

IS3R 2023

Berlin/Germany

August 24–26, 2023

Are AI algorithms sufficiently robust?

Oleg Pianykh, PhD

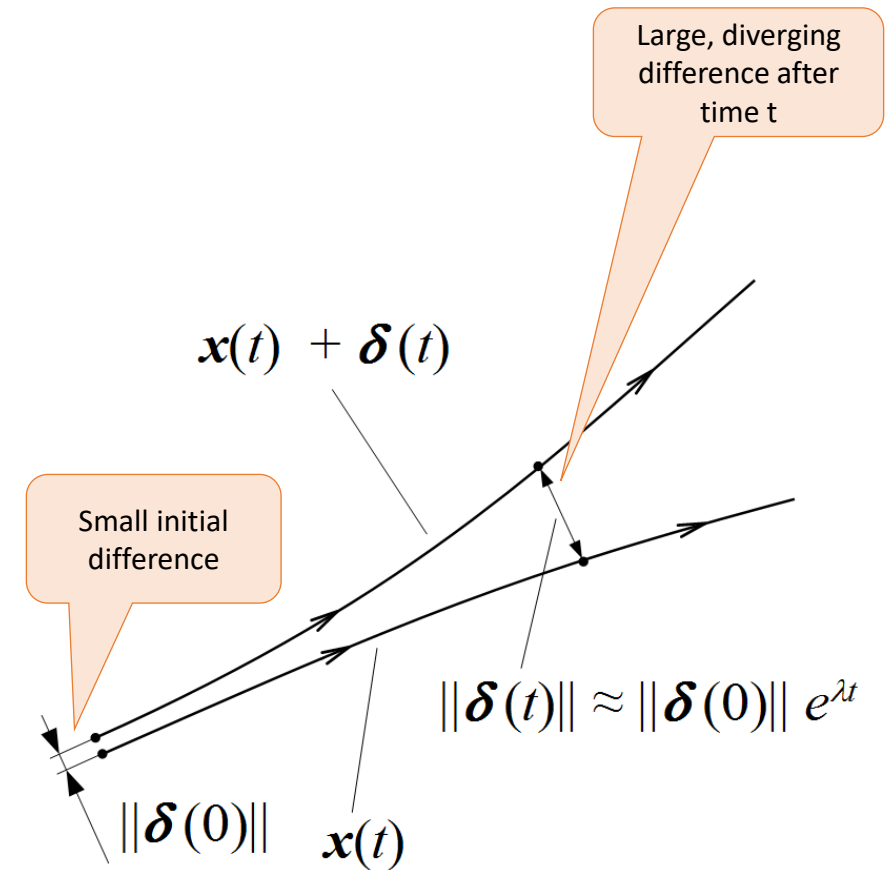
Department of Radiology,

Mass General Brigham

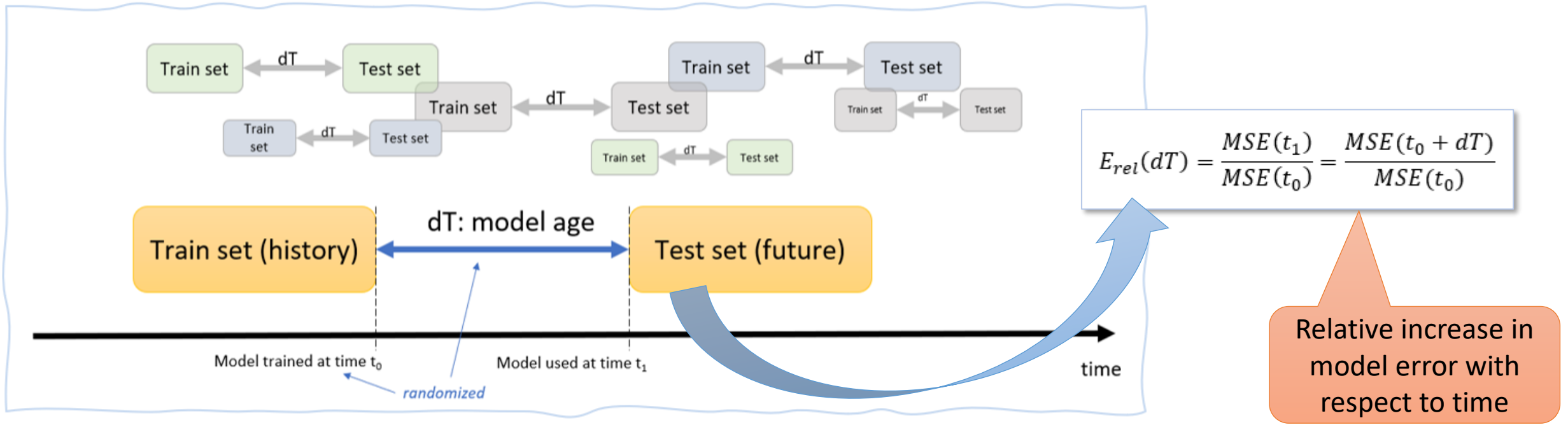
opianykh@mgh.harvard.edu

Stability of AI models

- **AI models are built from data**, and inherit the state of data at the time of AI training
- **Real-life data evolves** in time, constantly changing its patterns and properties
- As a result, **AI models will age** as more time passes since their last training
- Unlike classical math, **very little if anything was done to study AI model stability**, especially with respect to time since last model training

