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AWARD CONFERENCE **2025**

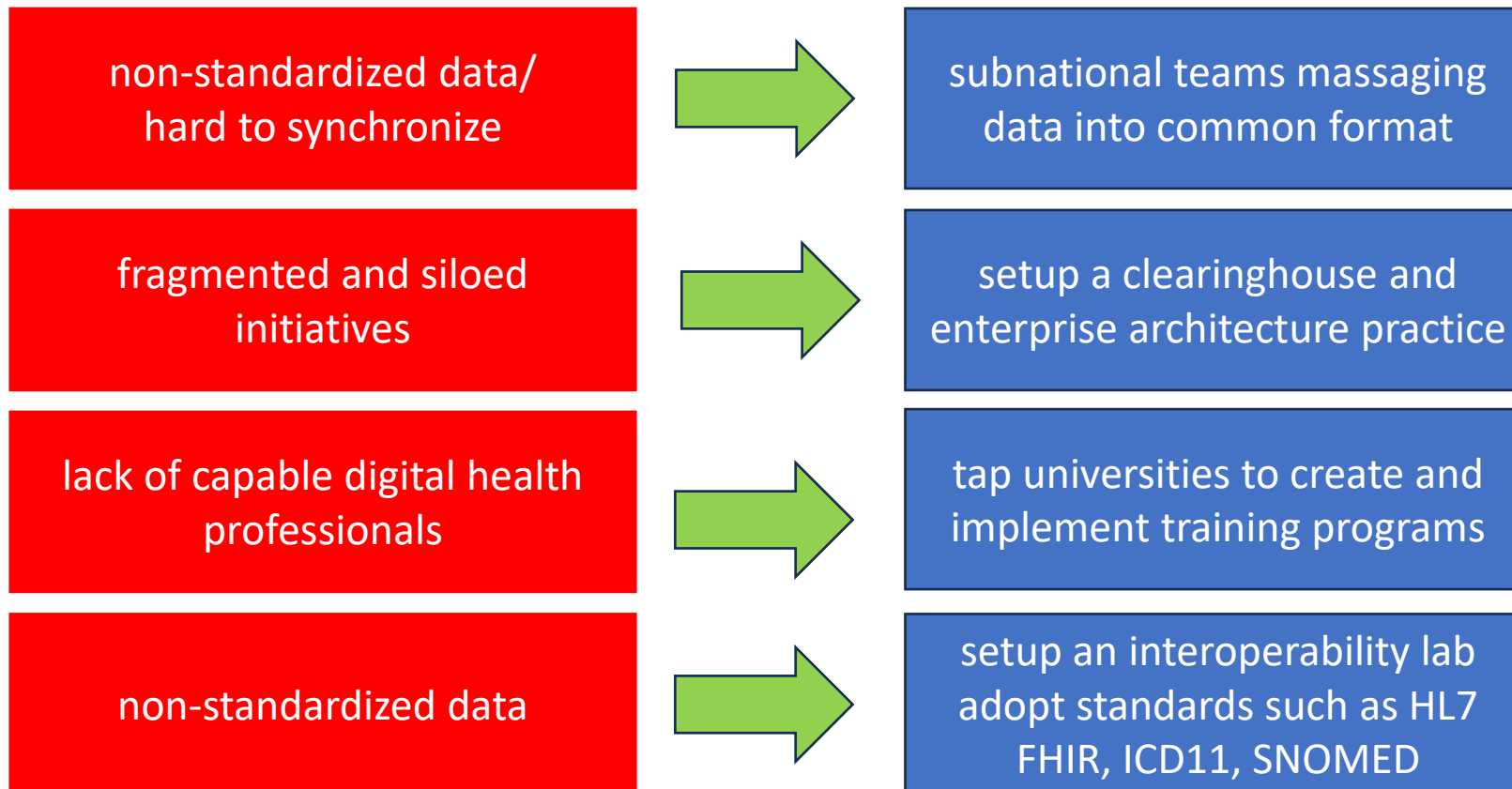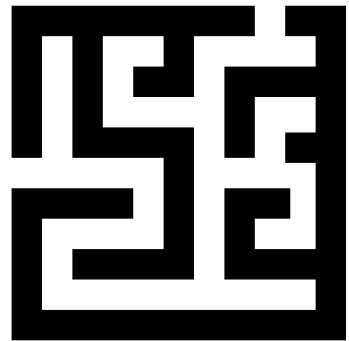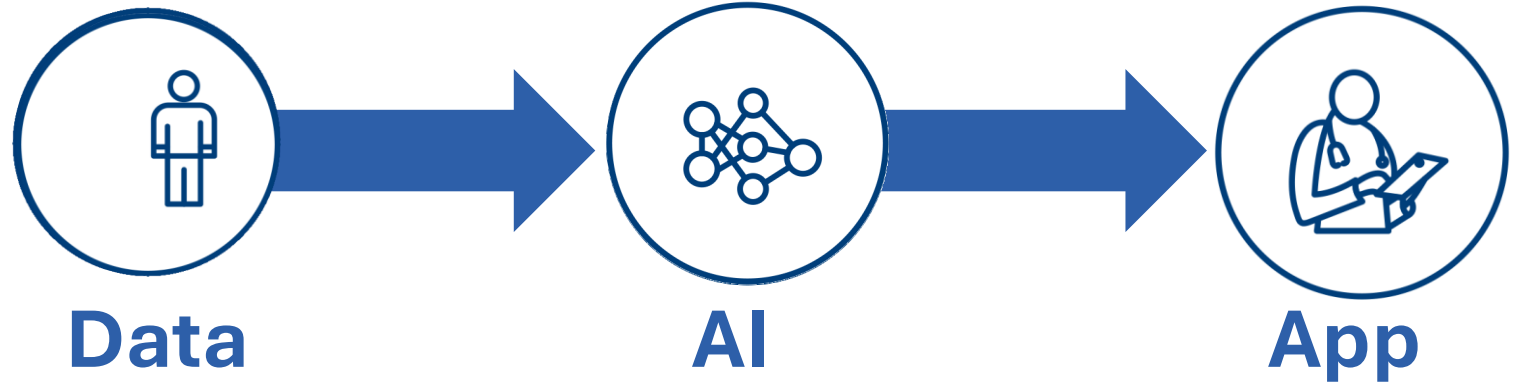| CONTENT AND MAIN USERS	RESPONSIBLE ORGANIZATION	DATA DOMAINS AND TOOLS
PRIMARY USE OF DATA		
PROVISION OF HEALTH CARE SERVICES – DIAGNOSTICS AND TREATMENT. **PHYSICIANS** AND **PATIENTS**	HEALTHCARE INSTITUTIONS. MINISTRY OF HEALTH. DIGITAL HEALTH DEPARTMENTS.	OPERATIONAL DATA – ELECTRONIC MEDICAL RECORDS, RADIOLOGY/LABORATORY/CARDIOLOGY/ INFORMATION SYSTEMS, PACS, ETC.
INFORMATION SYSTEM MUST BE USER FRIENDLY. DATA IS TIME CRITICAL		
SECONDARY USE OF DATA		
HEALTH CARE INSTITUTION MANAGEMENT **HOSPITAL MANAGERS**	HEALTHCARE INSTITUTIONS. MINISTRY OF HEALTH. DIGITAL HEALTH DEPARTMENTS.	BUSINESS INTELLIGENCE. PERFORMANCE INDICATORS.
HEALTH DATA ANALYTICS – RESEARCH, PUBLIC HEALTH DATA **RESEARCHERS**	NATIONAL INSTITUTE FOR HEALTH DEVELOPMENT. UNIVERSITIES	DISEASE PREVALENCE. HEALTH INDICATORS. DISEASE REGISTRIES.
HEALTHCARE FINANCING **INSURANCE. PAYER**	HEALTH INSURANCE. NATIONAL HEALTH SYSTEMS. MINISTRY OF HEALTH	REIMBURSEMENT. REPORTING OF MEDICAL ACTIVITIES. QUALITY INDICATORS.
HEALTHCARE AND POLICY INDICATORS **GOVERNMENT**	MINISTRY OF HEALTH. STATE STATISTICS AUTHORITY	HEALTHCARE SERVICES' PLANNING, KEY PERFORMANCE INDICATORS, REPORTS
THIRD-PARTY SERVICES **DIGITAL HEALTH INDUSTRY**	HEALTHCARE INSTITUTIONS. MINISTRY OF HEALTH. DIGITAL HEALTH DEPARTMENTS.	PROVISION OF TOOLS AND SERVICES FOR PATIENT OR HEALTHCARE PROVIDER – ACTIVITY MONITORING, BLOOD PRESSURE, GLUCOSE, PROMs, PREMs, ETC.
USER EXPERIENCE IS NOT SO IMPORTANT. DATA MUST BE OF HIGH QUALITY.		

