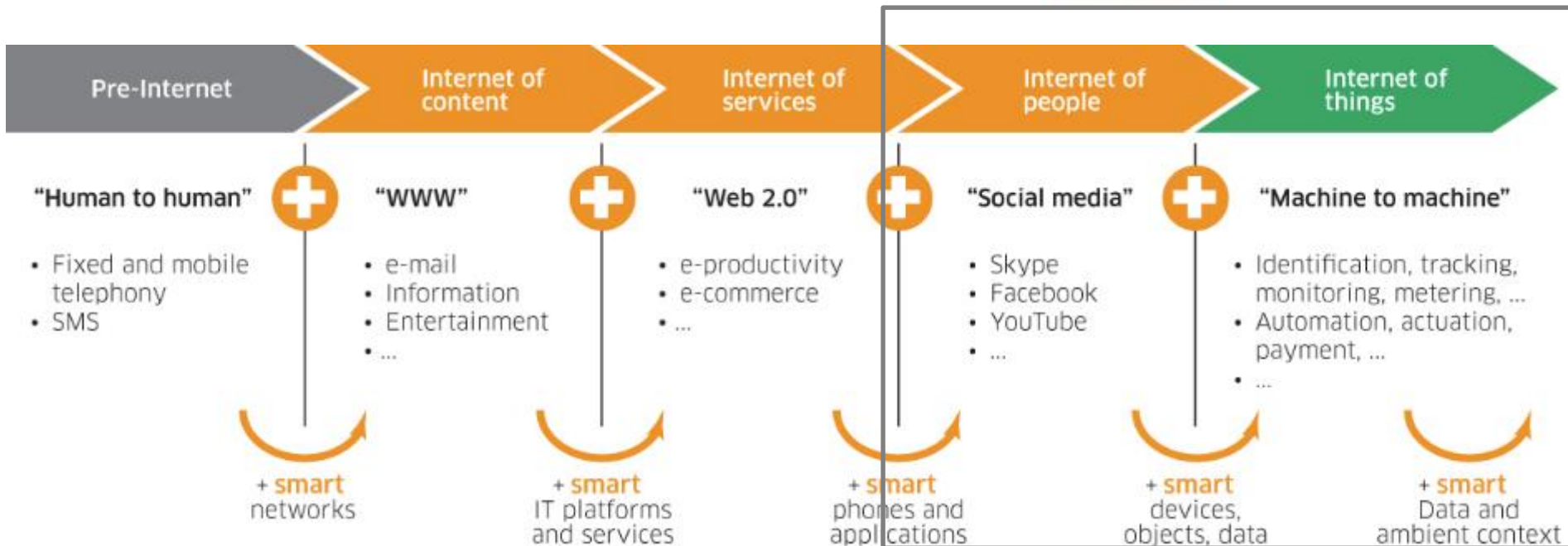
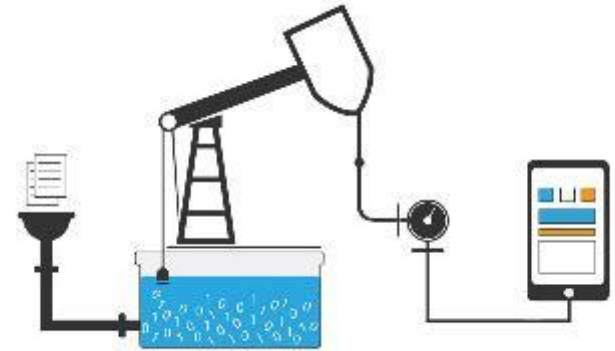


Toward Evidence-based Medicine
For the right living and right care



DATA IS THE NEW OIL

The rapid development of technology led to the **explosive growth of data** in almost every industry and business area.



Data of great
Volume, Variety, and Velocity

BIG DATA

An umbrella term for all sorts of data



Structured



Unstructured

BIG DATA IN HEALTHCARE



The Three “Vs”



- › EHRs, Doctors' notes, Clinical trials, Drug information, Insurance claims data
- › Image, lab test
- › Behavioral data (exercise routine, eating habits, stress, sleep, substance addiction, etc.)
- › Sensor and IoT data
- › New data generated from social media, forums and hosted sites (WebMD)



WHERE TO LOOK FOR DATA



Archives

Scanned documents, statements, medical records, e-mails etc..



Docs

XLS, PDF, CSV, HTML, JSON etc.



Business Apps

CRM, ERP systems, HR, project management etc.



Media

Images, video, audio etc.



Social Networks

Twitter, Facebook, Google+, LinkedIn etc.



Public Web

Wikipedia, news, weather, public finance etc



Data Storages

RDBMS, NoSQL, Hadoop, file systems etc.



Machine Log Data

Application logs, event logs, server data, CDRs, clickstream data etc.



Sensor Data

Smart electric meters, medical devices, car sensors, road cameras etc.



Descriptive Analytics

What happened; How many;
how often; where

Predictive Analytics

Project what will happen;
possible outcome indication

Traditional Analytics (BI)

vs

Big Data Analytics

Focus on

- Descriptive analytics
- Diagnosis analytics

- **Predictive analytics**
- **Data Science**

Data Sets

- Limited data sets
- Cleansed data
- Simple models

- Large scale data sets
- More types of data
- Raw data
- Complex data models

Supports

Causation: what happened,
and why?

Correlation: new insight
More accurate answers



WITH DATA & TECH, WE CAN



Provide better services and treatment delivery



Improves operational efficiency for better cost control

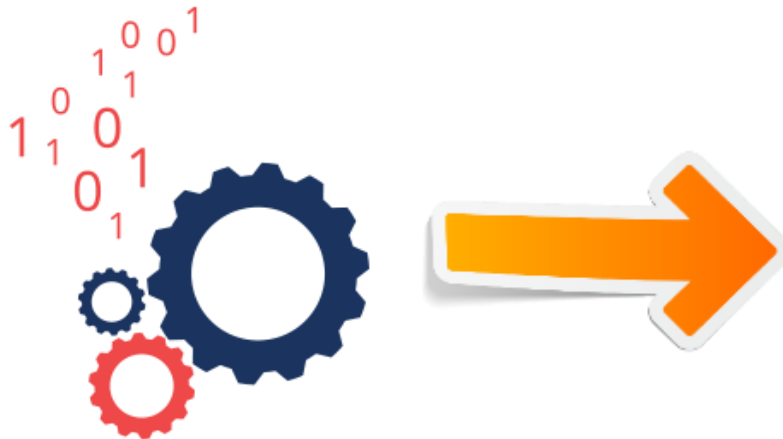


Predict epidemics and even...cure disease



PREDICTIVE ANALYTIC

A set of fundamental concepts/principles that underlie techniques for extracting useful knowledge from large datasets containing a variety of data types. To uncover hidden patterns, unknown correlations, market trends, customer preferences, and other useful business information





EXAMPLE TASKS

- **Clustering**

group individuals in a population by their similarity (not driven by any specific purpose).

- Do our diabetic patients form natural groups or segments?

- **Co-occurrence grouping**

find associations between entities based on transactions involving them.

- What symptoms are commonly occur together?

- **Profiling**

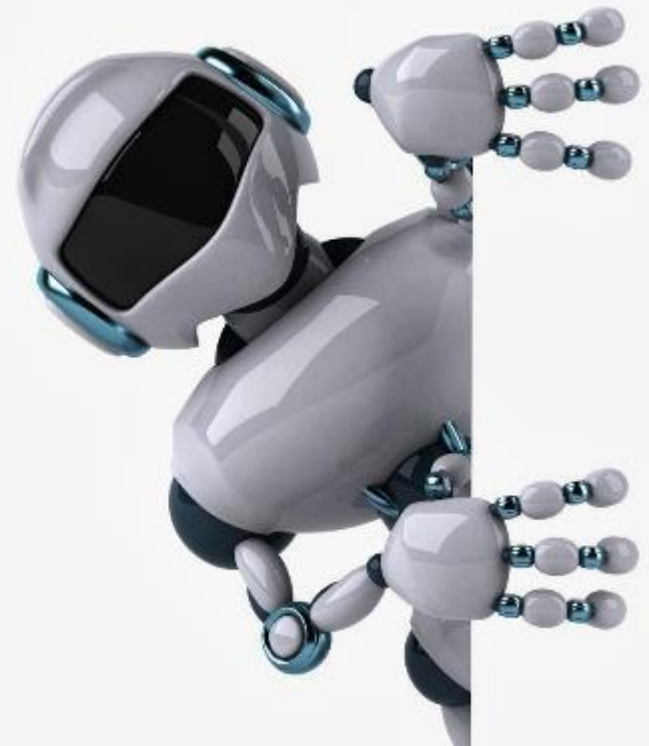
characterize the typical behavior of an individual, group, or population.

