Social impact and risk governance of machine learning in the context of infectious diseases

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Machine learning (ML) in health

Medical imaging

ML-based software as a medical device

Genomic medicine
- Diagnostic
- Prevention
- Treatment

Infectious disease prediction
1. Detection of outbreak
2. Contact tracing and control
3. Development of therapeutics

Big data and machine learning

Massive data sets

- Volume
- Velocity
- Diversity
- Quality
- Multiple channels

Machine learning makes sense of data:

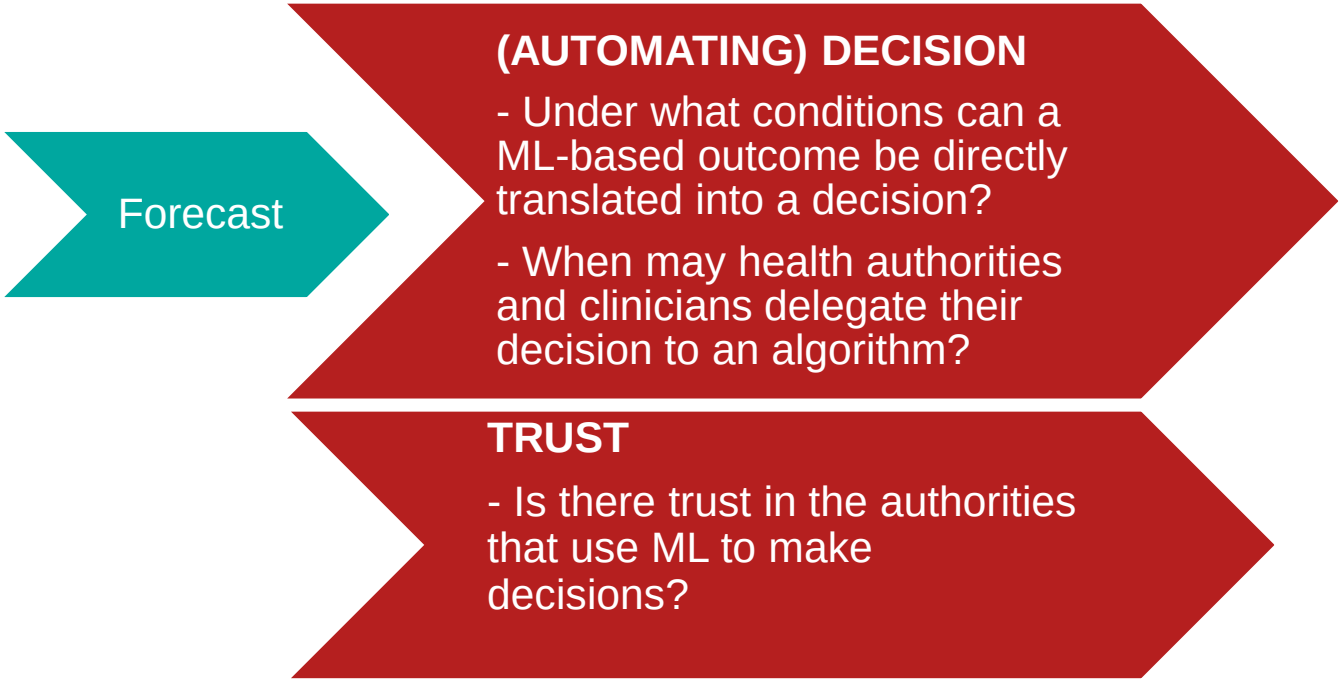
- Huge opportunities (accuracy, speed, prevention and control strategies…)
- Some limitations and concerns

Scaling research to support decision-makers

- Academic research / quantitative models of various types are developing rapidly
- Application to: Influenza, Dengue, Zika or Ebola
- Some sources of data seem to prove particularly useful for prediction, including weather data, and social media

