Digital Health AI in Life Sciences

Surging Digital Health AI Fundraising Drives Transformation in Life Sciences

DECEMBER 2017

Digital Health AI Accelerates Innovation in Life Science Industry

Artificial intelligence is devoted to making machines intelligent[1].

Digital Health AI refers to solutions that use AI and digital technology to improve patients' health outcomes and/or reduce the cost of healthcare.

Artificial intelligence (AI) is revolutionizing how the healthcare industry delivers patient care in value-based environment and how the life science industry creates novel medical products.

Venture investment in Digital Health AI companies has doubled in the past two years. Based on historical trends for other disruptive technologies, this momentum is expected to continue. In this report, we will focus on Digital Health AI companies that serve the life science industry[2]. In a future report, we will cover Digital Health AI companies that serve the healthcare services industry.
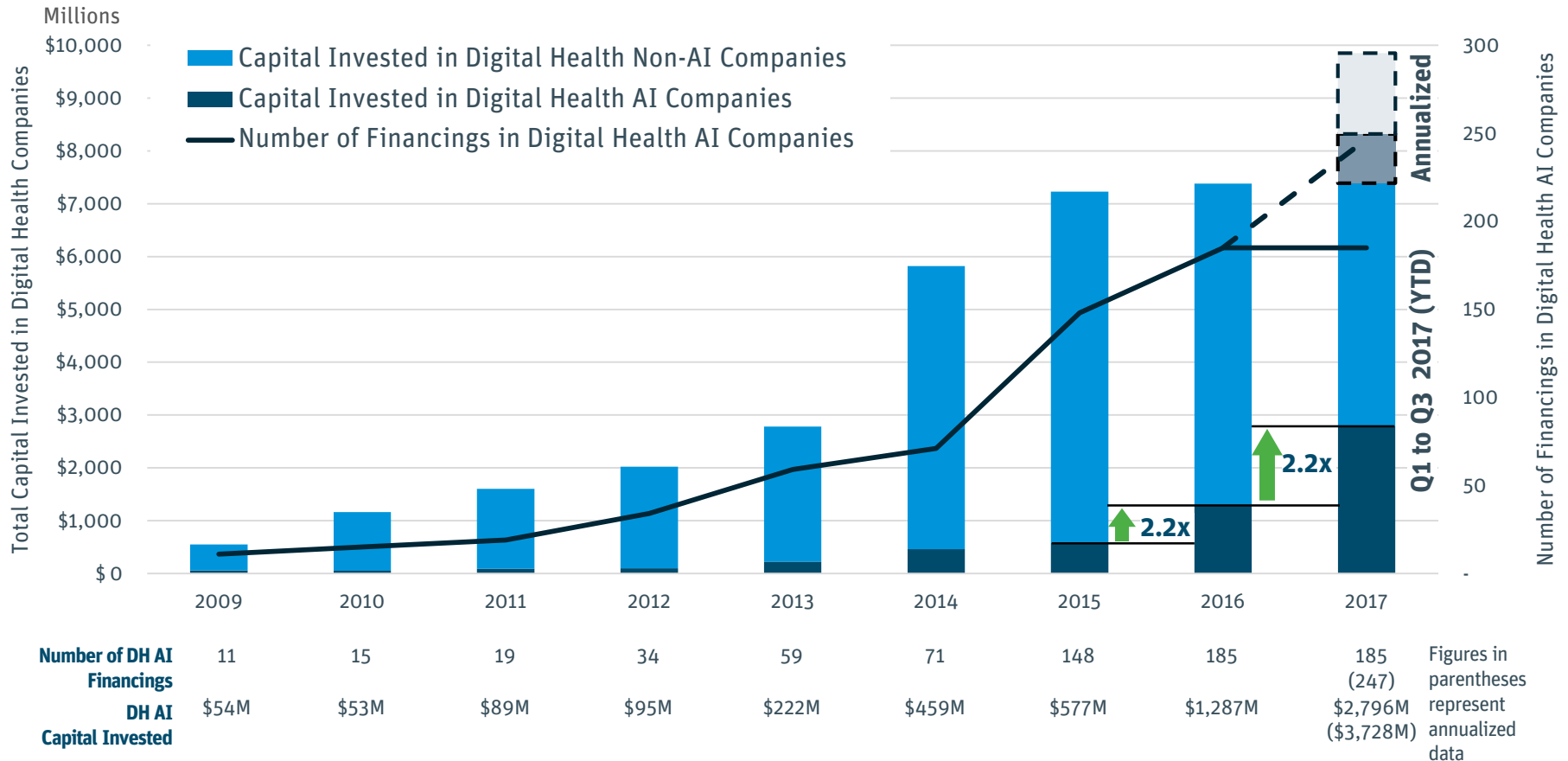
Report Highlights:

- Digital Health AI companies saw rapid growth in financings and capital invested in recent years, with Dx/Tools leading the way.
- The universe of life science focused Digital Health AI companies is growing rapidly, as companies are exploring AI in data-rich use cases.
- AI represents a new modality in digital technology, that compares to prior game-changers: SaaS, Mobile and Big Data.
- Proprietary data, defined use cases and measurable outcomes are key to Digital Health AI company success.
- Potential areas of growth include digital biomarker-based diagnostics and AI-assisted surgical robotics.

1. Source: Nils J. Nilsson, *The Quest for Artificial Intelligence: A History of Ideas and Achievements* (Cambridge, UK: Cambridge University Press, 2010). https://ai.stanford.edu/~nilsson/QAI/qai.pdf.
2. Life science industries refer to biopharmaceuticals, medical devices, clinical diagnostics & research tools companies and excludes healthcare service organizations such as healthcare providers & payers or Digital Health companies that service healthcare providers, payers & employers and patients & consumers.

Digital Health AI Grows Share of Deals, Capital Invested

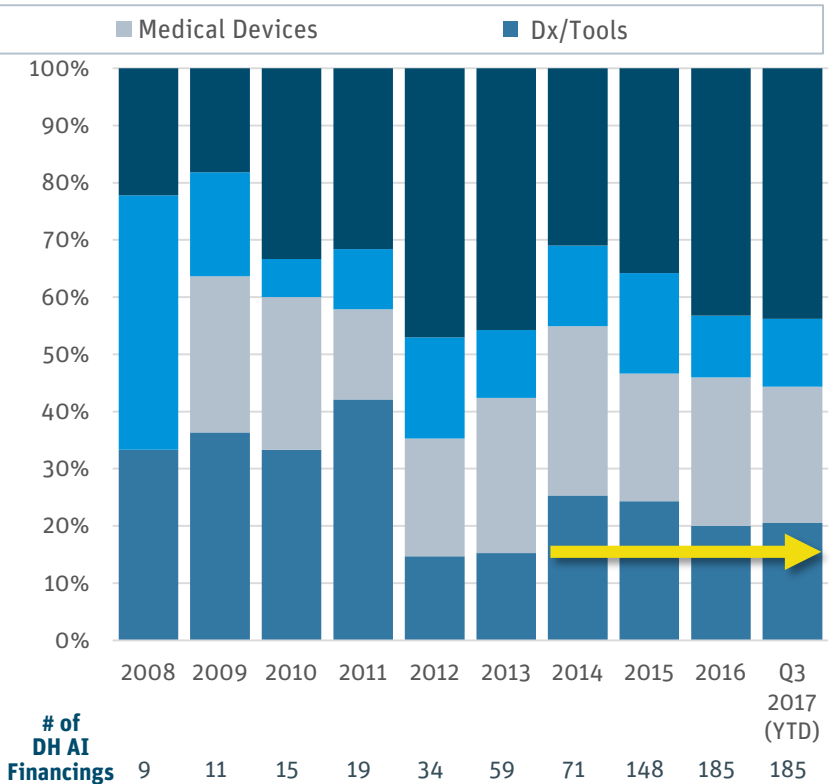|	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Number of DH AI Financings	11	15	19	34	59	71	148	185	185 (247)	Figures in parentheses represent annualized data
DH AI Capital Invested	$54M	$53M	$89M	$95M	$222M	$459M	$577M	$1,287M	$2,796M ($3,728M)	

In the first three quarters of 2017, Digital Health AI companies received 2.2x the funding compared to full year 2016.