- What is the typical food intake behavior of this patient segment ?
- Used to establish behavior norms for anomaly detection



MACHINE LEARNING

Learn from data and make predictions about data by using statistics to develop self learning algorithm



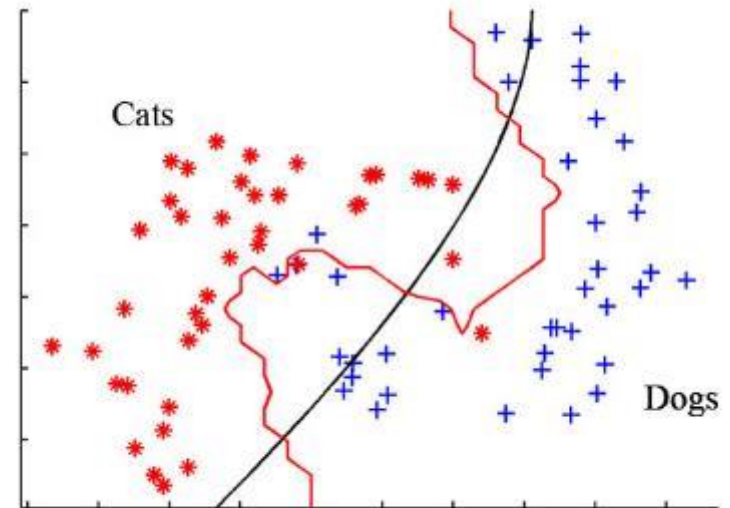
MACHINE LEARNING

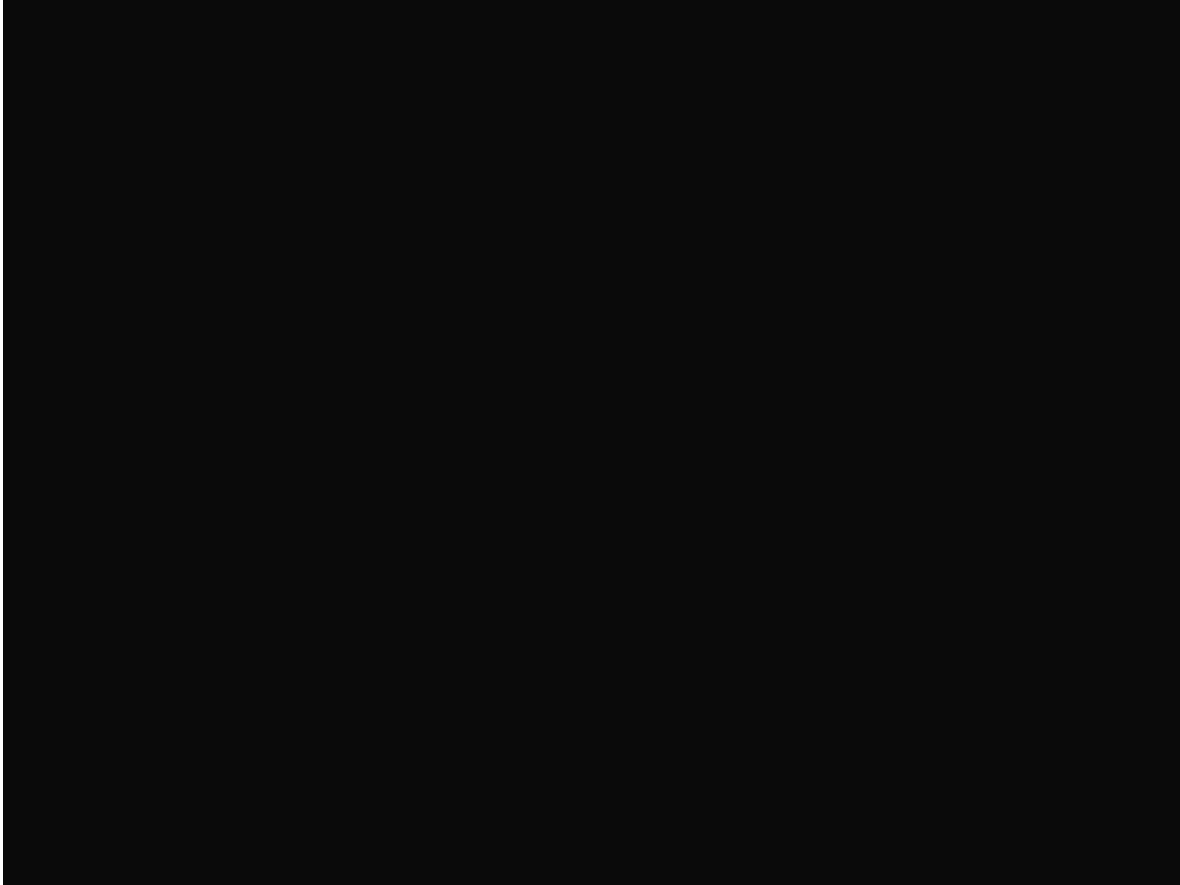
Machine Learning

“The science of getting computers to learn from data without having to be explicitly programmed by humans.”

Machine learning is surrounding you

- Google search
- Auto Facebook photo tagging
- Email Spamming
- Games
- Chat bot
- Recommender

