JHU vision lab

Opportunities for Accelerating Discovery: Mathematical and Algorithmic Issues

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AI 3.0

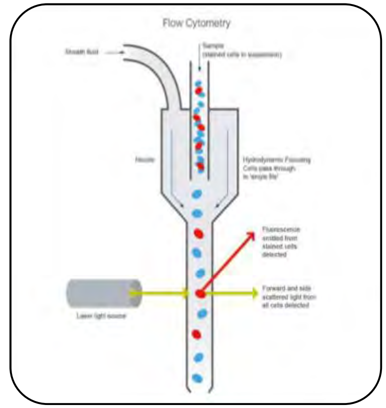
- AI 1.0: build mathematical/physical/biological/symbolic models
- AI 2.0: use big data to learn black-box (deep) models
- AI 3.0: develop new generation of AI methods that integrate mathematical/physical/biological/symbolic models & data-driven models.

- Explainable
- Robust
- Scalable

- Safe
- Adaptable
- Lifelong

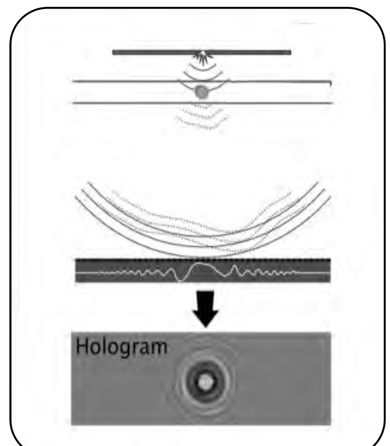
Example: AI for Point of Care Testing

- Complete Blood Count (CBC) using hematology analyzer



		Results
WBC		5.65 x 10^3 cells / µL
RBC	L	3.88 x 10^6 cells / µL
HGB		13.8 g / dL
HCT		41.3 %
MCV	H	106.5 fL
MCH	H	35.7 pg
MCHC		33.5 g / dL
CHCM		33.3 g / dL
CH		35.2 pg
RDW	H	15.5 %
HDW		2.74 g / dL
PLT	L	87 x 10^3 cells / µL
MPV		9.4 fL

- CBC using lens-free imaging



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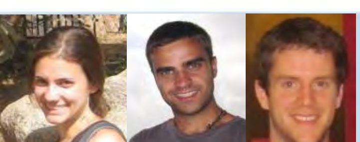

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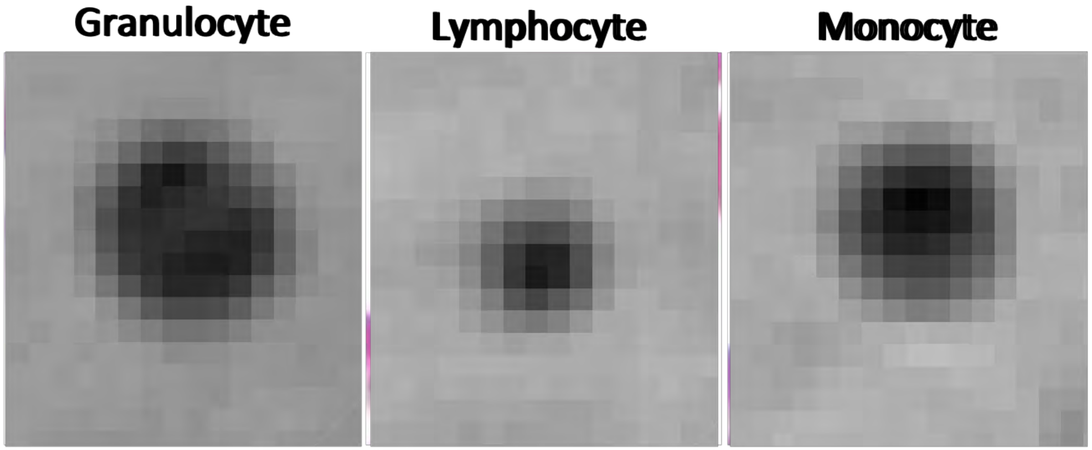
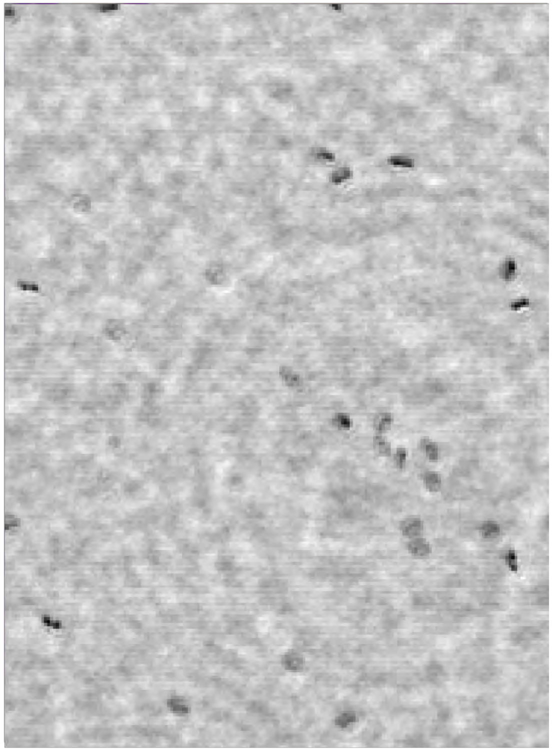
Example: AI for Point of Care Testing

- Number of training images/videos, patients, chips needed to achieve accurate/repeatable performance?





