Democratizing the Cure – Federated Learning in Healthcare and Life Sciences

The healthcare and life sciences industries are undergoing dramatic change, as leading organizations **adopt artificial intelligence (AI) and other emerging technologies** to understand disease and improve treatments and patient care. Part of the excitement around AI in these industries is driven by emergent capabilities of deep learning models that can now identify patterns and correlations in patient data at scale. They are leading to new insights, research pathways, and ultimately, more and better treatments. This has enormous potential for both patient health outcomes and business growth and product development.

There is, however, a common sticking point. The healthcare data that is necessary for some of the most sophisticated machine learning programs is fragmented globally across healthcare and research centers. Further, much of that data is individually identifiable health information (IIHI), where privacy, provenance, and security are tightly regulated by world governments. While hospitals, healthcare providers, dentists, and even patients may want to share data to further the cause of medical research, they do not have a safe way to do so, due to their accountability for the privacy and security of that data.

A pharmaceutical or life sciences organization seeking to research and **develop treatments for a specific disease using AI** may struggle to access the high-quality and diverse datasets they need.

To get around this tension between business, data, and regulations, some large enterprises have elected to acquire healthcare or related service providers in order to get access to their rich data sets. This is an enormously expensive approach that is unfeasible for most companies. Further, some data cannot be acquired in this way (e.g., UK Healthcare System data). As this approach is taken to its extreme, the result is turning out to be balkanized datasets being used as competitive moats preventing sharing and collaboration, which is not dissimilar from the state of healthcare data today.

There is another approach that can ultimately be cheaper, can grant more access to data insights, and neatly aligns with privacy regulations.

Federated Learning and a Platform for Collaboration

When it comes to developing new health treatments, insights are prioritized over data capture and ownership. By reframing the challenge from data ownership and access to insight and treatment ownership and access, companies can find a **workable path forward without treading across regulatory lines.** The AI approach is called federated learning, wherein a deep learning algorithm is trained across edge (node) datasets and devices without exchanging or exporting the data itself. For healthcare, this approach means IHII data never leaves its secure environment while valuable correlations within the data can be discovered and shared.