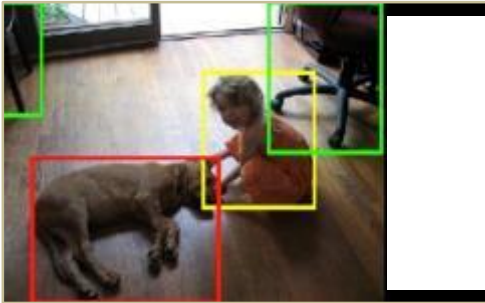




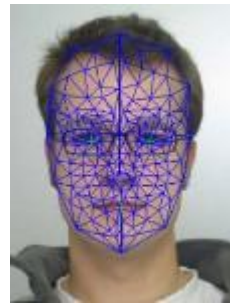


EARLY USE CASES

Image Classification, Object
Detection, Localization



Face Recognition



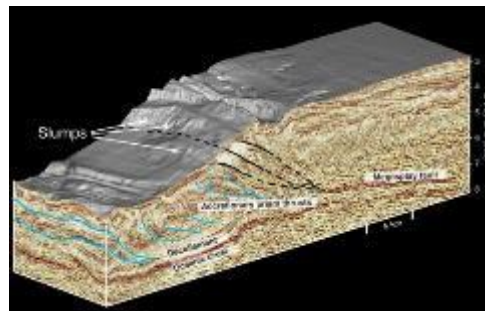
Speech & Natural
Language Processing



Medical Imaging &
Interpretation



Seismic Imaging &
Interpretation



Recommender
Systems



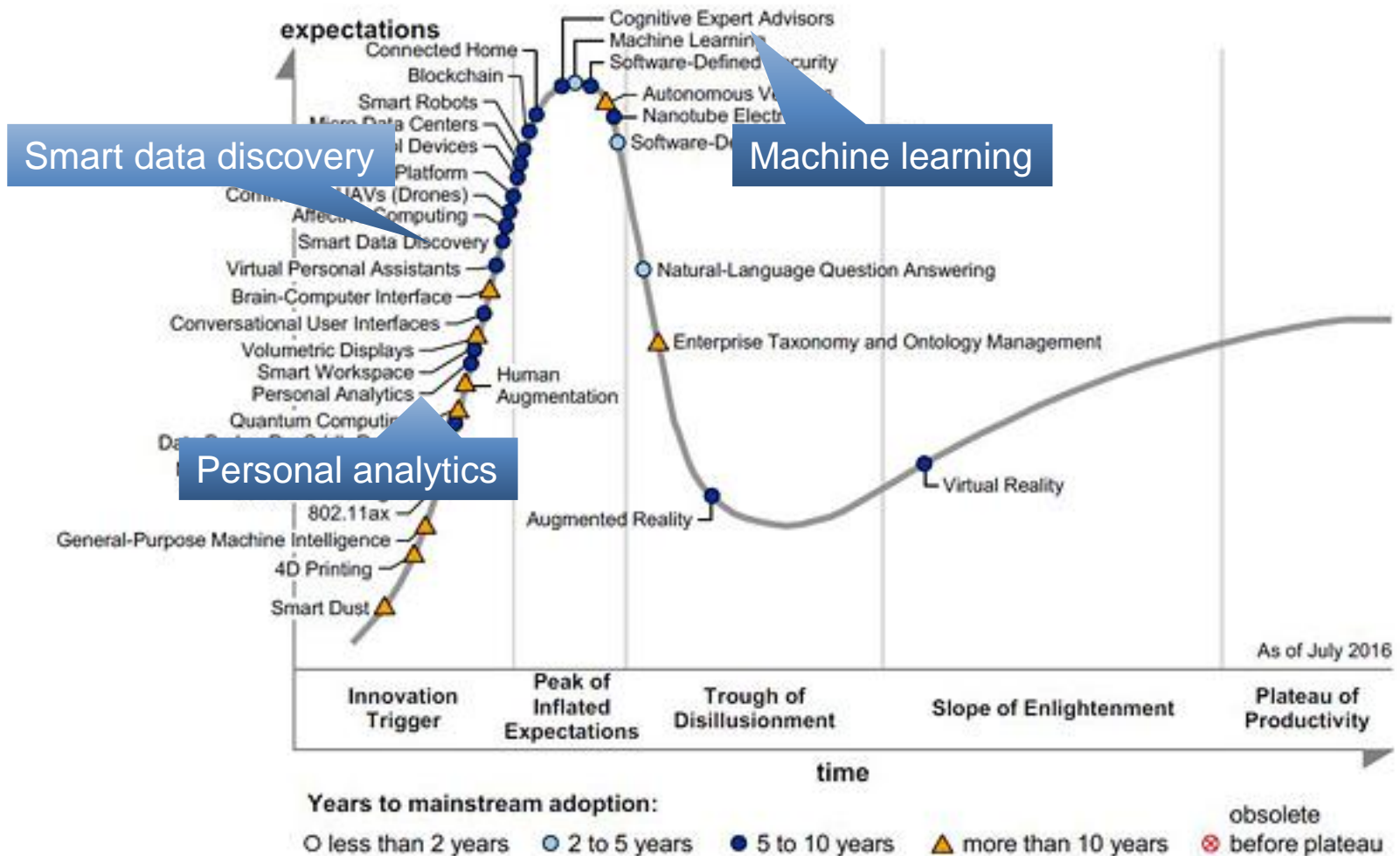


**BIG DATA
EXPERIENCE
CENTER**

Some examples of

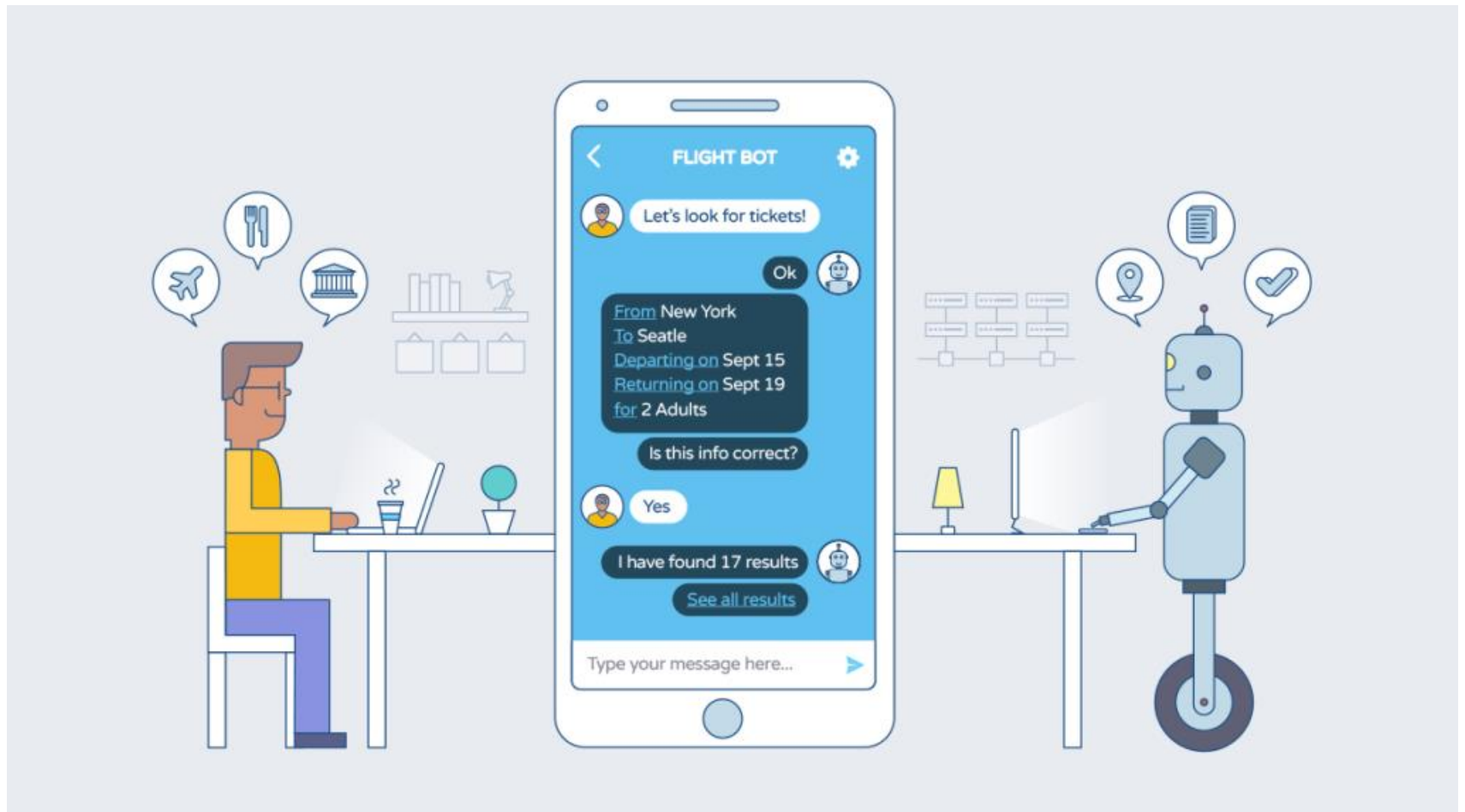
DIGITAL HEALTHCARE PROJECTS

Gartner's hype cycle 2016



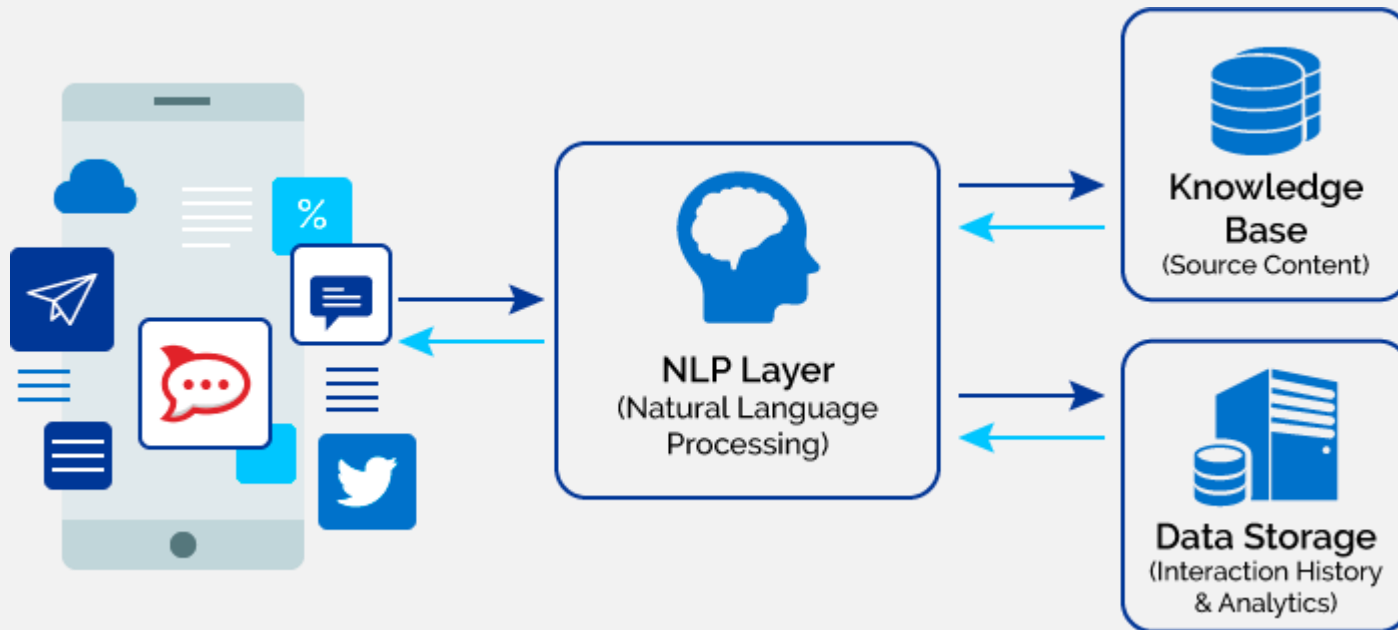
Source: Gartner (July 2016)

CHATBOT



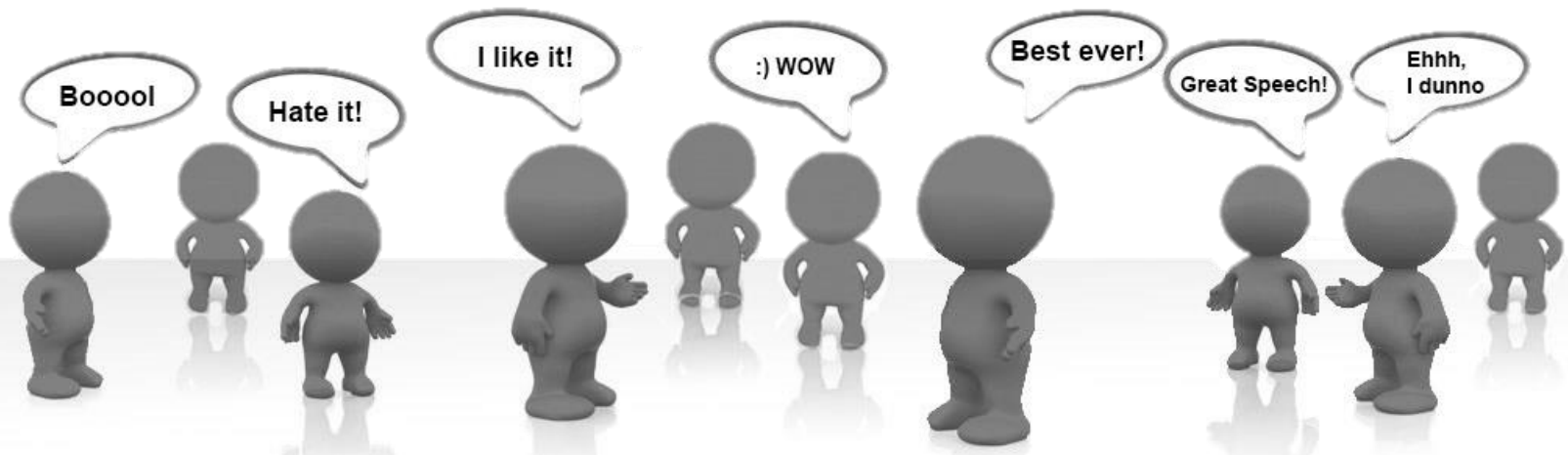
Natural Language Processing

Make computer understand human language in order to perform useful tasks



SENTIMENT ANALYSIS

- To determine the sentiment with respect to some topic or the overall contextual polarity of a post/comment.
- Widely applied to reviews and social media for marketing and customer service.

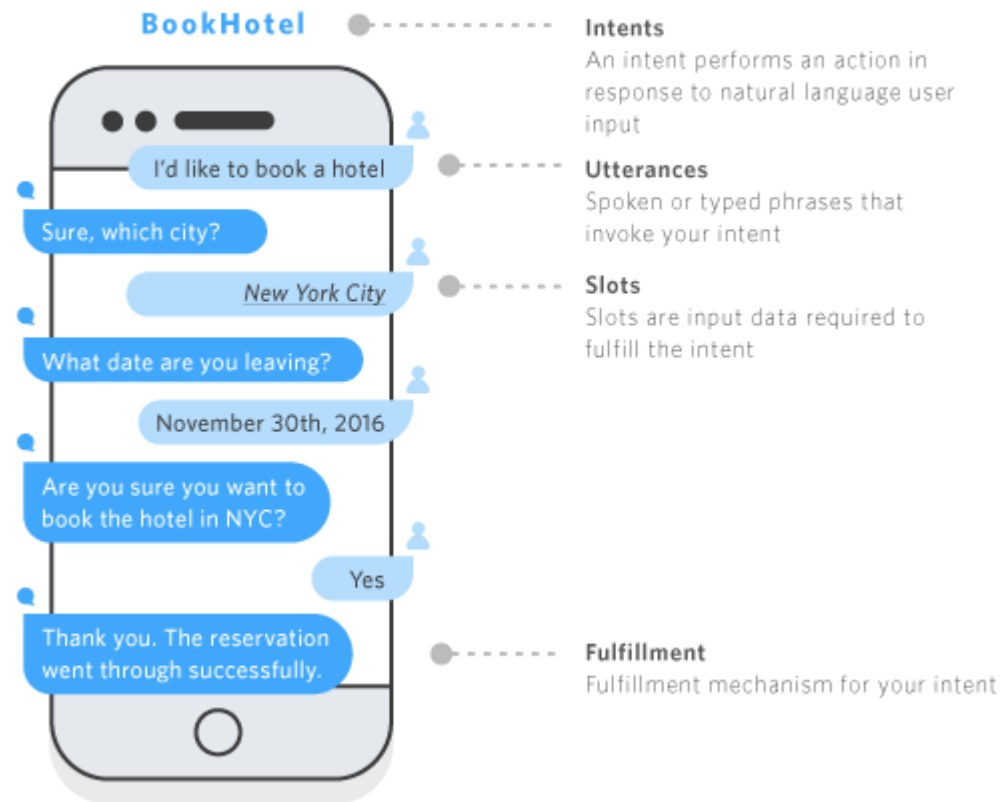