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# Q: What were the challenges faced during this process. and how were they addressed?

Challenge		Solution
non-standardized data/ hard to synchronize	→	subnational teams massaging data into common format
fragmented and siloed initiatives	→	setup a clearinghouse and enterprise architecture practice
lack of capable digital health professionals	→	tap universities to create and implement training programs
non-standardized data	→	setup an interoperability lab adopt standards such as HL7 FHIR, ICD11, SNOMED

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Data in low resource settings

Data → **AI** → **App**
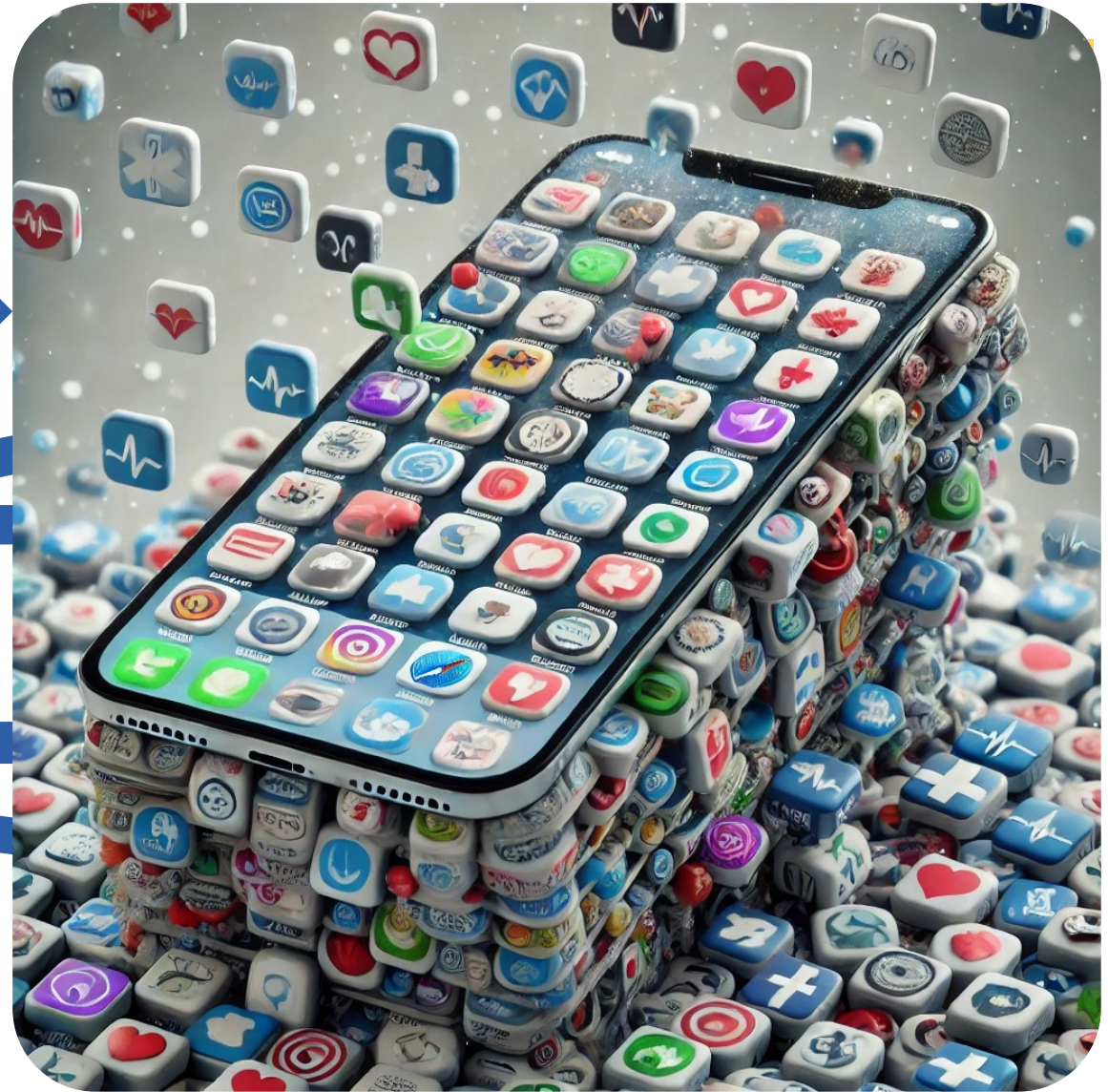
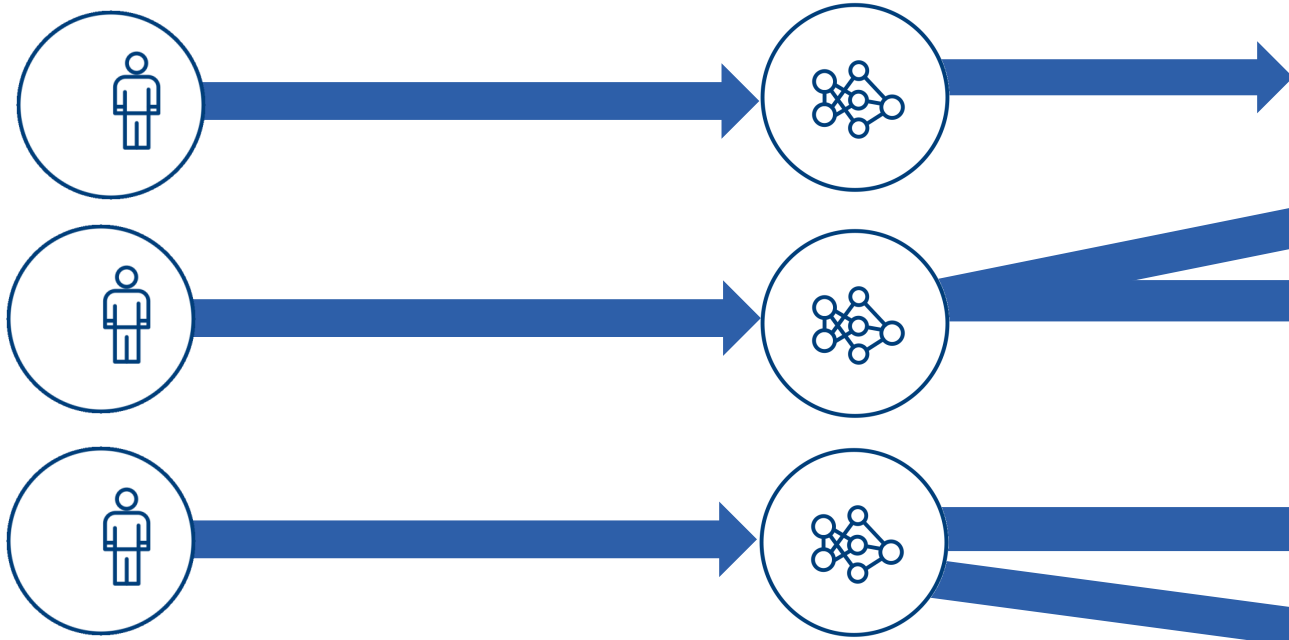# **Data in low resource settings** [fragmented]