Digital Health AI Companies Focused on Dx/Tools Lead in Total Amount of Capital Invested

Capital Invested in Digital Health AI Companies, Based on Life Science Sectors
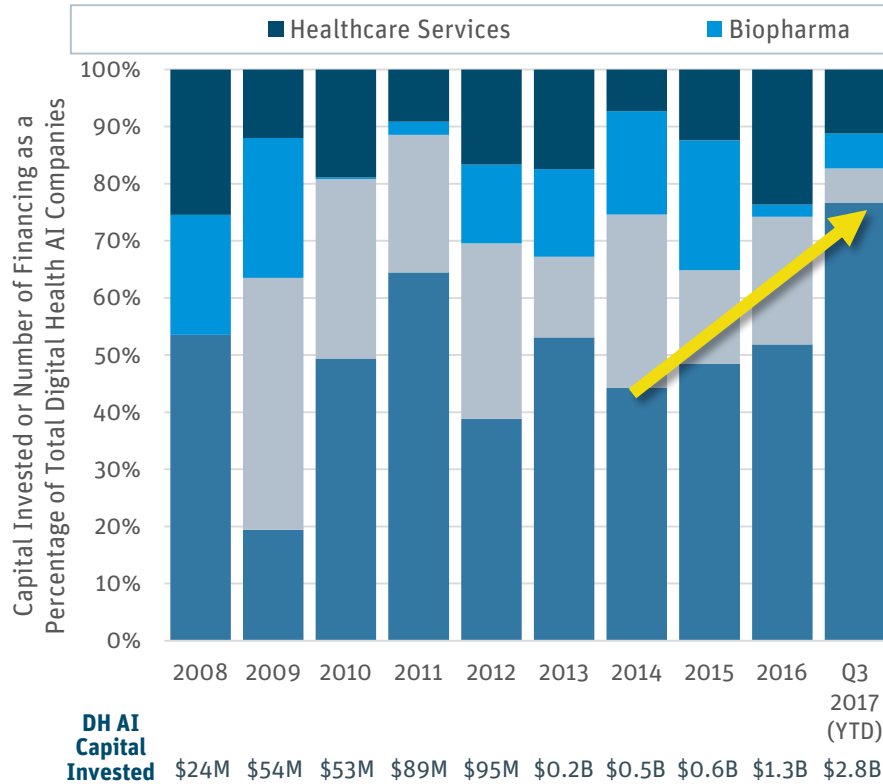
Number of Financings in Digital Health AI Companies, Based on Life Science Sectors

Legend: ■ Healthcare Services ■ Biopharma ■ Medical Devices ■ Dx/Tools

Y-axis (left chart): Capital Invested or Number of Financing as a Percentage of Total Digital Health AI Companies

DH AI Capital Invested	$24M	$54M	$53M	$89M	$95M	$0.2B	$0.5B	$0.6B	$1.3B	$2.8B
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	Q3 2017 (YTD)

# of DH AI Financings	9	11	15	19	34	59	71	148	185	185
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	Q3 2017 (YTD)

Mega-rounds by AI-powered liquid biopsy companies such as GRAIL, Guardant Health and Freenome have resulted in Dx/Tools gaining the majority of dollars deployed in 2017, but share of deal count remained flat.

• Sources: PitchBook, CB Insights and SVB Analysis.