INTENT CLASSIFICATION

Text Classifier: associates an input sentence with a “conversational intent”

- The input “how are you?” is classified as an intent associated with a response such as “I’m good” or “I am well.”
- Three kinds of text classifier
 - Pattern matchers (Brute force or rule based)
 - Algorithms
 - Machine Learning





Whatt time does teh checkup
cilnic open on Mnoday?

Spell Correction

Word Segmentation

POS Tagging

Entity Recognition

Intent Classification



What time does the checkup clinic open on Monday?

Spell Correction

Word Segmentation

POS Tagging

Entity Recognition

Intent Classification



What | time | does | the | checkup |
clinic | open | on | Monday?

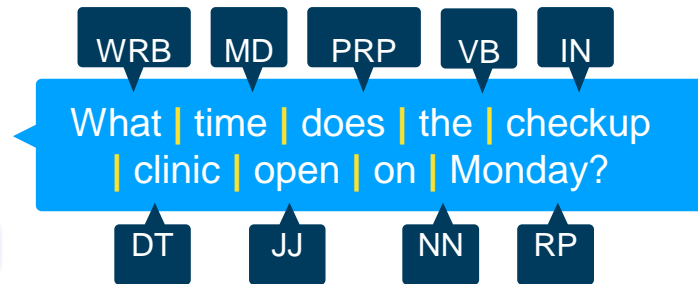
Spell Correction

Word Segmentation

POS Tagging

Entity Recognition

Intent Classification



Spell Correction

Word Segmentation

POS Tagging

Entity Recognition

Intent Classification



What | time | does | the | checkup
| clinic | open | on | Monday?