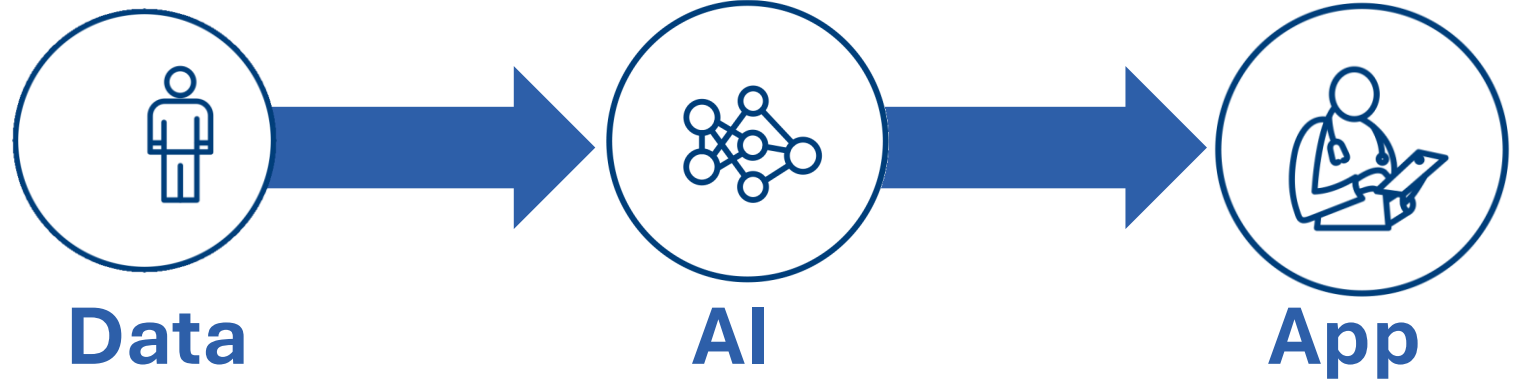

FRAGMENTED

AI
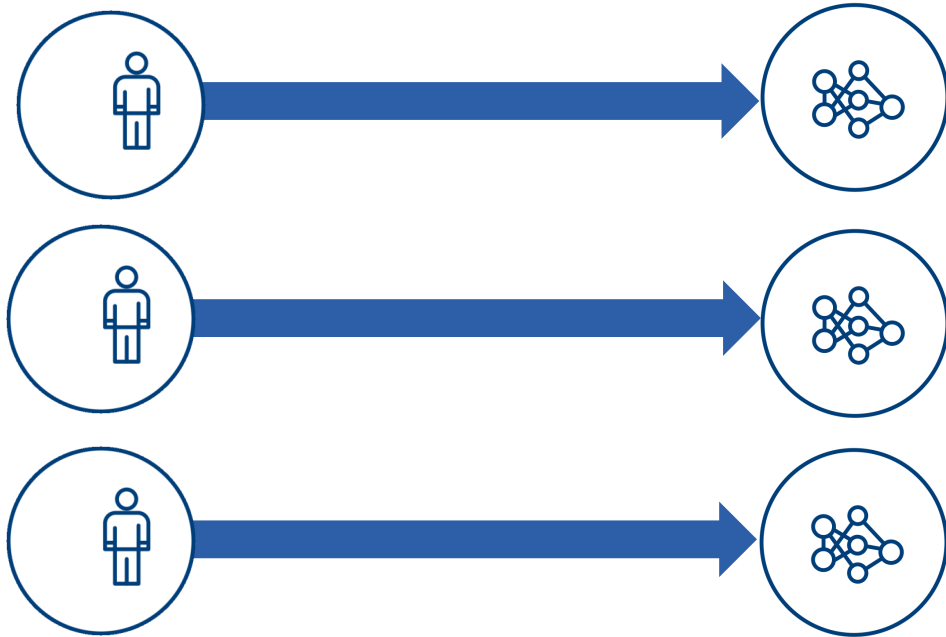
FRAGMENTED

Data *collection*

Fragmentation

De-fragmentation : foundation models

Foundational model
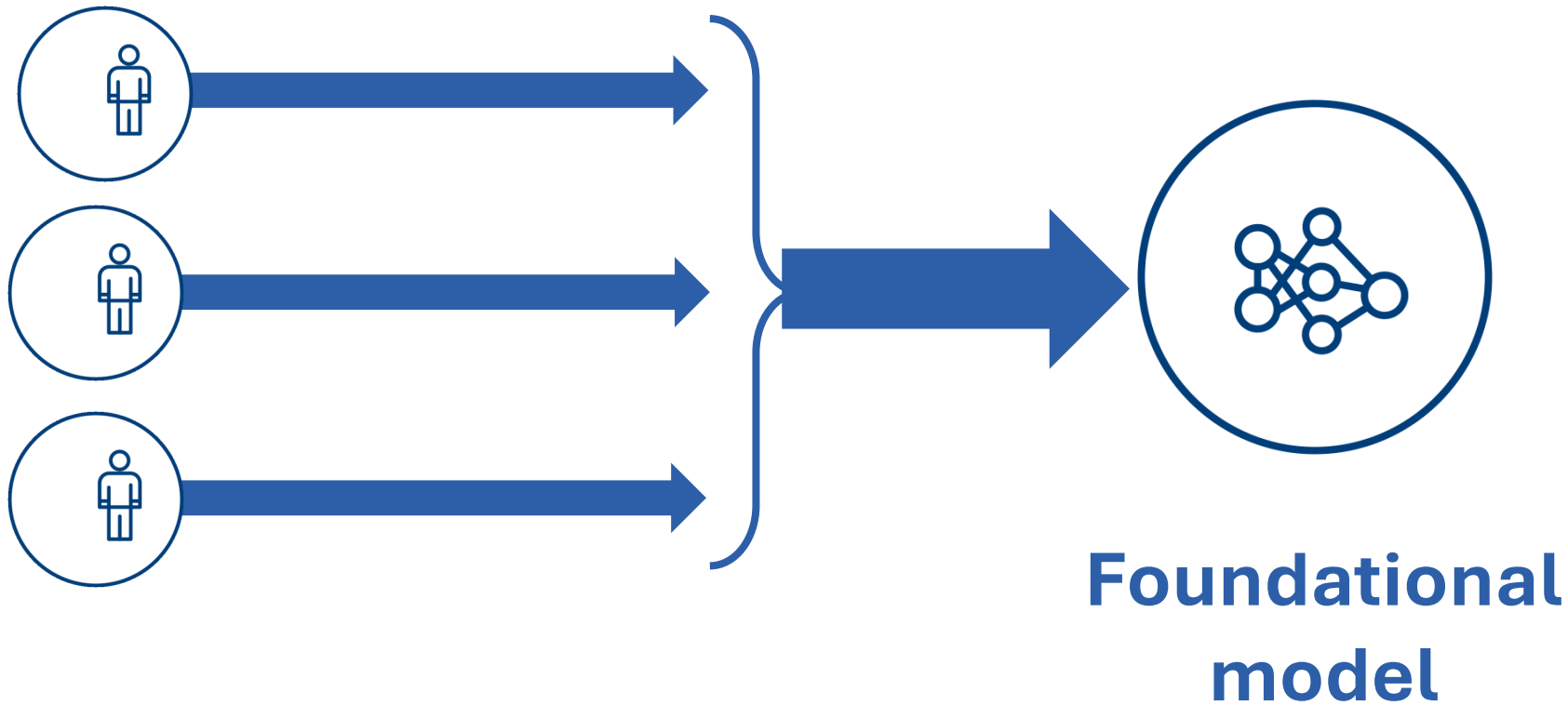
Imperfect data = Imperfect models

Nudging Imperfect foundations with MOOVE

Nudging through use

Imperfect
Foundational model

Adapted
Foundational model
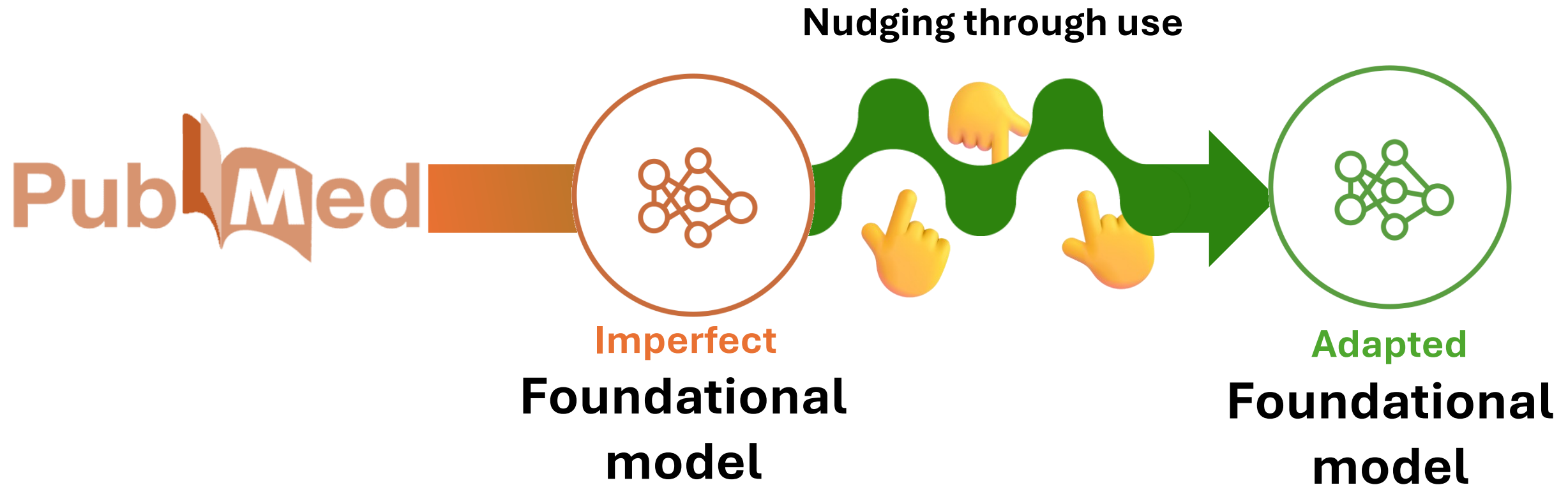
Data capture Healthcare Institution

CLINICAL – Prevention, diagnostics, treatment, rehabilitation

ADMINISTRATIVE Stock, Human Resources, Performance Indicators

FINANCE Provided services, Quality Indicators

STATISTICS Healthcare Performance Indicators

RESEARCHERS INVESTIGATORS Clinical Trial Data, Research Data

INFORMATION SYSTEMS

Primary use of data

Secondary use of data

Electronic Medical Record (EMR)

Hospital Management Information System

Claims management system

Public Health Data Analytics

Research and Industry

Data cleaning. Data encoding

Data cleaning. Data encoding

Data cleaning. Data encoding

DATA BASE

Electronic Health Record (EHR)

Health Authority / Local Government Database

Health Insurance Database

Institute for Public Health Database

University / Clinical trial database

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Data capture

CLINICAL and NON-CLINICAL DATA

Universal Data Models

Data harmonization – terminology, classifiers, catalogues, standards, etc.

INFORMATION SYSTEMS

Primary use of data

Electronic Medical Record (EMR)

Hospital Management Information System

Secondary use of data

Claims management system

Public Health Data Analytics

Research and Industry

Virtual Registries
Data cleaning. Data encoding. Registry formation

DATA BASE

Electronic Health Record (EHR)

Health Authority / Local Government Database

Health Insurance Database

Institute for Public Health Database

University / Clinical trial database

SERVICES

Digital Health Services

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TAL
TECH

Q: What are the critical success factors for effective data integration and management in public health?

- clear decision-making and accountability framework (who makes key decisions and investments?)

- a shared blueprint (what are we building?)

- competent people (are the builders capable?)