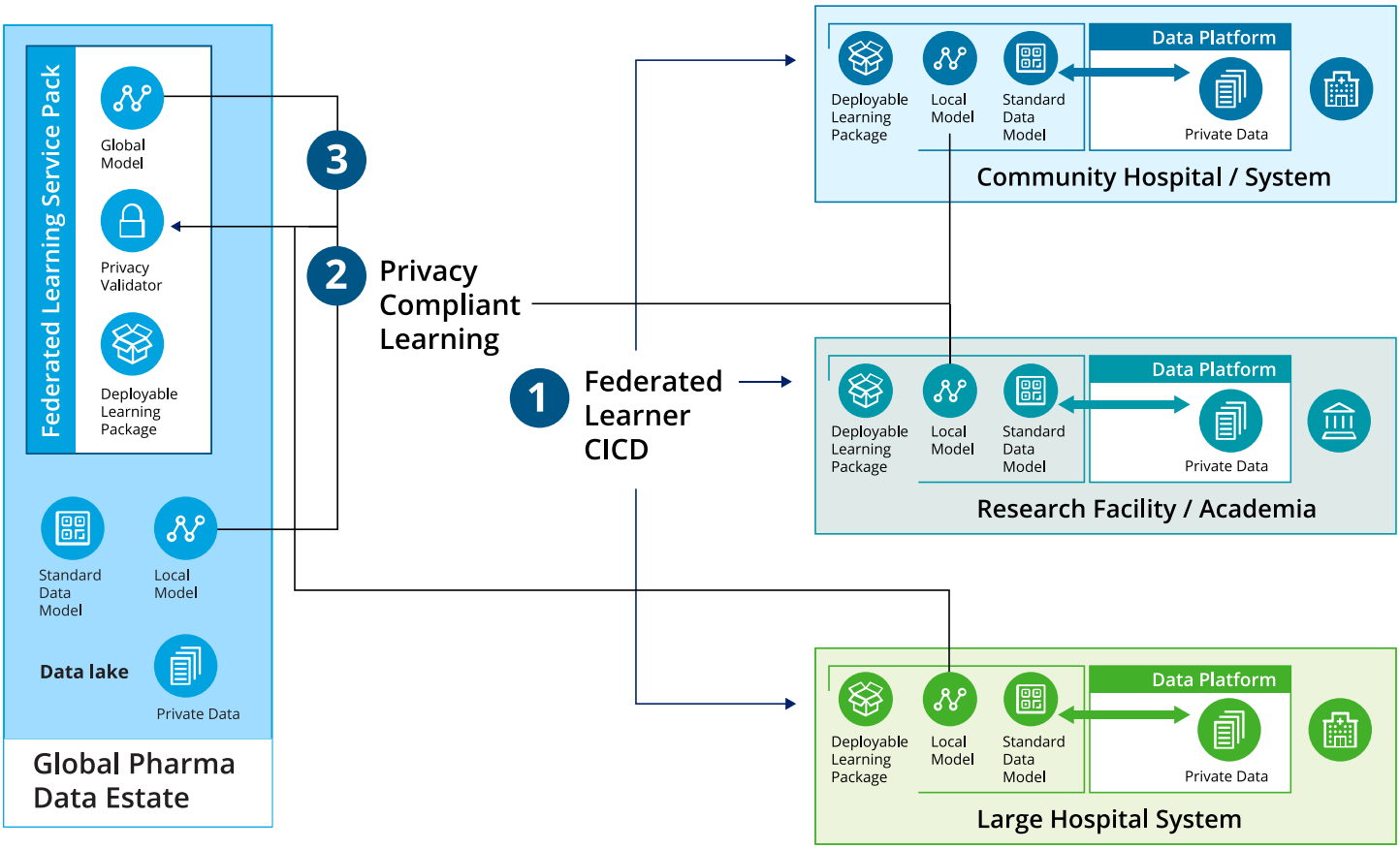
The data to make this AI approach feasible exists in enormous volumes and variety globally, and life sciences and healthcare organizations are eager to collaborate. The outstanding piece of this puzzle is a collaborative platform that makes this kind of federated learning possible at scale. To this end, Deloitte and NVIDIA implement an operating system for life sciences and pharmaceutical companies based on NVIDIAs Federated Learning SDKs that are specially developed for Lifesciences companies. This collaborative platform can help solve diseases in a regulatory compliant manner while also helping to reduce the complexity.

We illustrate this by way of a hypothetical example. A pharma company is seeking to develop a mechanism to examine medical images and predict malignancy and tumor kinetics, so as to inform and customize oncological management plans. Deep learning algorithms can be used to look at multiple MRIs per patient over time, revealing previously unseen image features that can inform diagnoses.

Using the operating system for collaborative learning **co-developed by Deloitte and NVIDIA,** the pharma company seeking to develop a screening strategy deploys a Federated Learning Package to a health system willing to collaborate on a cure. The package contains AI models for learning, standard data models, and a set of transformation routines that work for standard source formats.