Date

Spell Correction

Word Segmentation

POS Tagging

Entity Recognition

Intent Classification



What | time | does | the | checkup
| clinic | open | on | Monday?



Working hours
and contact

Coverages

Check up

Waiting Time

Navigation

Spell Correction

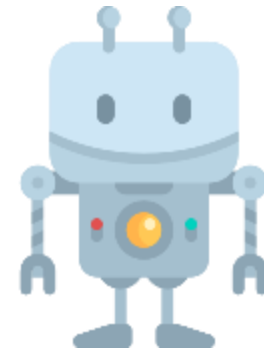
Word Segmentation

POS Tagging

Entity Recognition

Intent Classification

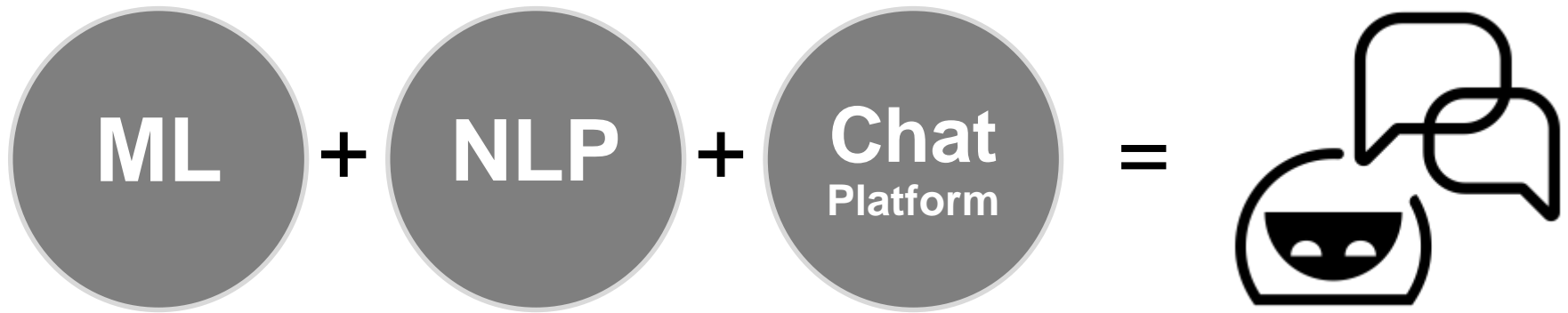
Check up clinic is open on
Monday from 07.00 to 16.00



Bot Framework

Chatbots have revolutionized the customer service space

Chatbot = Conversational interface powered by AI





PROCESS TO BUILD A BOT

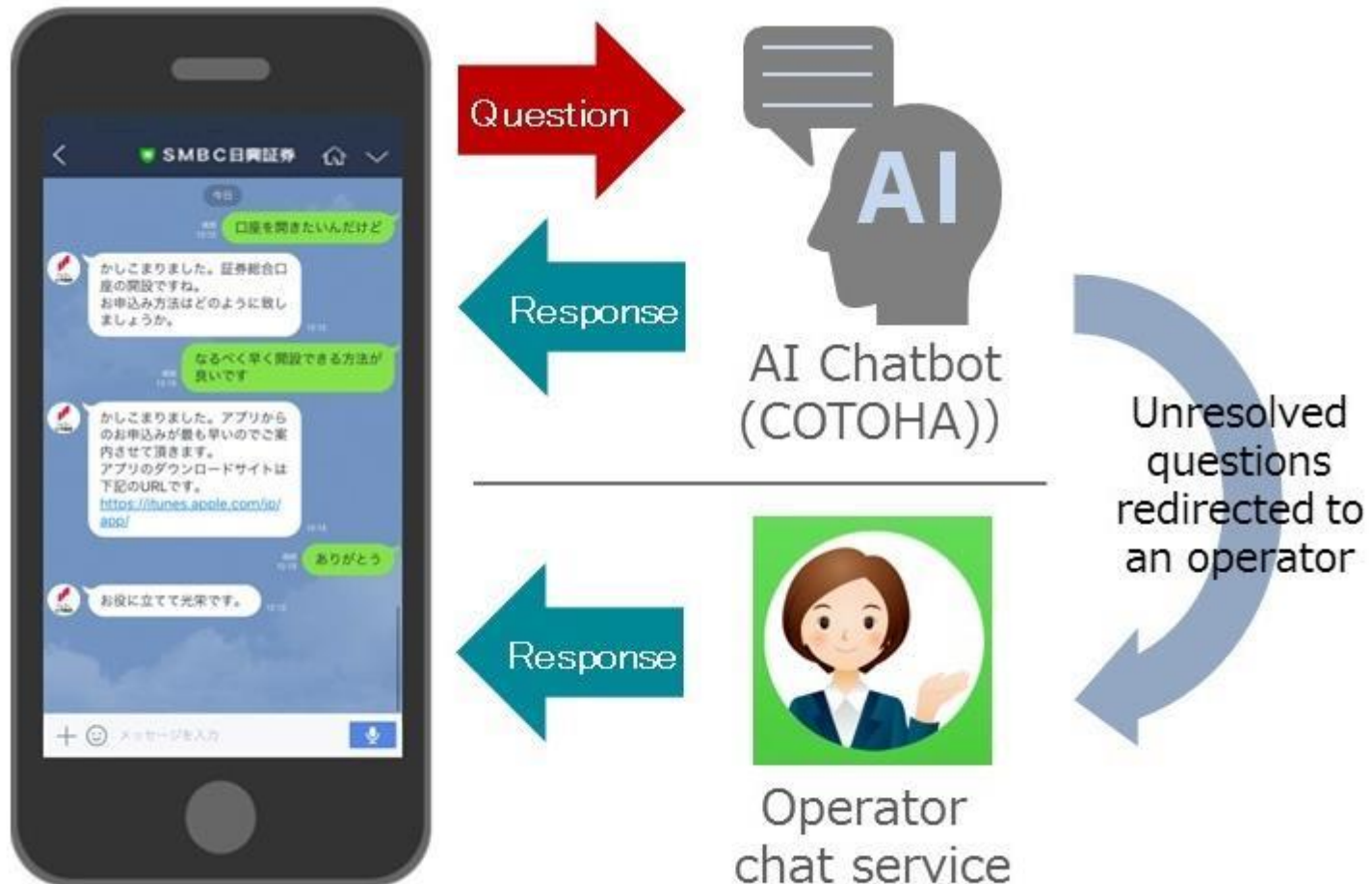
- **Identify the right use case** and the right scope. BOT may
 - not be feasible technically
 - not be really useful
 - Be too expensiveDon't hesitate to start small and scale up !
- Design the **conversation flows**
- Choose the most appropriate **tech stack**
- **Develop** in agile methodology using sprints, **test** with beta-users, **improve** the bot flow, the knowledge base, the bot personality, etc.
- **Scale up**, follow **analytics**/KPI and compare to objectives you want to achieve