- available and accessible data standards (are the builders using the same building blocks?)
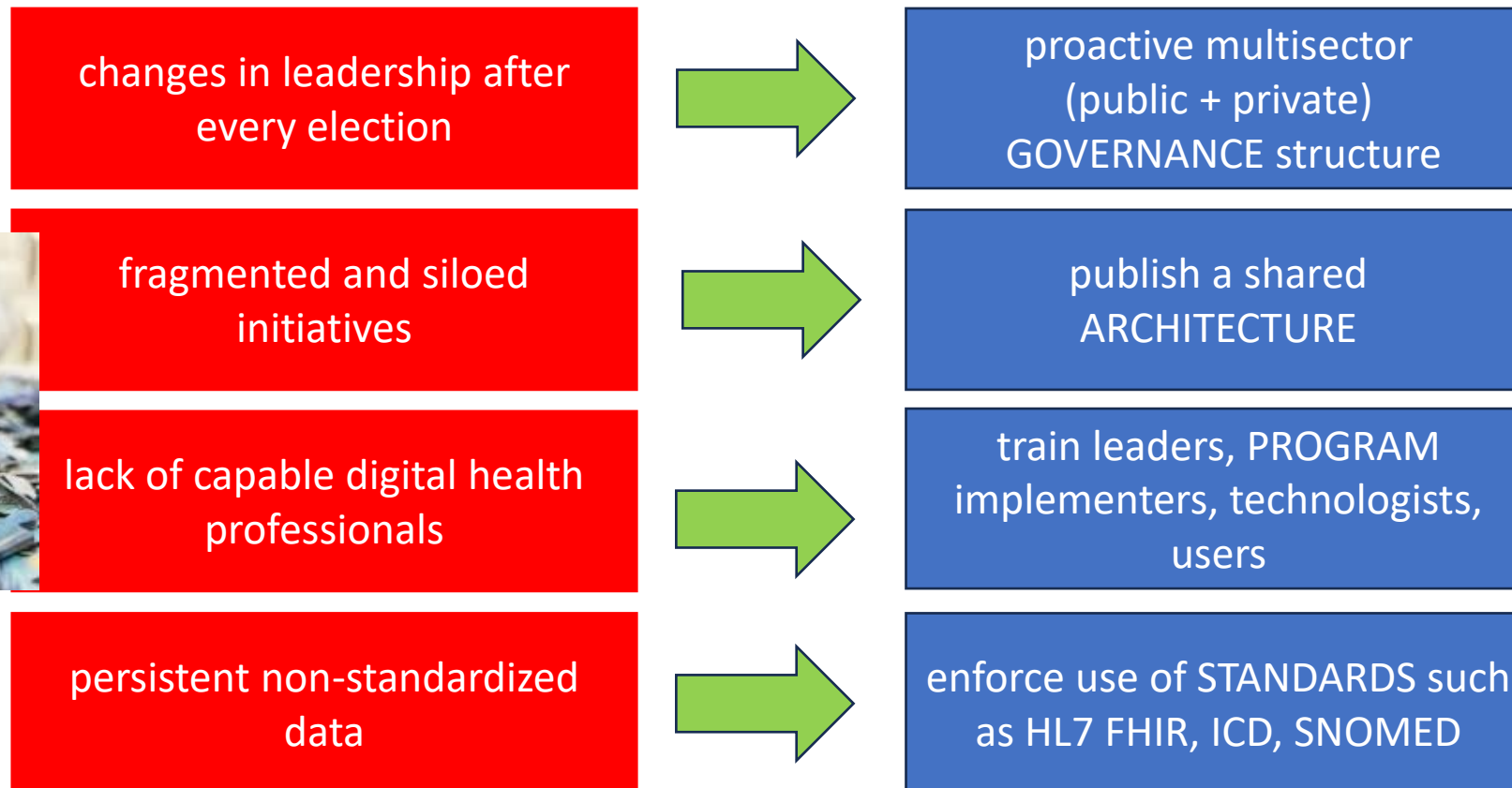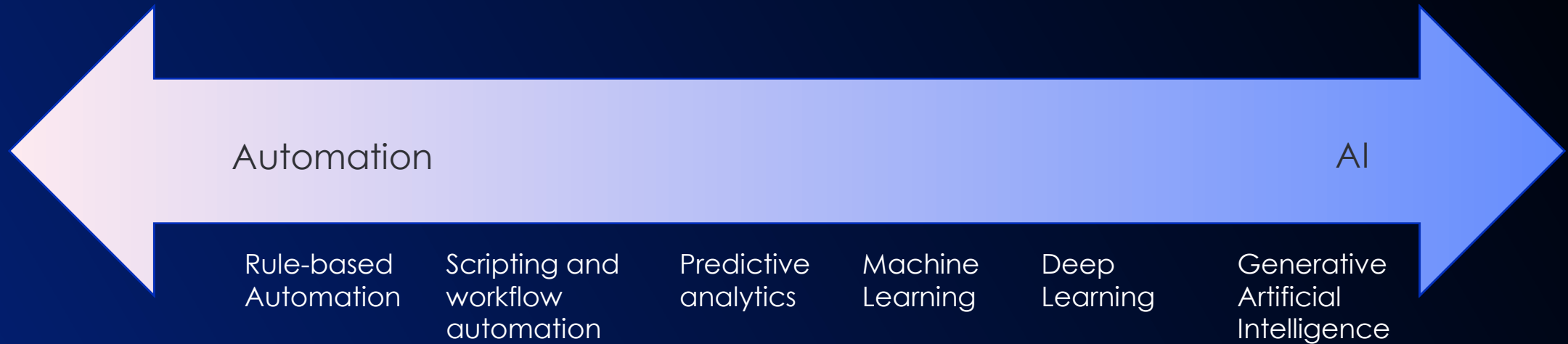
Governance

Architecture

People/Programs

Standards

Q: What potential pitfalls should be anticipated, and how can they be mitigated?

changes in leadership after every election	→ proactive multisector (public + private) GOVERNANCE structure
fragmented and siloed initiatives	→ publish a shared ARCHITECTURE
lack of capable digital health professionals	→ train leaders, PROGRAM implementers, technologists, users
persistent non-standardized data	→ enforce use of STANDARDS such as HL7 FHIR, ICD, SNOMED

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Automation and AI across the Healthcare Spectrum

Automation ← → AI

| Rule-based Automation | Scripting and workflow automation | Predictive analytics | Machine Learning | Deep Learning | Generative Artificial Intelligence |

Automation Benefits

- Increases efficiency – allows focus on higher value activities
- Reduces errors – ensures consistent and accurate results
- Cost efficient – typically leads to reduced labor costs

Example

- Automated data entry, enrollment, and onboarding

AI Benefits

- Analyze large datasets
- Adaptive learning – can learn from changes in data
- Support tasks that are probabilistic

Example

- Predict patient outcomes based on historical data and trends

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Generative AI

WHAT IS IT?

A type of artificial intelligence that can **create new content** based on the patterns it has learned from existing data.

It learns from existing examples and then **generates something new**, rather than simply making predictions based on previous samples.

