Multicenter Study Design for Development of a Predictive Model for Ascending Aortic Aneurysm Growth Using Artificial Intelligence via Federated Learning

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Objective:

Create a patient-specific risk model for thoracic aortic aneurysms to better guide management

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Background:

- **Thoracic aortic aneurysms (TAAs)** are associated with an **increased risk** of aortic rupture or dissection. However, the **optimal timing** for preemptive surgical intervention remains **uncertain**.
- Current societal guidelines rely on maximum aneurysm diameter to determine when to intervene, but this **one-size-fits-all approach has limitations**.
- **Modern artificial intelligence (AI)** enabled models have significant potential for characterizing disease patterns, but they require **large datasets** to achieve clinically useful performance.
- TAA related complications are **relatively uncommon** within the general population, making it **difficult** for any single institution to achieve **sufficient cohort size** alone.

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Federated Learning:

A multi-center AI training methodology that increases data security

- **Multi-institutional studies** are traditionally **time consuming**, logistically **challenging**, and **expensive** to implement to ensure patient data security.
- **Federated learning** is an approach that allows for the training of a single AI prognostic model across **multiple institutions** without the need for sharing of **protected patient data** between the centers.

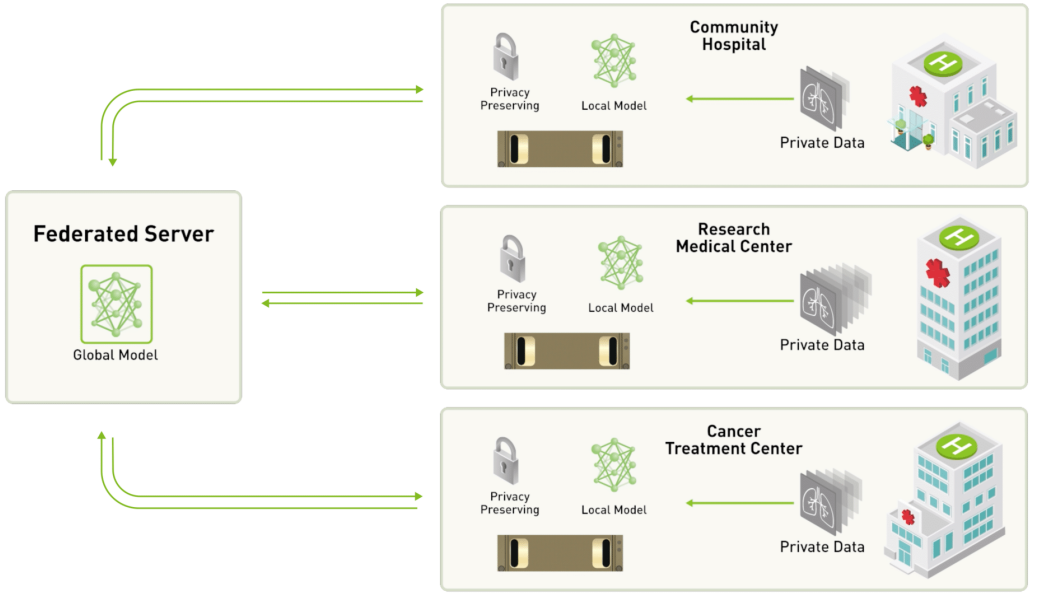

Photo: NVIDIA Blog, "What is Federated Learning"

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Methodology:

Robust data processing is necessary to account for many sites and image acquisition protocols

1. Patient cohort creation
2. Inclusion filtering
3. Study acquisition
4. Image series selection
5. Image resizing and cropping
6. Aorta segmentation
7. Centerline determination
8. Training

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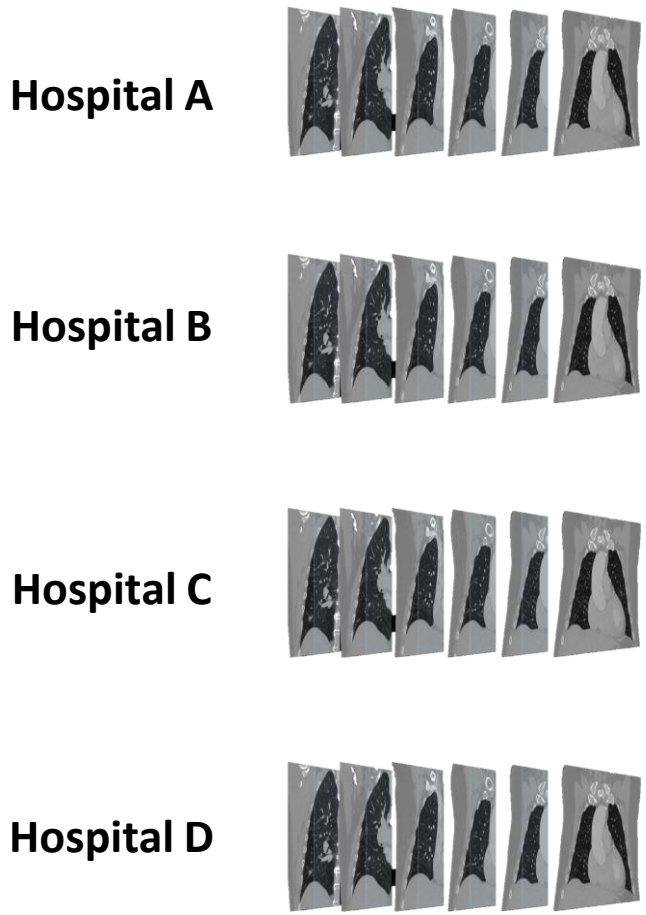
Proposed Study Design:

AI model training for personalized aorta risk score via federated learning



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- Questions or comments?
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