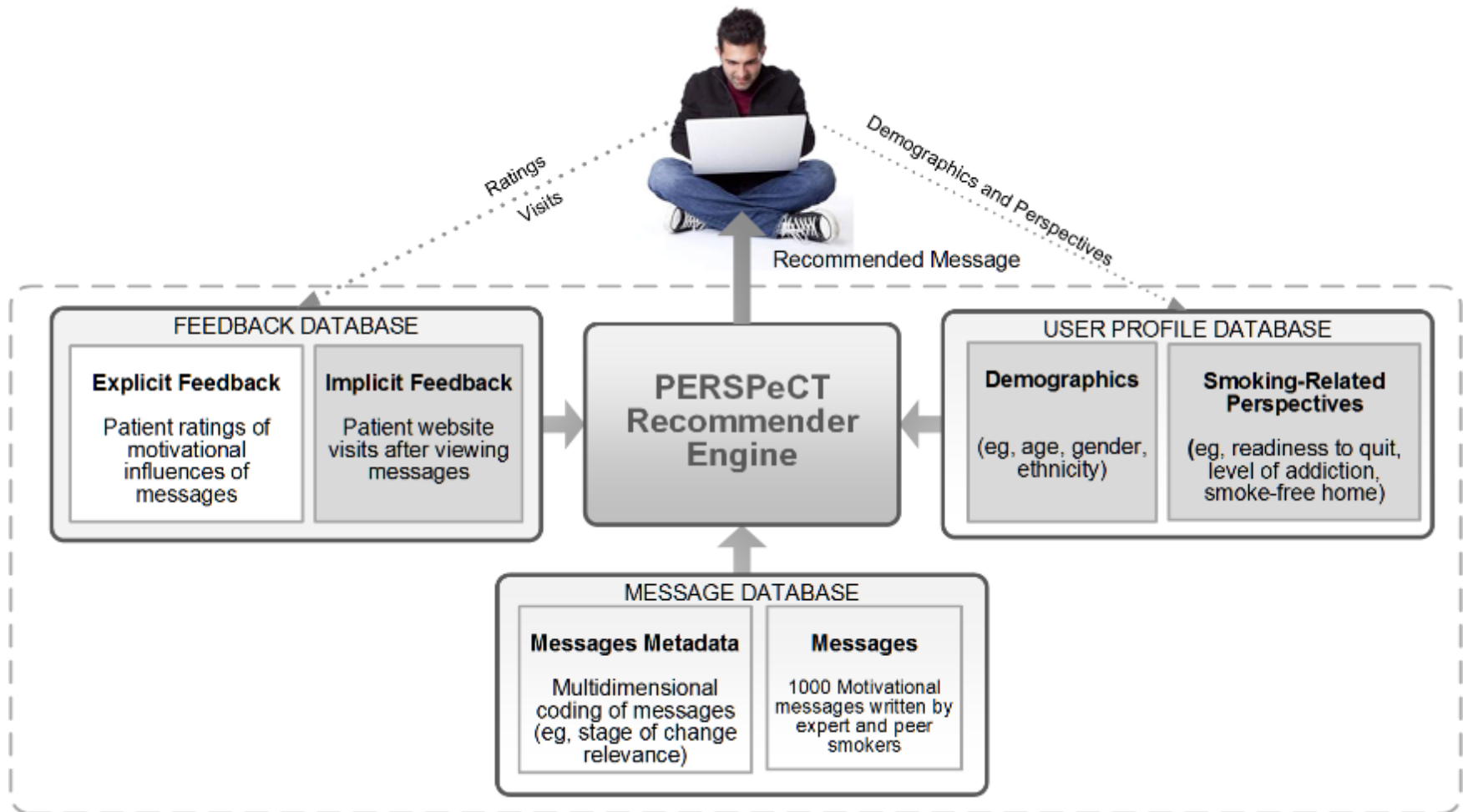
HUMAN MUST TRAIN THE BOT

- Needs human handover protocol
- Chatbot is a supervised learning engine. It is nothing without human. We need to
 - Improve its conversation flow regularly
 - Add new intents to enrich its knowledge base from time to time
 - Provide help on intent classification when the bot is not confident enough
 - Go through all the conversations and confirm/deny the intent qualified by the bot almost daily
 - Listen and observe users for unexpected behaviors so that the bot can be trained accordingly.

HUMAN HANDOVER

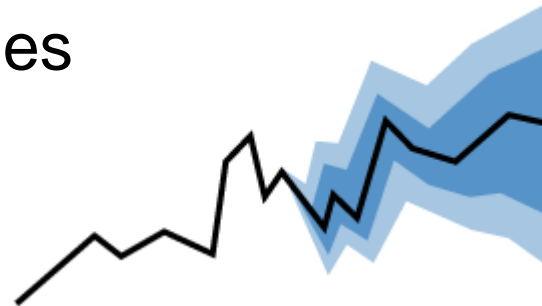


HEALTH RECOMMENDER SYSTEM



ADMISSION RATE PREDICTION

- Key data: 10 years of hospital admissions records
- External data: Weather, public holidays, flu patterns
- Find patterns in admission rates across multiple sites
- Build a model to predict hourly and daily future admissions trends
- Leading to more efficient deployment of resources and better patient outcomes



Hospital Receptionist



59%

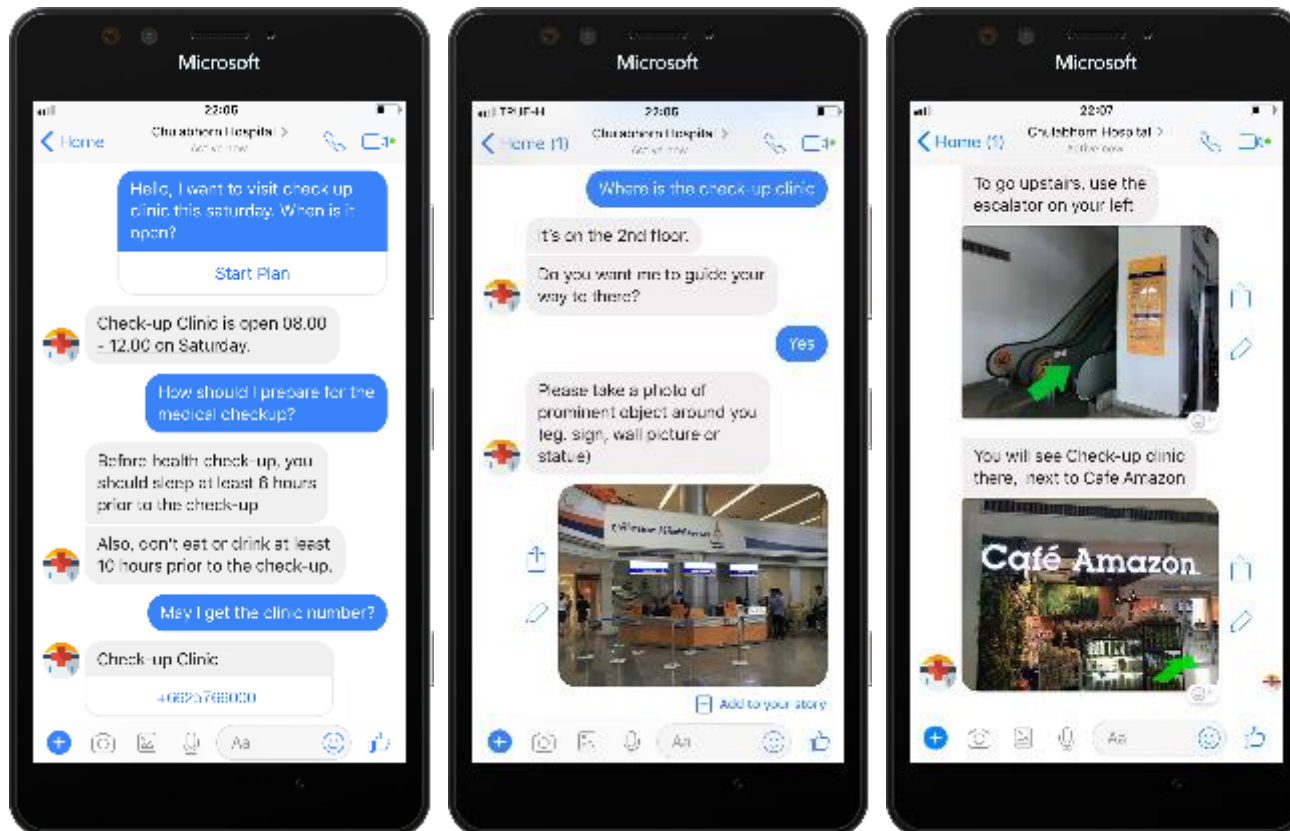
of the population using
mobile **messengers**
in Thailand