Think of it like an **artist** who can **draw new images** after **studying and understanding** various styles and techniques
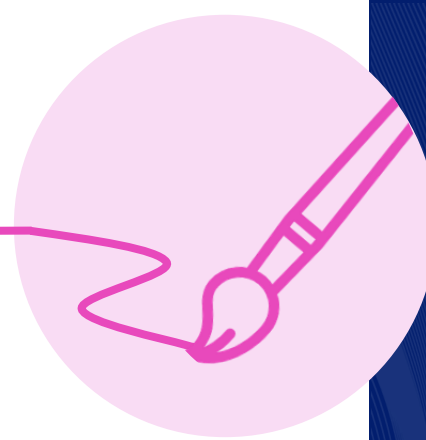
WHAT CAN IT DO?

Generate code

dio and sound

ges and videos

Applications in Infectious Disease Management

Public Health

- Communication and outreach
- Outbreak detection and response
- Sentiment analysis of public opinion
- Tracking misinformation
- Policy wargaming

Clinical

- Note generation and document summarization
- Decision support and triage
- Vaccine and drug development
- Infection prevention and control support
- Clinical education and training

Advances in Artificial Intelligence for
Infectious-Disease Surveillance

Where has AI already been shown to improve infectious disease surveillance?
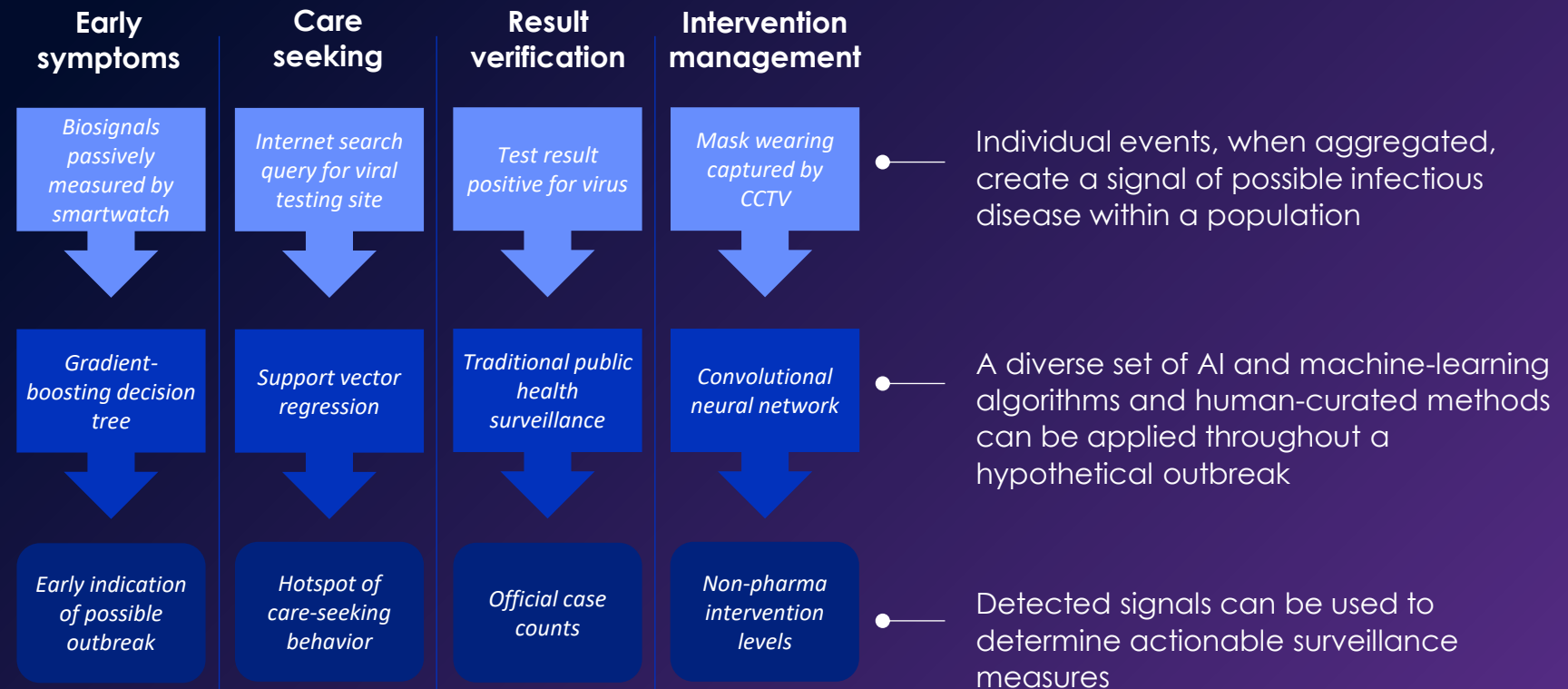
Early warning of outbreaks

Risk assessment and resource allocation

Disease surveillance in resource limited settings

Nonexhaustive sets of representative examples

What role might AI play in a hypothetical respiratory virus outbreak?
AI and ML transformations of individual behavior into population health information

Early symptoms	Care seeking	Result verification	Intervention management
Biosignals passively measured by smartwatch	Internet search query for viral testing site	Test result positive for virus	Mask wearing captured by CCTV
Gradient-boosting decision tree	Support vector regression	Traditional public health surveillance	Convolutional neural network
Early indication of possible outbreak	Hotspot of care-seeking behavior	Official case counts	Non-pharma intervention levels

Individual events, when aggregated, create a signal of possible infectious disease within a population

A diverse set of AI and machine-learning algorithms and human-curated methods can be applied throughout a hypothetical outbreak

Detected signals can be used to determine actionable surveillance measures

Each approach has distinct advantages and disadvantages, and in combination, the algorithms constitute a system for detecting and responding to an outbreak

How we plan to use generative AI at BCH

1 Alleviation of pain points

Generative AI can be used to alleviate **time-consuming or tedious digital tasks** that could benefit from automation

Types of pain points well-suited for generative AI solutions include:

Time-consuming tasks involving digital systems

Challenges navigating large amounts of information

2 Administrative or clinical innovation

Generative AI can enhance specific tasks or workflows, especially where **written or visual content creation** is needed

Innovative applications of generative AI to enhance ways of working include:

Analysis of large datasets

Generating or translating written or visual content

Personalizing content or responses

Help us to understand and synthesize research

Data analysis - large datasets, aggregating sources, sentiment

- written or visual content, translation

tion – research papers, notes, and documents

ng – tracking misinformation, creating succinct points

1 Incorrect information can be provided by the model

2 Confidence is often exhibited in the response, regardless of information accuracy

3 False Sources can be created by the model

4 Bias can be introduced through training data

5 Data Privacy should be considered when inputting information

Research Considerations

Protection of PHI and PII

Secure data transmission and storage
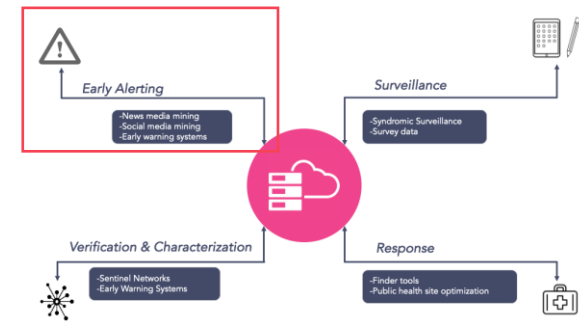
Proper data sharing agreements (e.g., BAA)