The Universe of Digital Health AI Companies in Life Science Industry Is Growing Rapidly

Artificial Intelligence

Biopharma
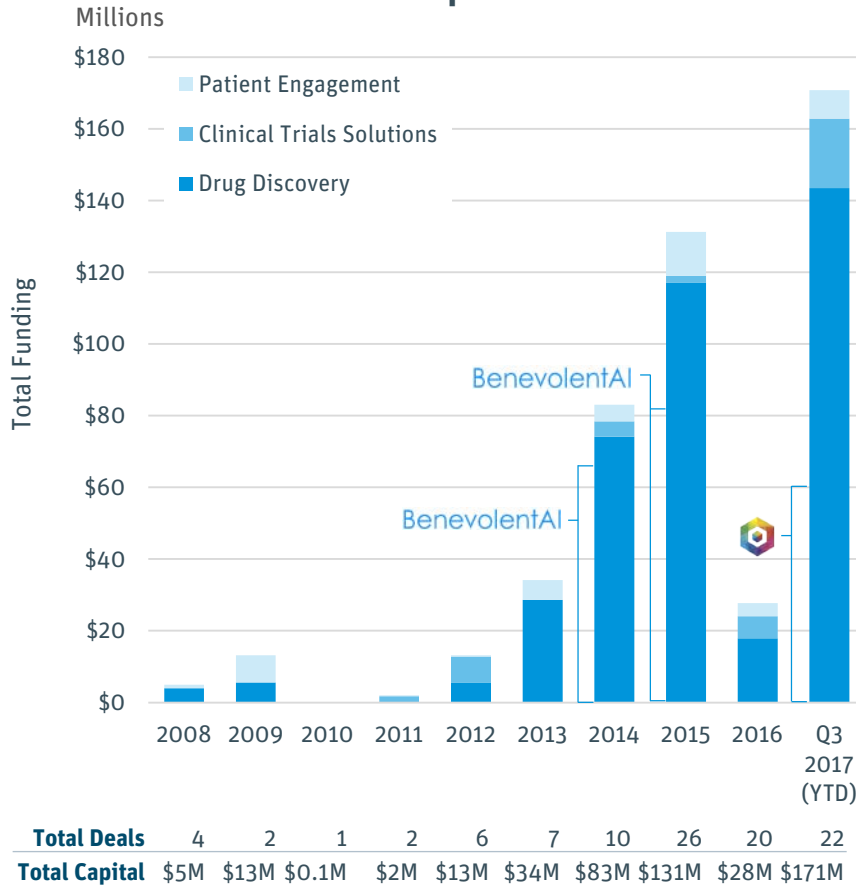

Medical Devices

Dx/Tools

- Sources: PitchBook and SVB Analysis.
- Representative life science focused Digital Health AI companies sourced from PitchBook as of 9/30/2017.
- Diagnostic and Imaging Analytics companies are classified as Medical Devices if they primarily process in vivo data but as Dx/Tools if they primarily process in vitro data.
- Most companies in this report are software companies. AI-powered liquid biopsy companies are included in the Dx/Tools category in this report because of their strong emphasis on AI and machine learning.

Biopharma: AI Companies Focused on Drug Discovery Lead in Funding

Funding in Digital Health AI Companies in Biopharma

Millions

Total Funding

Legend:
- Patient Engagement
- Clinical Trials Solutions
- Drug Discovery

BenevolentAI
BenevolentAI

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Q3 2017 (YTD)
Total Deals	4	2	1	2	6	7	10	26	20	22
Total Capital	$5M	$13M	$0.1M	$2M	$13M	$34M	$83M	$131M	$28M	$171M

DRUG DISCOVERY

BenevolentAI
Uses AI to scan medical databases to improve target selection and optimize compounds

RECURSION pharmaceuticals
Automates labs and uses machine vision to scale morphological profiling and high throughput screening of potential drug candidates