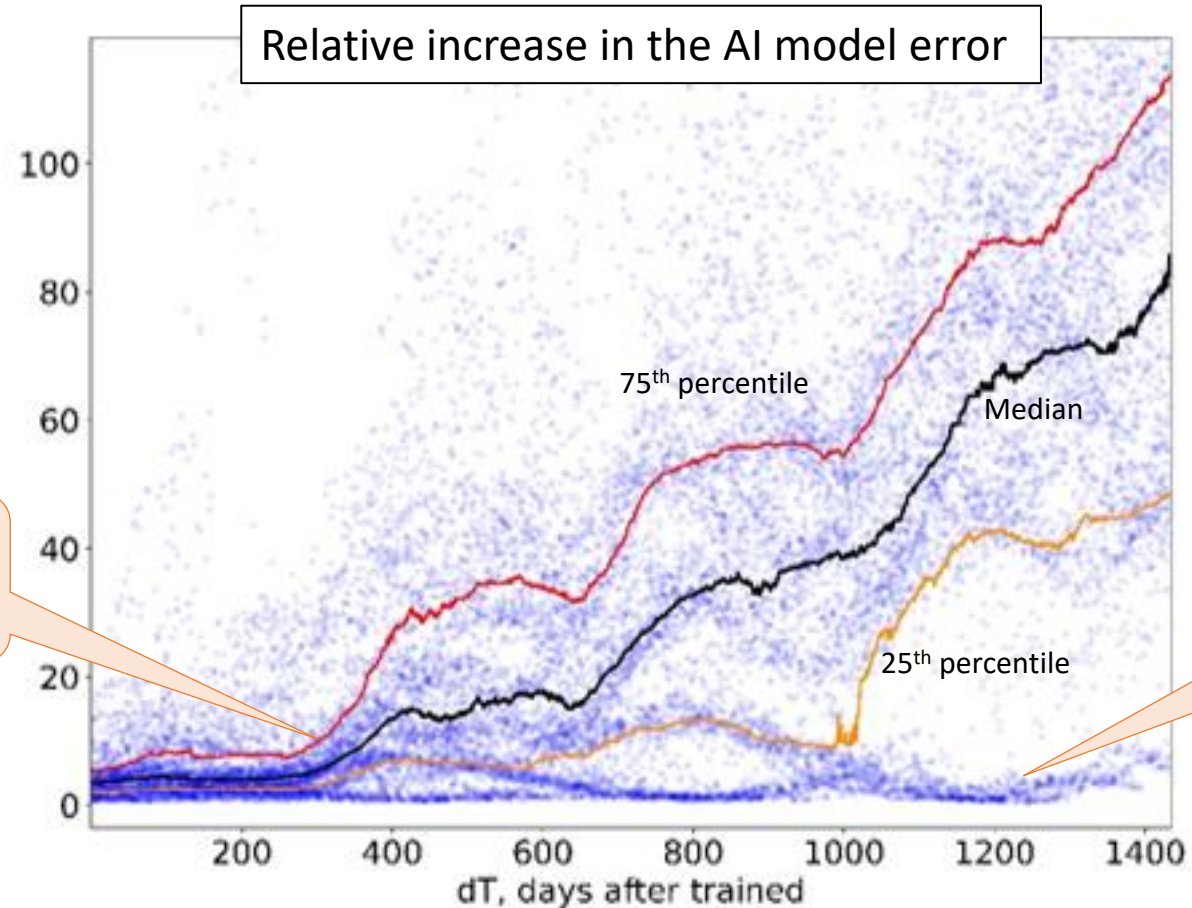


“Aging AI” Experiment



Each ((Train, Test, dT) run creates a single data point with error $E = E(dT)$