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Example: BEACON

Biothreats Emergence, Analysis and Communications Network

Evolving Global Public Health Surveillance

HealthMap

Early Alerting

-News media mining
-Social media mining
-Early warning systems

Outbreaks Near Me

Surveillance

-Syndromic Surveillance
-Survey data

GLOBAL .hEALTH a Data Science Initiative **EPICORE**

Verification & Characterization

-Sentinel Networks
-Early Warning Systems

Vaccines.gov

Response

-Finder tools
-Public health site optimization
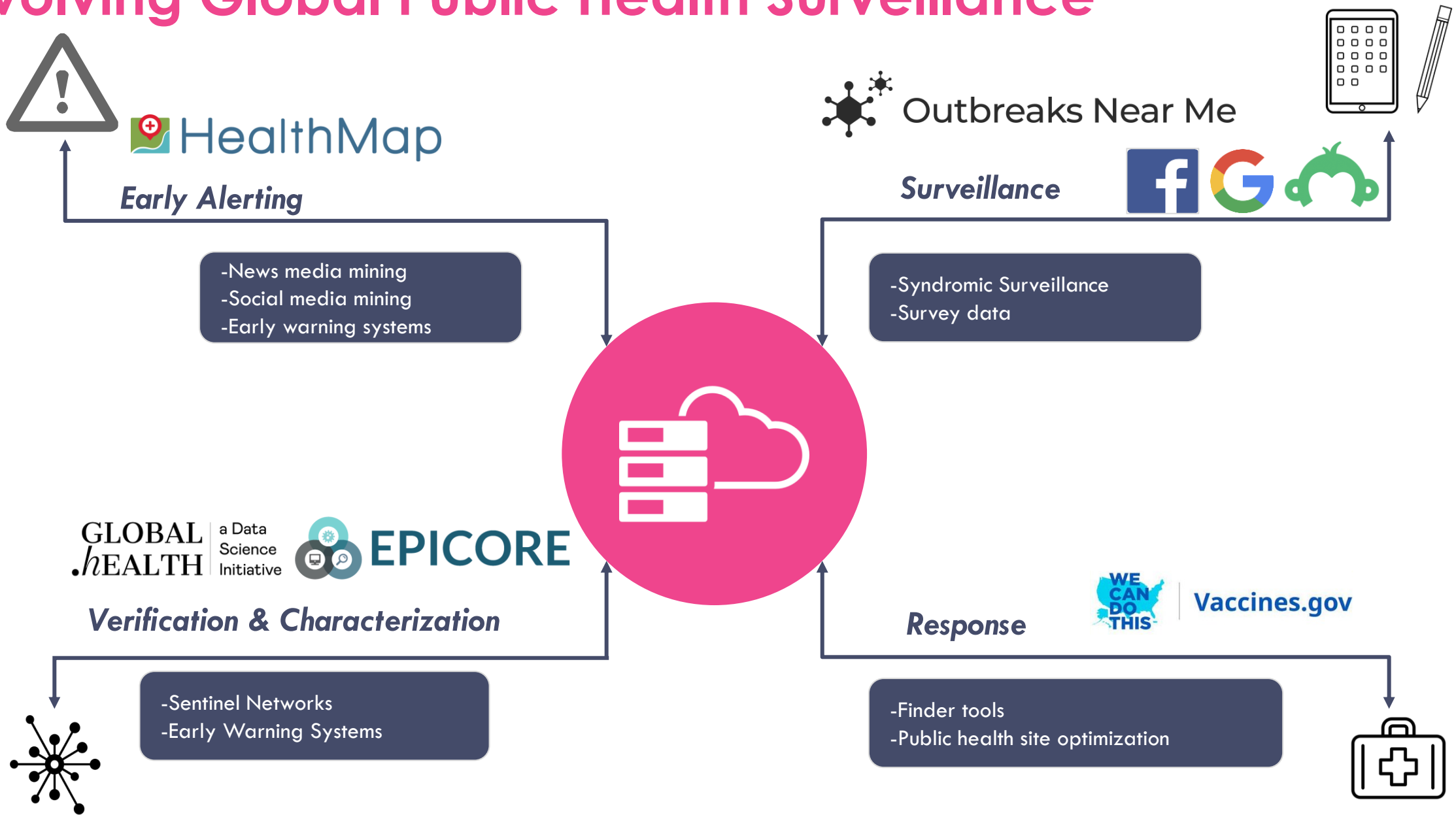
Early Warning of Outbreaks

HealthMap - Natural Language Processing

BEACON

Biothreats Emergence, Analysis, and Communications Network

- Dedicated to the rapid collection, vetting, reporting, and analysis of information on emerging threats affecting humans, domestic animals, wildlife, plants and the environment globally

- Combines emerging infectious diseases surveillance, a global network of moderators who are subject matter experts and the power of artificial intelligence and large language models.

- At its launch, BEACON will be an open-source and freely available global surveillance platform, linking public health authorities, practitioners, researchers, and the general public, rapidly and transparently sharing data and contextual knowledge about new threats.

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BEACON
Biothreats Emergence, Analysis, and Communications Network

BEACON is based at **Boston University's Center on Emerging Infectious Diseases** (CEID) and operated in partnership with the **Hariri Institute for Computing and Data Sciences** at Boston University and **HealthMap at Boston Children's Hospital.**

By providing early warnings of sentinel cases, clusters and outbreaks, BEACON will enable early public health response.