CLINICAL TRIALS SOLUTIONS

DEEP 6 AI
Applies AI to unstructured medical records data to quickly identify the most qualified patients for drug trials

clinithink
Analyzes patient medical records data to support bid-phase feasibility assessment, patient recruitment and REMS
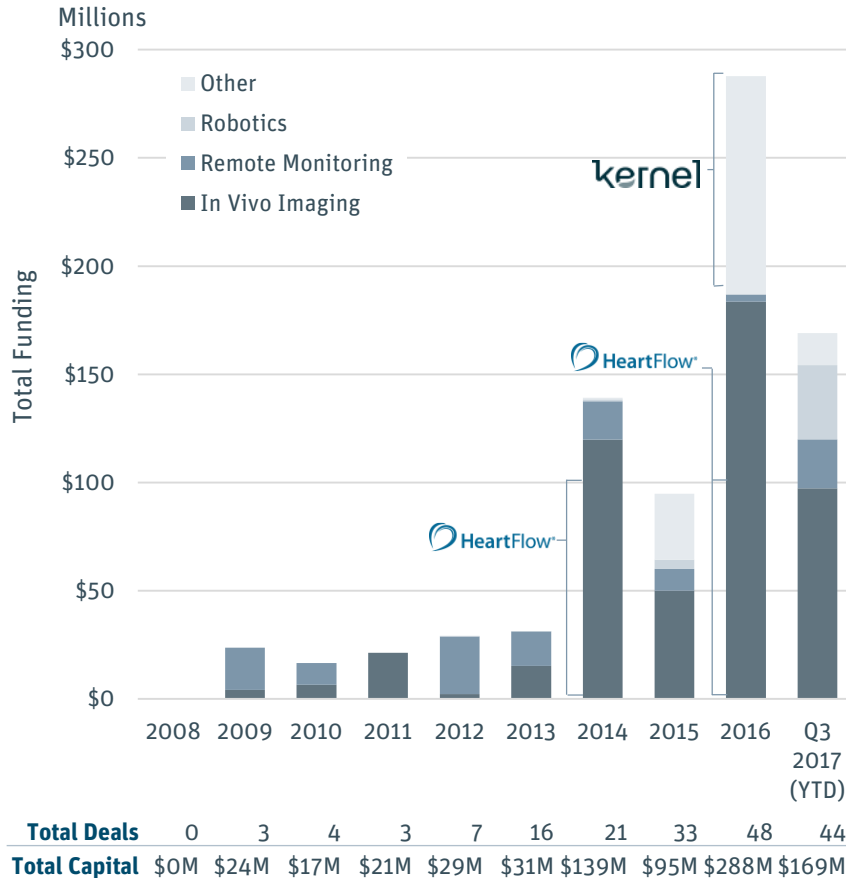
PATIENT ENGAGEMENT

AiCure
Provides an AI-powered and machine vision solution to visually verify medication ingestion by patient

phys iQ
Uses physiology data and AI-powered analytics to develop clinical endpoints for Rx safety and efficacy validation

Medical Devices: AI Companies Focused on In Vivo Imaging Lead in Funding

Funding in Digital Health AI Companies in Medical Device

Legend:
- Other
- Robotics
- Remote Monitoring
- In Vivo Imaging

Y-axis: Total Funding (Millions) — $0, $50, $100, $150, $200, $250, $300

X-axis labels: 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, Q3 2017 (YTD)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Q3 2017 (YTD)
Total Deals	0	3	4	3	7	16	21	33	48	44
Total Capital	$0M	$24M	$17M	$21M	$29M	$31M	$139M	$95M	$288M	$169M

IN VIVO IMAGING

HeartFlow — Uses AI to create 3-D models of heart arteries based on CT scans to measure coronary ischemia

gauss — Uses machine vision to analyze blood monitoring solutions to improve accuracy in OR settings

REMOTE MONITORING

iRhythm — Employs AI in EKG remote monitoring to identify arrhythmias from EKGs, with results outperforming those of cardiologists

Cardiologs — Analyzes EKG readings from any device and using AI-powered software alerts physicians of arrhythmias