HPChat

A Chatbot for patient care and customer service



Working hours and contact

Insurance Coverages

Check up packages, flow, and preparation

Estimate waiting time

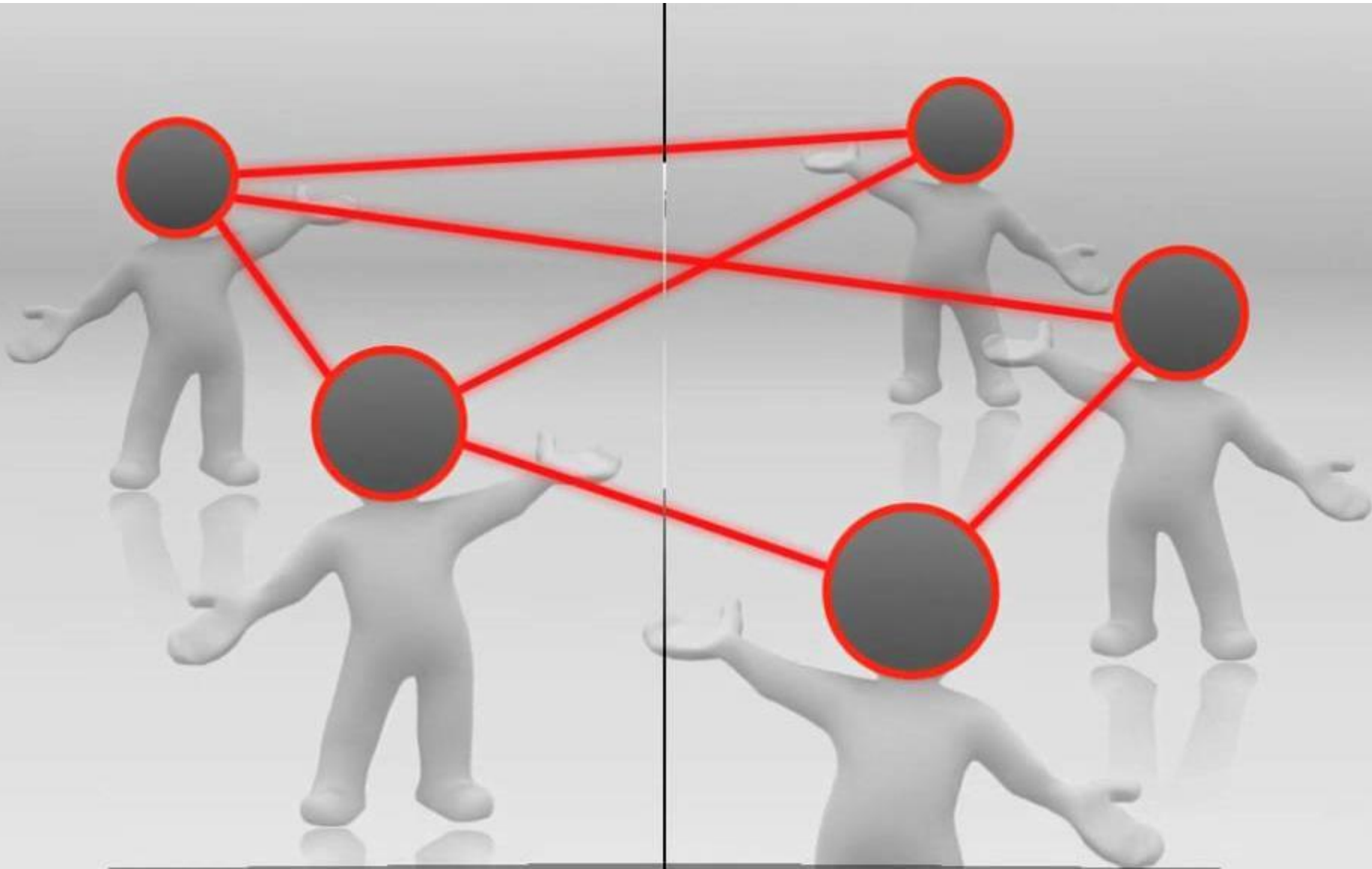
Basic Navigation



Conversation-as-a-Service

No need to integrate with
Hospital Information System

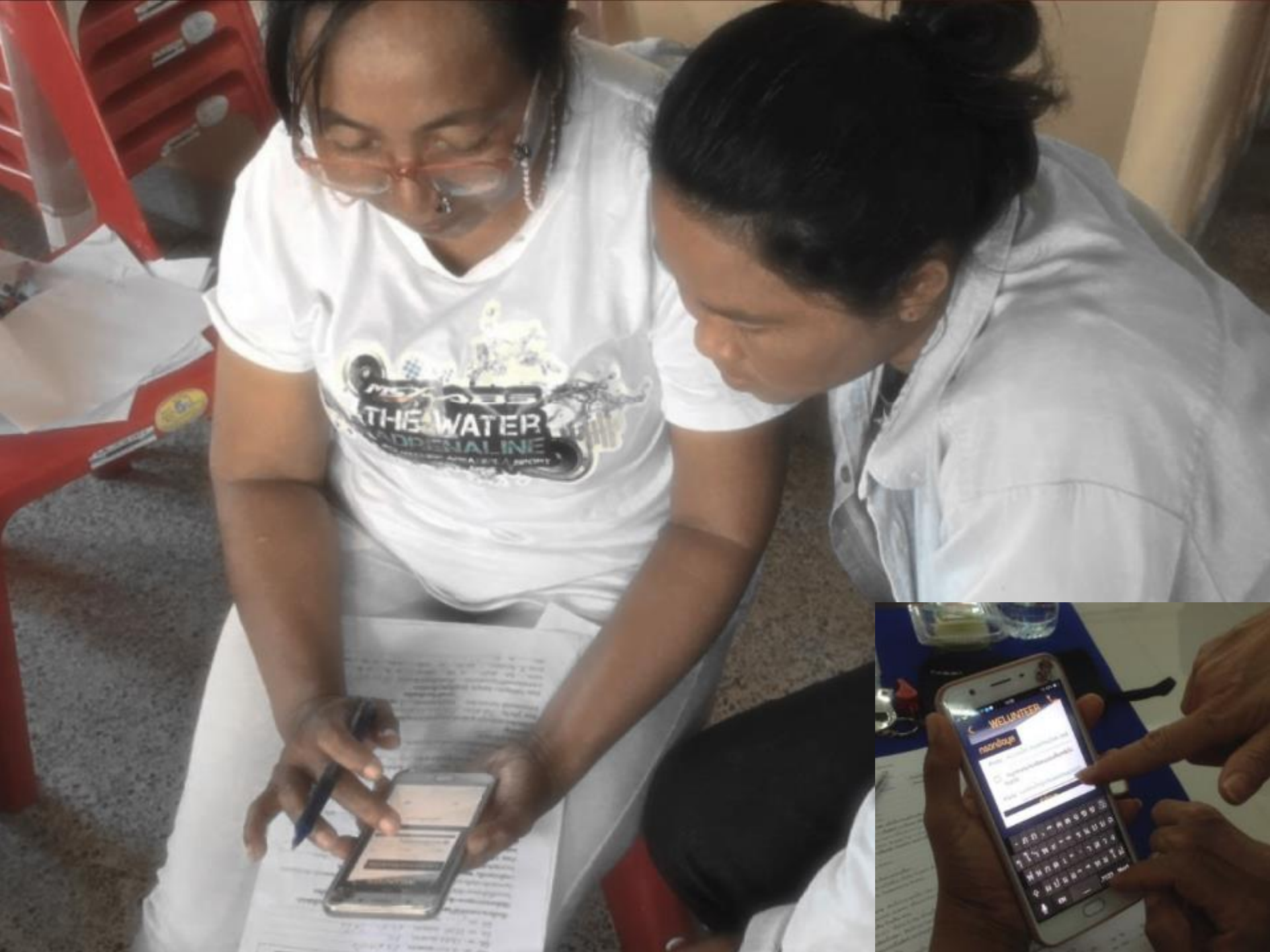
HEALTH RECOMMENDER



REAL-LIFE VOLUNTEERS

Knowledge Management Institute
District Health System and KMUTT







LESSONS LEARNED

Not enough doctors and volunteers in the loop





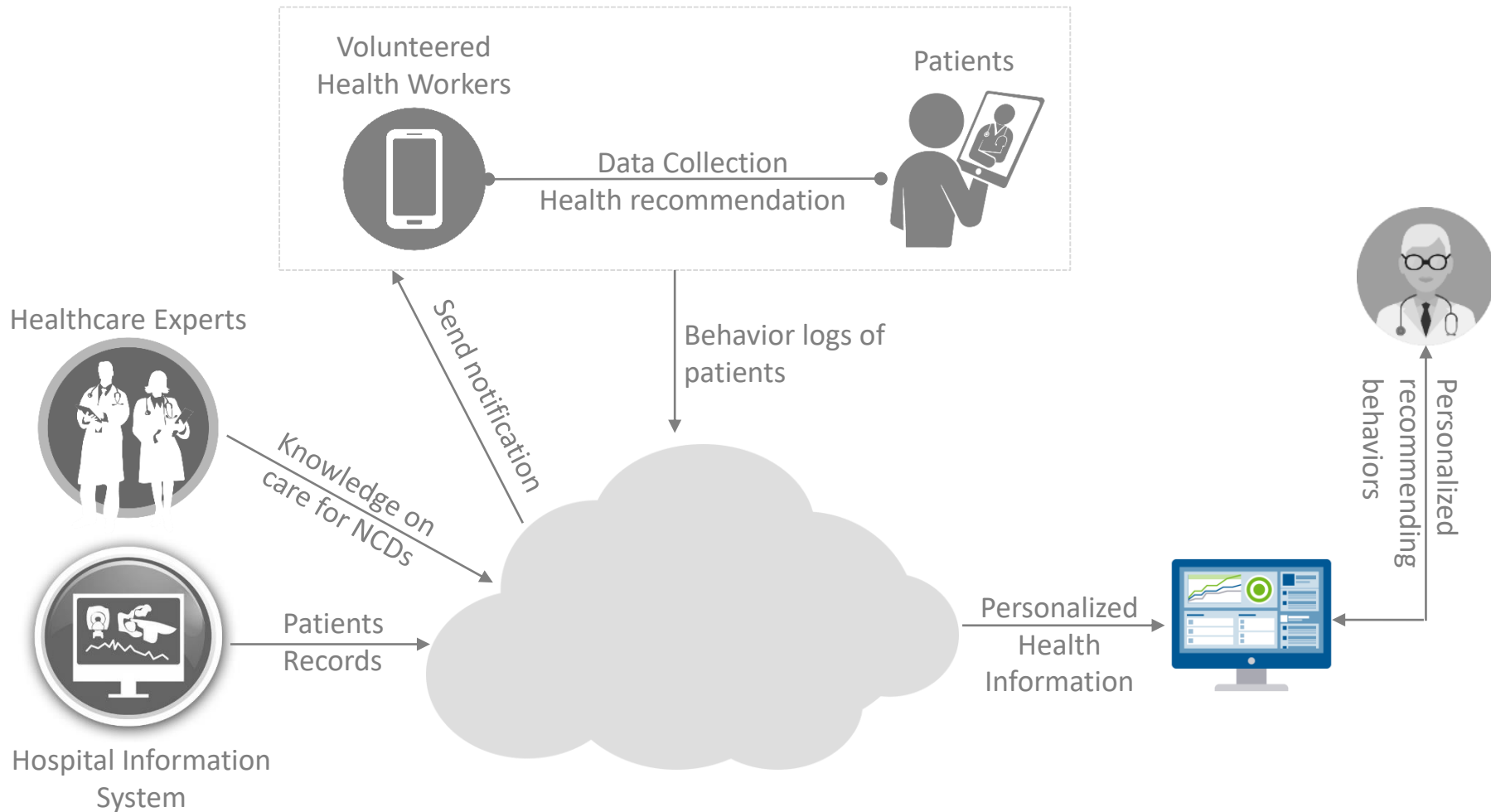