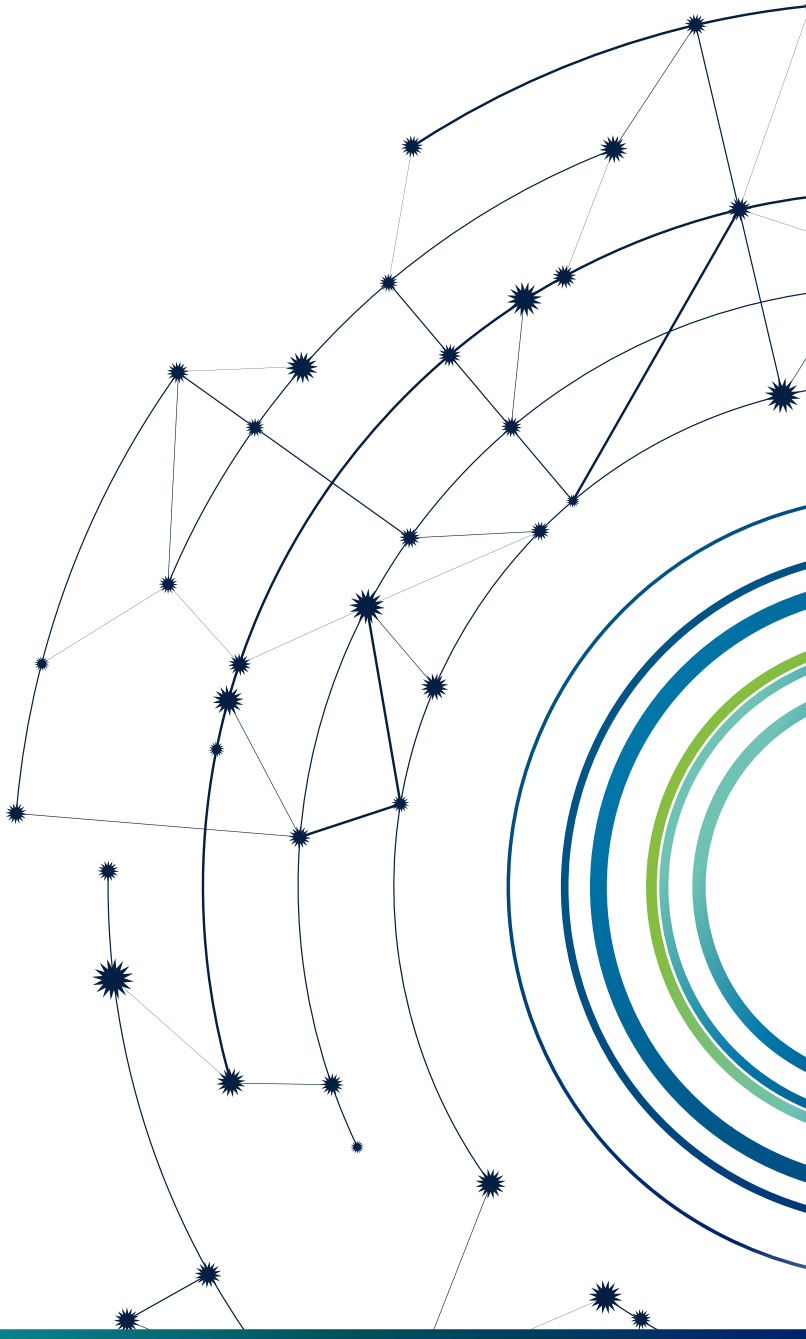
The model uses local compute to start the learning process. At no point are patient data or image files leaving the protected environment. The resulting insights are pushed to a Privacy Validator, which autonomously checks the Insights Package for compliance before passing insights to the pharma company's global model. The result is that the pharma company can access a larger volume of data for drug and treatment discovery and from a more diverse range of patients.

These data sources are accessed in an economical way, as large data transfers lead to high costs, whereas the federated learning approach does not require or permit image transfer. Further, this approach is compliant with data security standards. The mutual benefits of insights for pharma and improved care for patients reveal why this is a leading growth solution in life sciences and healthcare.



1. Federated Learning Package is deployed into healthcare provider
2. Learnings are shared with Privacy Validator
3. Privacy Validator checks the learning package for compliance and passes compliant packages to the Global Model

This approach permits scale in a way other approaches cannot. Learning Packages can be deployed to most any relevant dataset held by a collaborating organization, and it may also provide a vehicle for new ways of sharing credit or revenue with partners. Future platforms can accommodate fingerprinting capability to record each organization's contribution to the overall outcome. The pharma company can patent solutions that result from shared insights. The attribution is baked into the solution, enabling credit and revenue sharing. These enticing outcomes can lead to new business models and agreements and encourage even more collaboration.



It has been a byword for years that AI will **completely transform healthcare** as we know it. New and better treatments, personalized medicine, disease prediction, and more—we are at the threshold of a revolutionary period in healthcare and life sciences. Federated learning with an enabling platform is one avenue to unleash this promise of Humanity Scale AI across our fragmented healthcare estate.

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