ROBOTICS

VERB SURGICAL — Employs machine vision and AI-powered surgical robotics; a joint venture of Johnson & Johnson and Verily
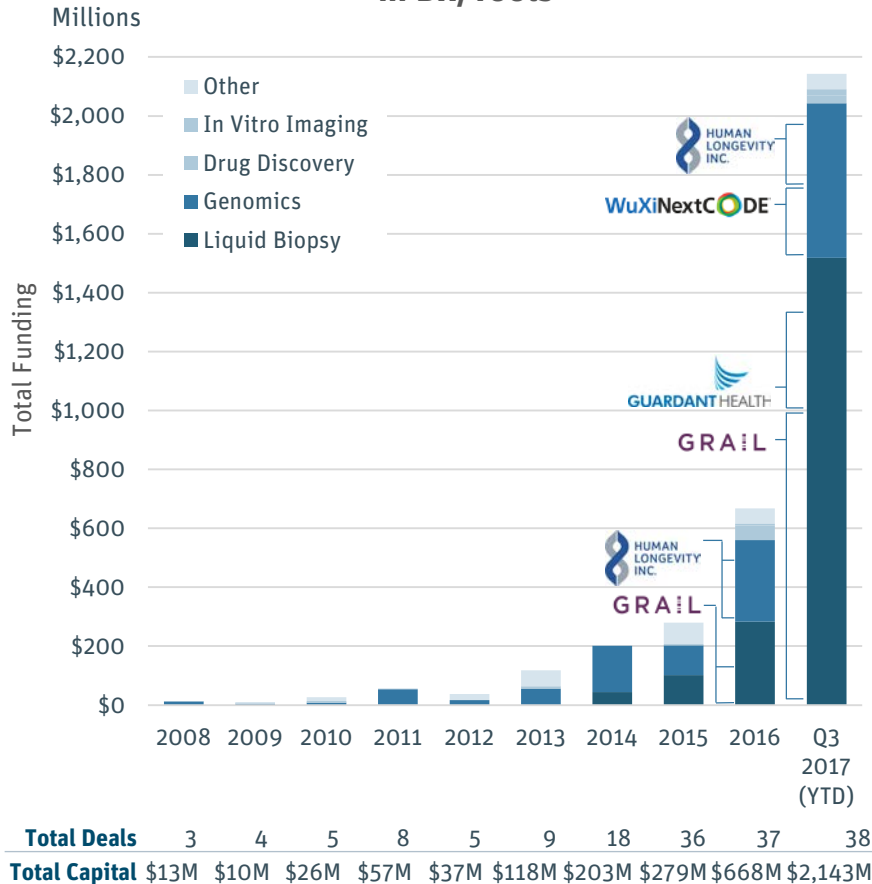
PSYONIC — Uses AI to develop an advanced bionic hand; through machine learning and sensory feedback, mimics human motions and reactions

Dx/Tools: AI Companies Focused on Liquid Biopsy Lead in Funding

Funding in Digital Health AI Companies in Dx/Tools

Millions — Total Funding (Y-axis: $0 to $2,200)

Legend:
- Other
- In Vitro Imaging
- Drug Discovery
- Genomics
- Liquid Biopsy

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Q3 2017 (YTD)
Total Deals	3	4	5	8	5	9	18	36	37	38
Total Capital	$13M	$10M	$26M	$57M	$37M	$118M	$203M	$279M	$668M	$2,143M

LIQUID BIOPSY

GRAIL
Uses machine learning on massive liquid biopsy data sets for early detection of presymptomatic cancers

GUARDANT HEALTH
Employs AI-powered liquid biopsy for early detection and screening of cancers, including malignancy and location