THE OFFLINE SUPPORT PLATFORM





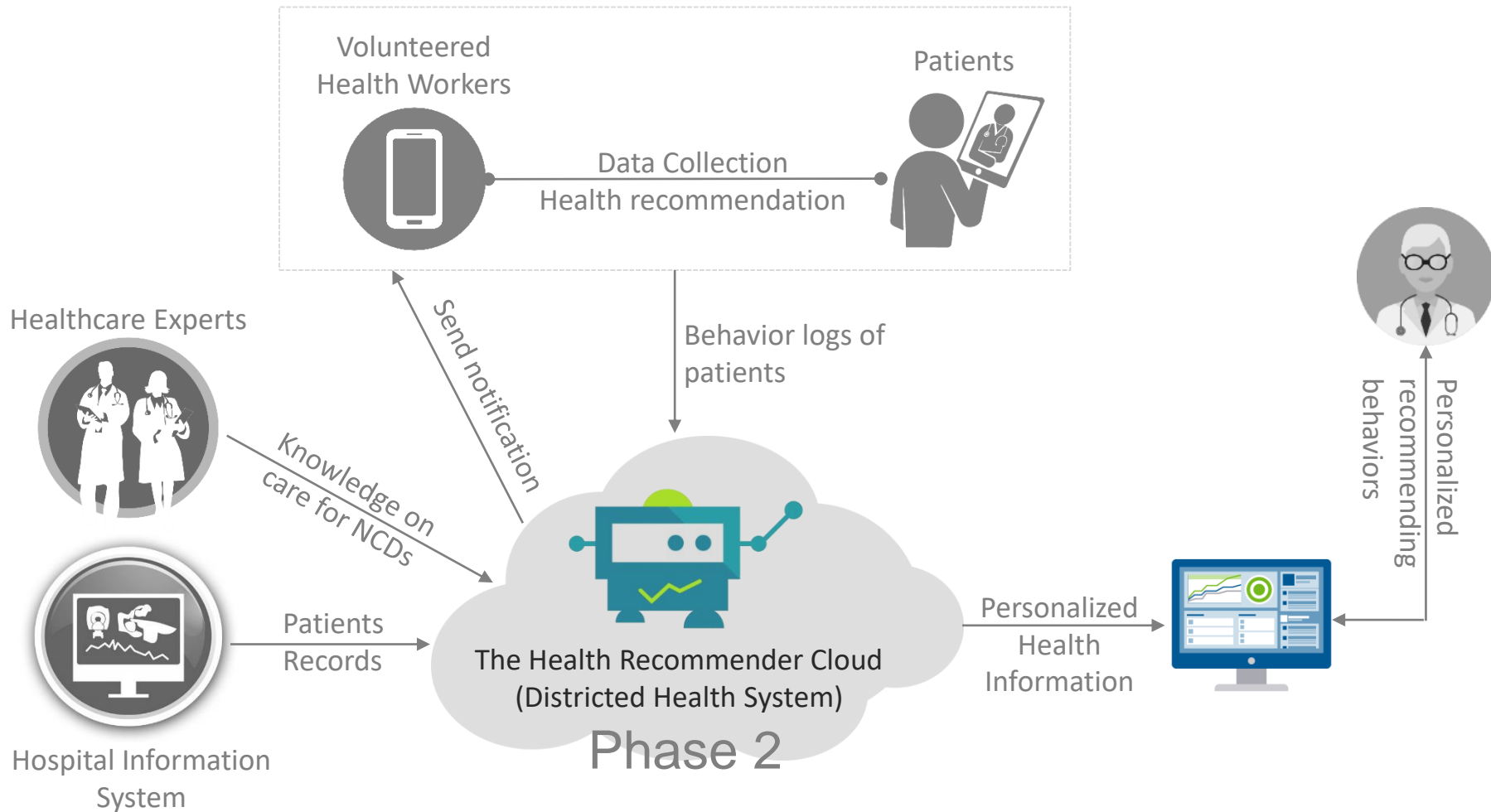
HEALTH RECOMMENDER SYSTEM

Prototyped in collaboration with the KMI Foundation (Phase 1)





HEALTH RECOMMENDER SYSTEM



WELSE



IoT Platform and Point-of-care Device



Image source: <http://cepclab.org.in/>



SOFIA

by Hanson Robotics



A service robot designed to care for the elderly, assist people with disabilities, help children with special needs to learn.





**BIG DATA
EXPERIENCE
CENTER**

**EXPLAIN
EXPLORE
EXCHANGE**

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