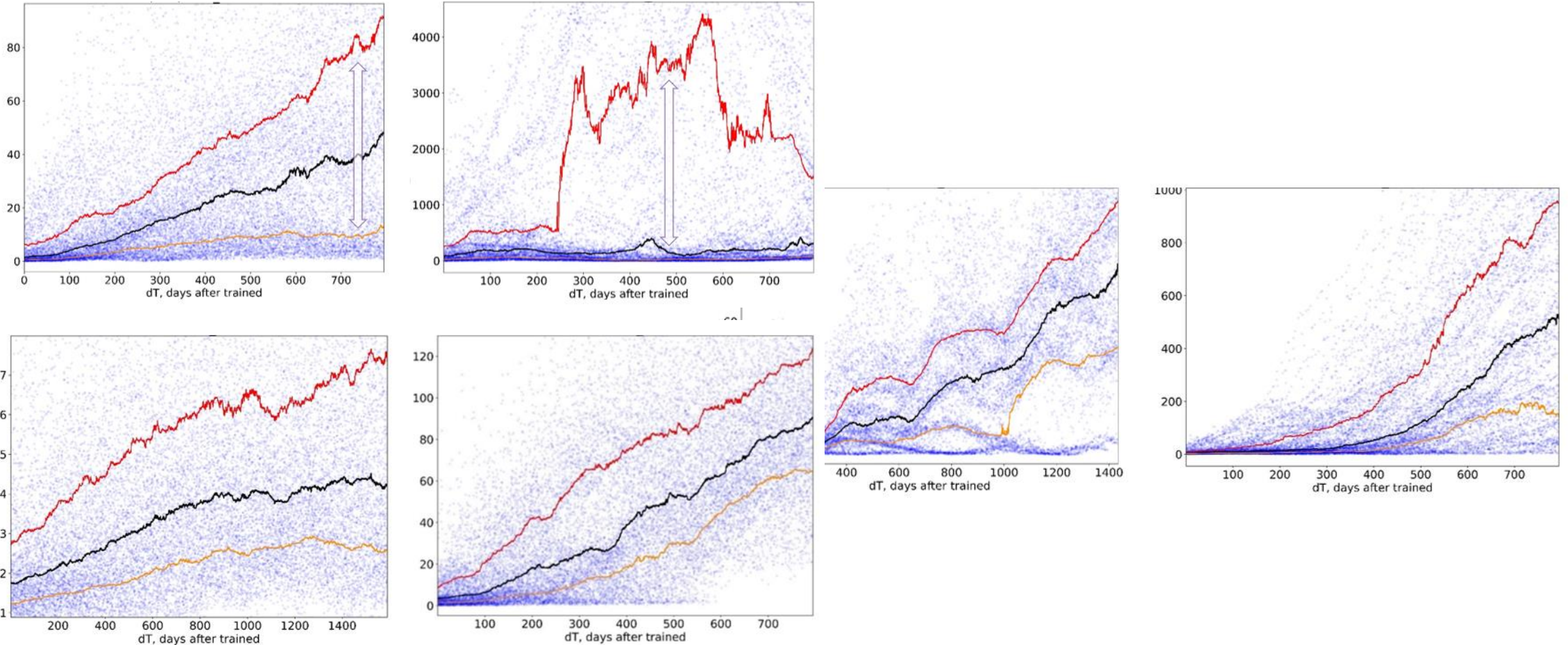
AI temporal degradation (aging)



Explosive aging:
dangerous pattern,
escalating model collapse.