- Data cleaning/annotation is very costly

- To succeed, exploiting biological knowledge was essential

ARO MURI: Semantic Information Pursuit

MURI: Semantic Information Pursuit for Multimodal Data Analysis

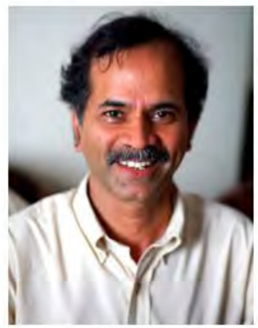
Overview Research People Publications Meetings

FACULTY INVESTIGATORS

RENE VIDAL (PI)

EMMANUEL CANDES

RAMA CHELLAPPA



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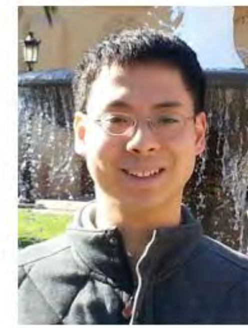

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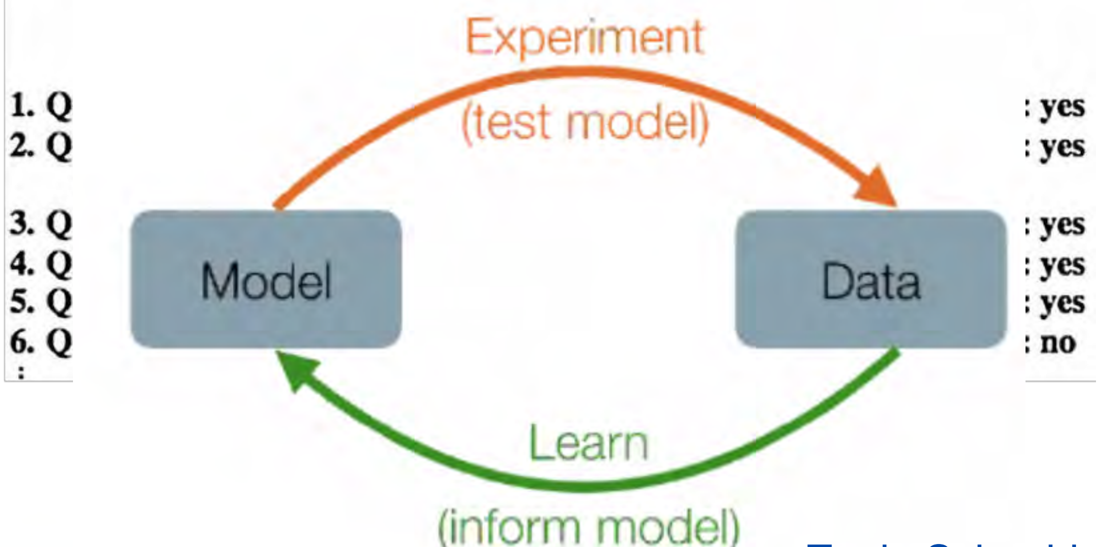
ARO MURI: Semantic Information Pursuit

- Develop an information-theoretic framework for characterizing semantic information content in complex multimodal data
- Semantic information = expected number of queries
- Can we use it to determine what experiment to conduct next?



Tapio Schneider

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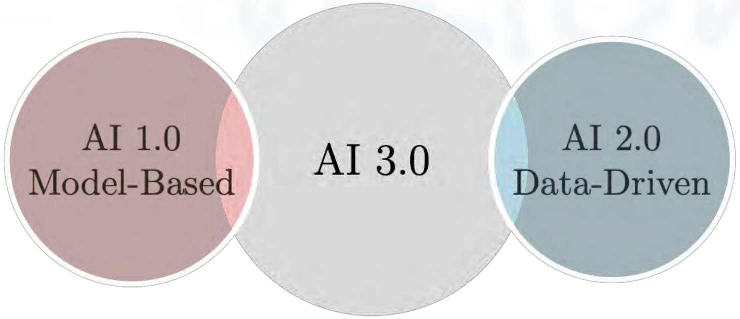
AI 3.0



- Integration of generative models, graphs, geometry, topology & deep learning
- Integration of mechanistic models & ML for accelerating discovery in biology, neuroscience & personalized medicine
- Integration of PDEs with deep learning for accelerating scientific discovery (e.g., physics, chemistry, geosciences)
- Integration of dynamical systems and reinforcement learning for designing the next generation of autonomous system