GENOMICS

WuXiNextCODE
Employs AI in global analysis of genomic information

HUMAN LONGEVITY, INC.
Uses machine learning to drive discovery through analysis of massive genotypic and phenotypic databases
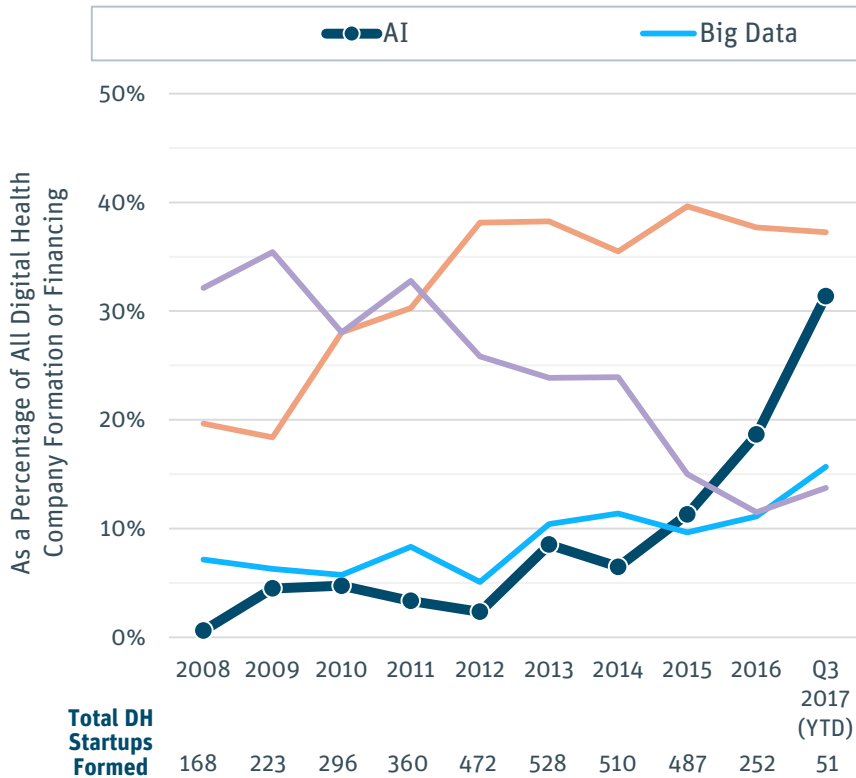
IN VITRO IMAGING

PathAI
Advances clinical diagnosis and drug discovery through lab automation and AI-powered pathology analysis
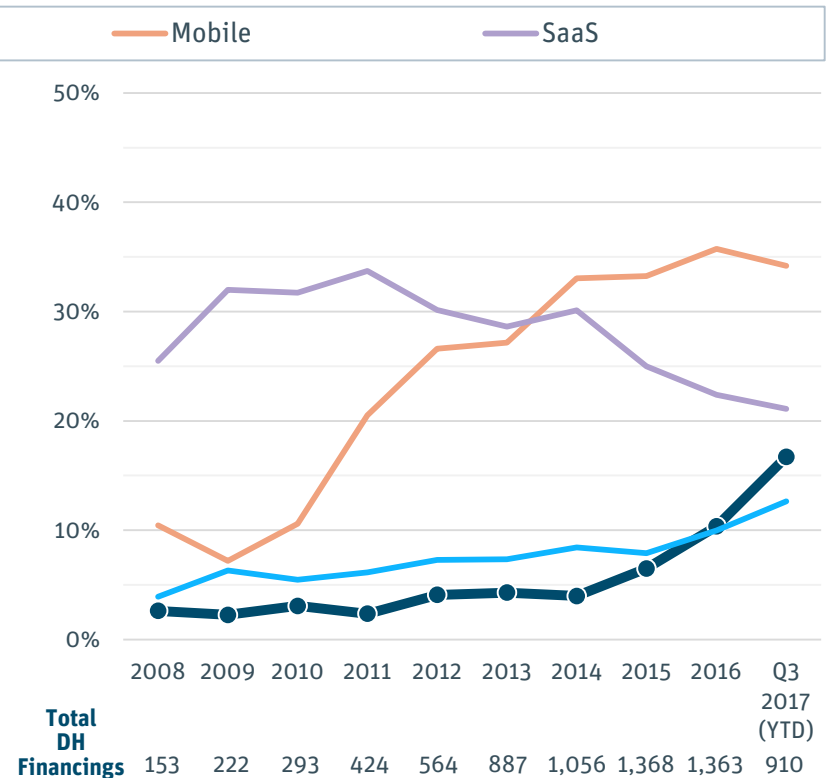
SIGTUPLE
Analyzes pathology slides using AI and machine learning to improve clinical diagnosis