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Training Pandemic LLM

BEACON
Biothreats Emergence, Analysis, and Communications Network

AfricaCDC
Centres for Disease Control and Prevention

ecdc
EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

625 Documents

7,008 Documents

CDC
U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION

1,528 Documents

5.7 Billion tokens (48 GB)

469,701 Full Papers

PMC

8,264 Documents

5,966 Books

2,152 Documents

World Health Organization

NATIONAL LIBRARY OF MEDICINE

WIKIPEDIA
The Free Encyclopedia

Starting from a Generic, Open-Source, Pretrained LLM

∞ Meta
LLaMA 3.2

Support from DOE

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

NERSC
SUPERCOMPUTER CENTRES
BEST PRACTICES: BUILDING COMMUNITIES IN HPC

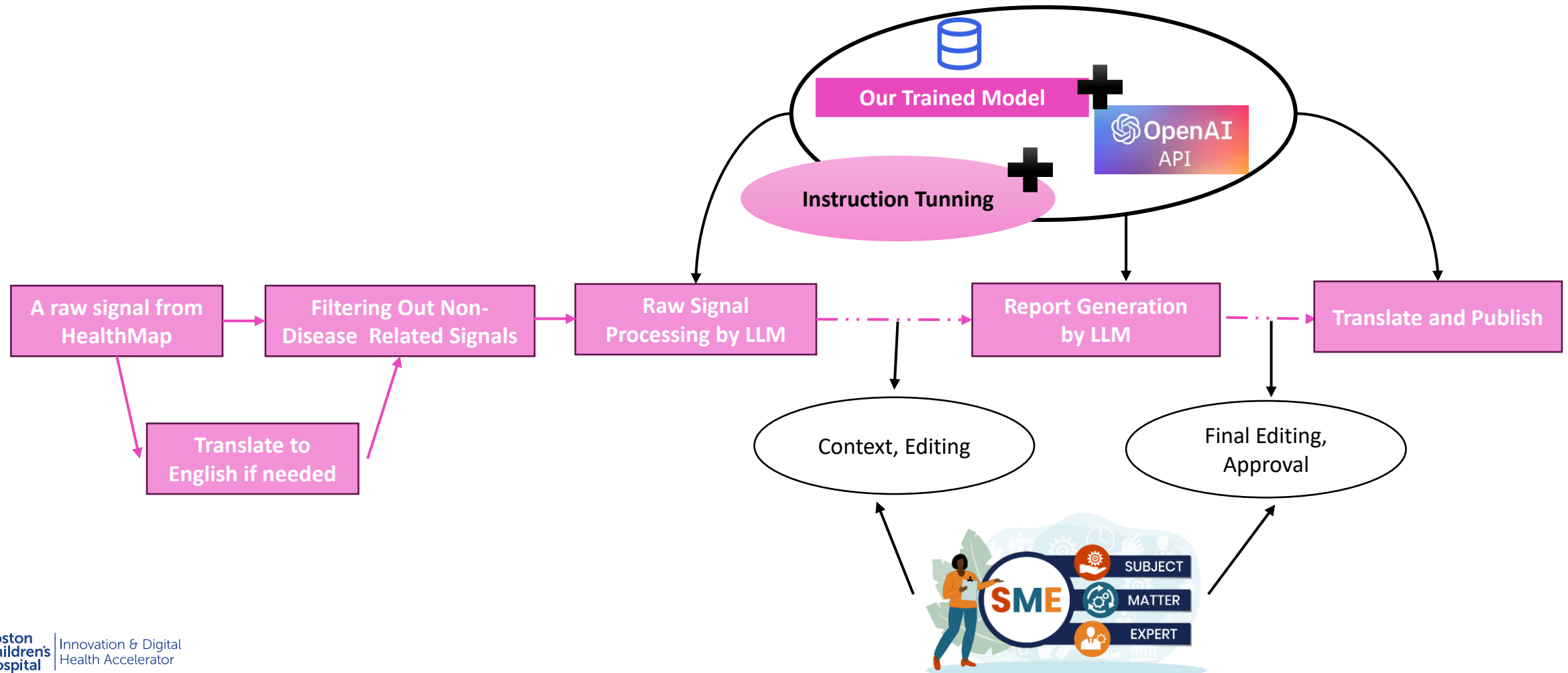**National Energy Research Scientific Computing Center**

Parameter-Efficient Fine-Tuning

Low-Rank Adaptation
- 2 nodes
- 4 GPUs per node -> 8 GPUs
- 80 GB memory per GPU
- LLaMA 3.2 (1B parameters)
  - Total training duration: 80 hrs
- LLaMA 3.2 (3B parameters)
  - Total training duration: 240 hrs

Using Publicly Available Documents

NVIDIA.

NSF

Support from NSF

Full Parameter Fine-Tuning

- 4 A100 nodes
- 8 GPUs per node -> 32 GPUs
- 80 GB memory per GPU

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Beacon Outbreak Reporting and Signal Prioritization Pipeline

A little-known, rare, and extremely deadly virus has killed at least 17 people in India — here's what to know about Nipah virus

Kevin Loria Jun 4, 2018, 12:04 PM EDT

⤴ Share 🔖 Save

Fruit bats are the natural hosts for the virus. REUTERS/Sukree Sukplang

- At least 17 of the 18 patients infected in an outbreak of the Nipah virus in India have died, according to the World Health Organization.

- Nipah is a deadly virus that can be transmitted between people. It has killed between 40% and 75% of infected people in past outbreaks.

- Fruit bats are the natural host of the disease, and there is no cure or vaccine.

- **Summary:**
  An outbreak of the Nipah virus in Kozhikode, Kerala, India, has resulted in 17 deaths out of 18 confirmed cases. Nipah, a highly deadly virus with a high mortality rate, is transmitted from fruit bats to humans and between people. The source of the outbreak may be bats found in a local well. There is currently no cure or vaccine for Nipah, but experts believe the outbreak has been contained as approximately 1,400 people have been quarantined. Efforts to trace contacts and quarantine individuals have been implemented to prevent further spread.
- **Diseases:** Nipah virus
- **Pathogens:** Nipah virus
- **Publish Date:** 2018-05-21
- **Event Date:** 2018-05-21
- **Link:** http://www.businessinsider.com/nipah-virus-outbreak-deaths-in-india-2018-5
- **Signal Source**: Business Insider
- **City**: Kozhikode
- **Country**: India
- **Continent**: Asia
- **Location Type**: Urban
- **Species**: Humans
- **Cases:** 18 confirmed cases
- **Fatalities**: 17 deaths
- **Transmission**: Person-to-person via close contact, particularly through saliva. Also spread from fruit bats, the natural hosts, to humans, possibly through contaminated food or water.
- **Symptoms:** Symptoms include fever, headache, drowsiness, confusion, respiratory problems, flu-like symptoms, and possible progression to coma within a few days. Survivors may experience lasting issues like personality changes and persistent convulsions.
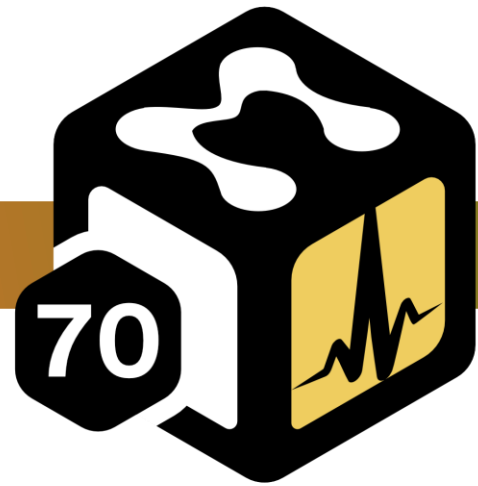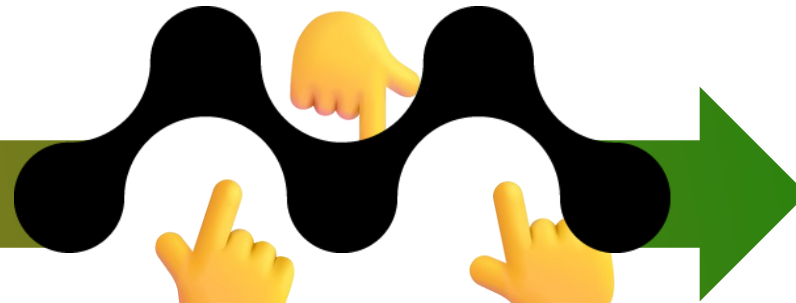
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Free Text → **Decomposes** → **Structured Output**

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Nudging Imperfect foundations with MOOVE