“Strange attractors”
(mathematical chaos)

Temporal degradation in AI models



Conclusions: What do we need to do, practically?

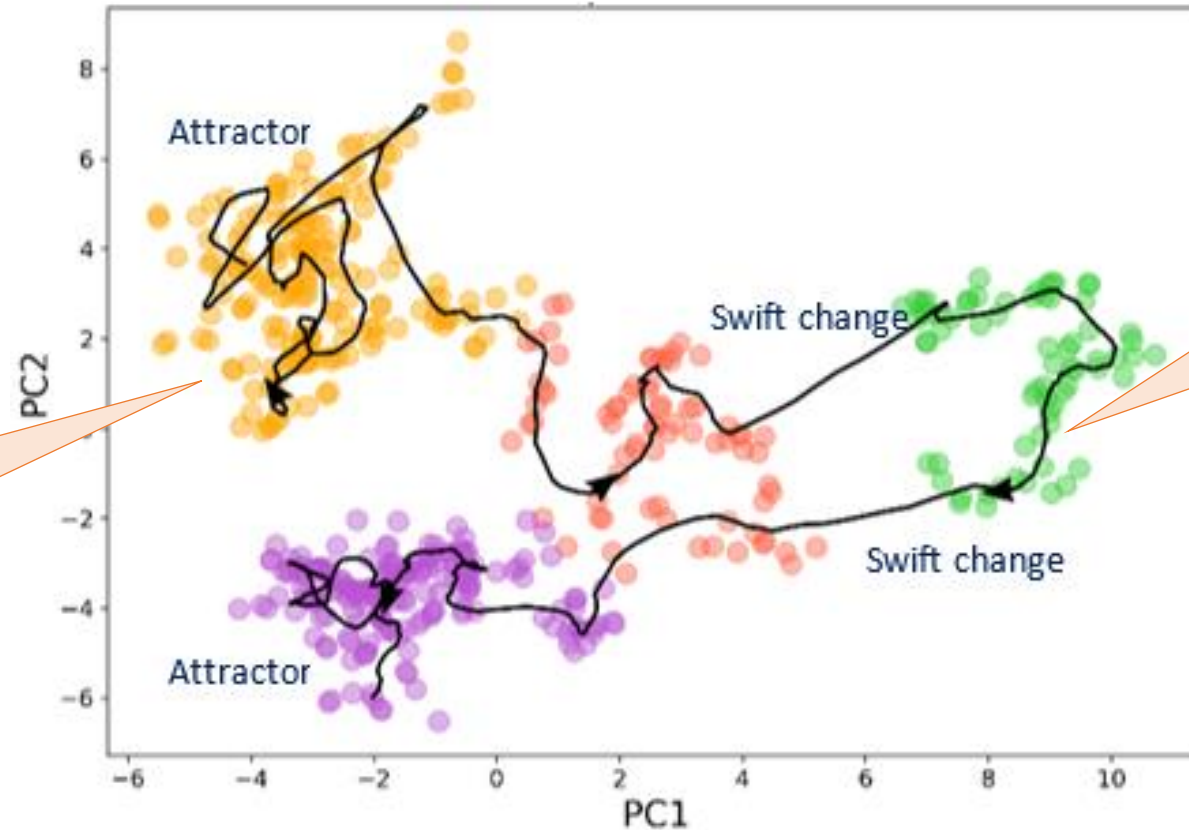
1. Develop **better AI policies and regulatory requirements (!)**
 - Do not install models without verified aging performance
2. Constantly **monitor model quality**
 - **Routinely retrain data models** with the most recent data
 - Constantly **monitor model quality**
 - Improve **computational performance**
3. Study/Develop **stable** AI algorithms
 - Scale up the models to **broader ranges of most stable features**
 - Develop **robust** data models



Extra slides for Q/A

Models evolving in time

Patient dataset, RV model



Model getting stuck at some times, changing at some others

Model temporal evolution path

Interpreting data/models: Be careful!