AI Drives Digital Health Company Formation, Is Key Differentiator for Funding

Digital Health Company Formation, Based on Key Differentiating Technology

Number of Digital Health Financings, Based on Key Differentiating Technology

Legend: AI, Big Data, Mobile, SaaS

Total DH Startups Formed	168	223	296	360	472	528	510	487	252	51

Years: 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, Q3 2017 (YTD)

Total DH Financings	153	222	293	424	564	887	1,056	1,368	1,363	910

Years: 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, Q3 2017 (YTD)

The Digital Health category advanced along the same patterns as general technology. Digital Health startups focused on SaaS a decade ago, then mobile as smartphones arrived and now AI and machine learning.

• Sources: PitchBook, CB Insights and SVB Analysis.

Future Opportunities Lie in Digital Biomarker Diagnostics and Surgical Robotics

Digital Biomarker and Audio/Visual-Based Diagnostics

Defined sources of data and proprietary data
- Facial video files
- Audio voice files
- Smartphone usage

Defined use cases
- Diagnostics for neurodegenerative diseases
- Diagnostics for mental health or behavioral health disorders
- Neurocognitive tests and memory assessments

Representative companies

Surgical Robotics

Defined sources of data and proprietary data
- Sensing force and finger motions of surgeons
- Physiological mapping of patients
- Video files of surgeries, with multiple angles and health outcomes of surgeries

Defined use cases
- AI-guided surgeries
- Minimally invasive robotics-assisted surgical platforms

Representative companies

Forecast for Digital Health AI: Proprietary Data Will Be Key to Digital Health AI Race

Proprietary Data, Both Input and Results, Is a Valuable Differentiator

Liquid Biopsy Samples

GUARDANT HEALTH

freenome

GRAIL

Genomic Data

HUMAN LONGEVITY, INC.

WuXiNextCODE

- As Digital Health AI companies capture and utilize all publicly available data for their algorithms, soon they will turn to private and proprietary data to further augment their AI.

- This is already evidenced in Dx/Tools by the massive capital that was received and deployed by liquid biopsy and genomic companies to capture samples from patients and track their health outcomes via longitudinal clinical trials.

Consistent Data Sources, Well-defined Use Cases and Measurable Results Are Key

Imaging for Diagnostics and Clinical Decision Support

HEALTHMYNE
Quantitative Imaging Decision Support (QIDS)™

zebra
MEDICAL VISION

RADLogics™

PathAI

SIG TUPLE

- Current well-funded sectors tend to have a limited type of or well-defined data input (images, genomic data, etc.), a clear and validated use cases and objective and clinically verifiable results.

- Once an AI use case is well validated, investments and startups will proliferate quickly, and thereafter the rush for proprietary data will follow.

AI Investment Patterns by Life Sciences and Tech Diverge

Tech Investors Step Up AI Activity

AME CLOUD VENTURES

khosla ventures

OBVIOUS VENTURES

DCVC

formation 8

ANDREESSEN HOROWITZ

crv

Foundation CAPITAL

Felicis Ventures

true ventures

Y Combinator

- Major life science corporations and investors have been slow to invest or acquire AI companies unlike technology corporations and investors.

- The conservative nature of the life science industry means that the industry will take a wait-and-see approach, with few investors dipping their toes to test the waters. Tech investors will be the vanguard for this sector and reap the risks and rewards of this disruptive technology.

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