But we need to make progress in: Moving from diagnostic to prediction

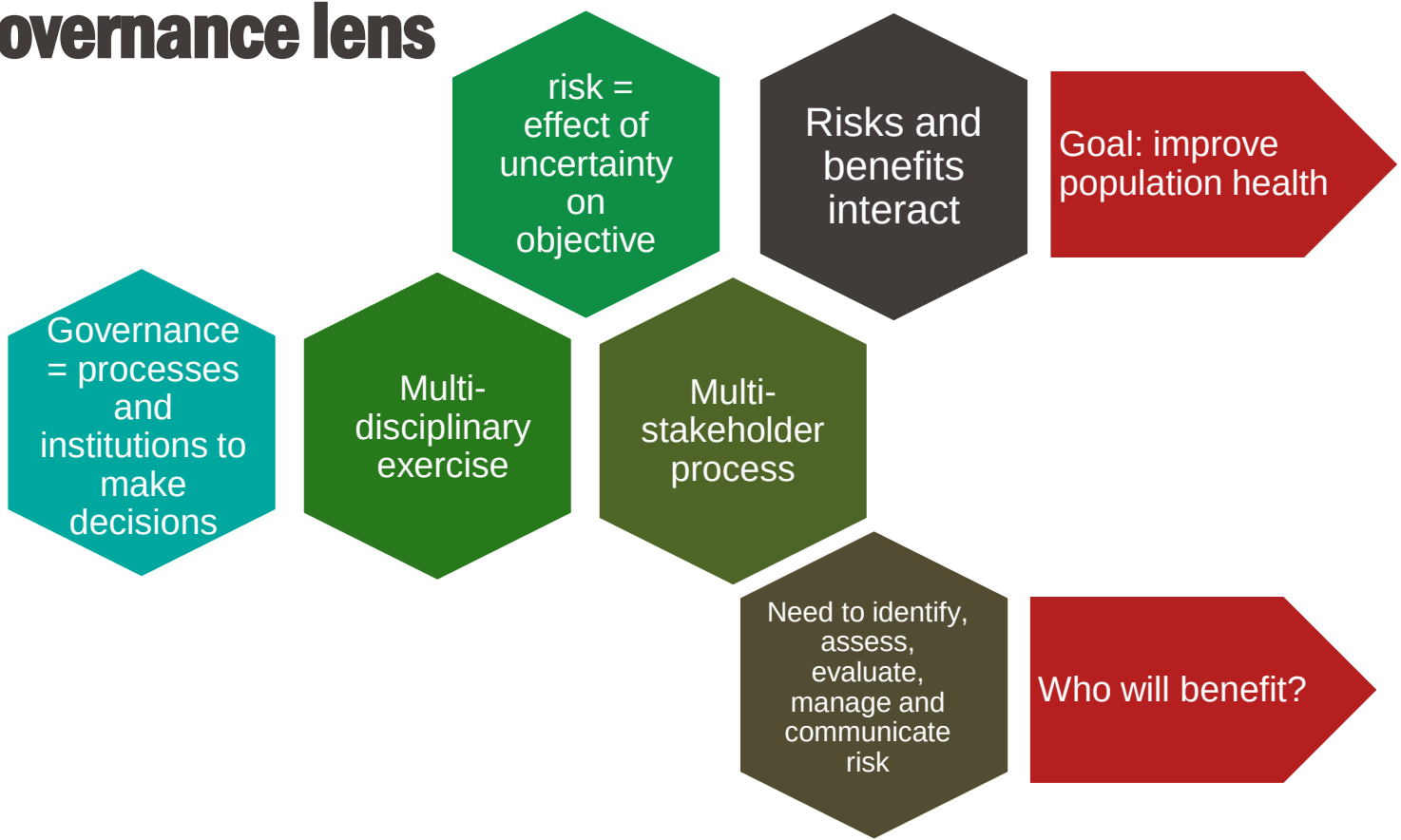
And we also need to move from prediction to decisions which raises other types of challenges:



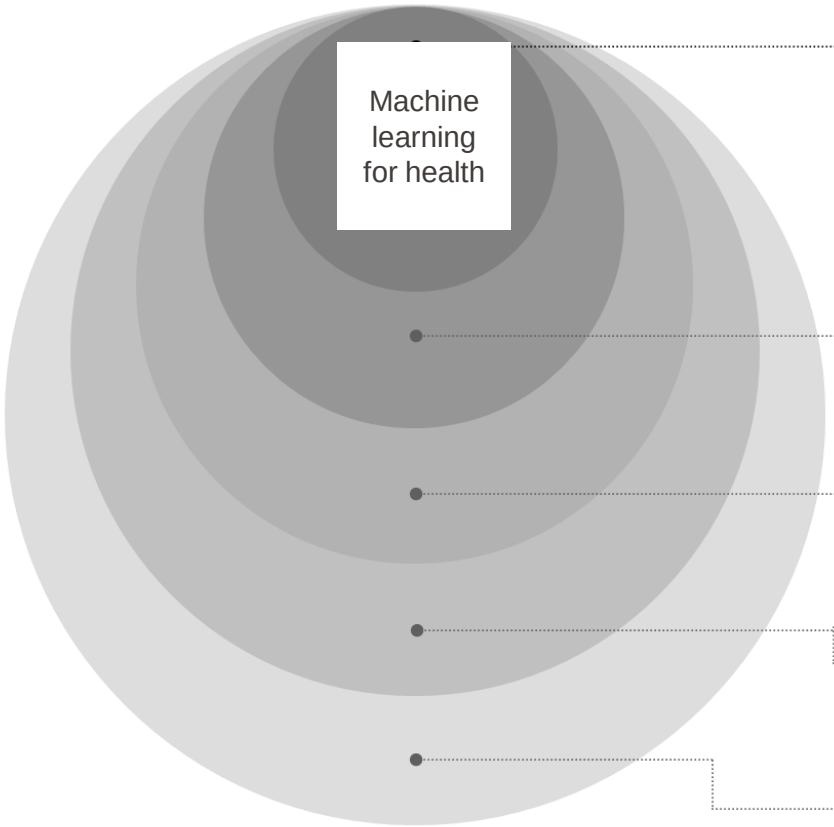
Issues

- Data: availability, quality, data management systems,…
- Target:
  - What goal should the algorithmic outcome serve to reach?
  - Trade-offs between goals
- Privacy and consent
- Ethics, non discrimination and fairness
- Interpretability / explainability
- Acceptability / social preference
- Regulation (contributes to determining conditions of trustworthiness)

Bringing a risk governance lens



Understanding the context



Identification, evaluation and management of risks and challenges

Organisational Capacity
- assets
- skills
- capabilities

Actor Network
- politicians
- regulators
- industry/business
- NGOs
- media
- public at large

Political & Regulatory Culture
- different regulatory styles

Social Climate
- trust in regulatory institutions
- perceived authority of science
- degree of civil society involvement
- **RISK CULTURE**

A roadmap to deployment?

Analogy with a roadmap for precision / personalized medicine

1. Creating appropriate context conditions

Dialogue between:

- Health sector
- Industry and non-medical domains
- Citizens and patients
- Regulators and payers
- Academia
- Policy makers

2. Incremental implementation

- Data collection, sharing and analytics
- Precision diagnostics and treatment
- Personalised prevention
- Complex traits and new biomedical data-based therapies

3. Addressing the data issue

- Type and quality
- Privacy and confidentiality
- Issues of consent
- Data sharing
- Interoperability
- Biobanks
- IP issues

4. Reforming regulation and payment systems

- Planned adaptive licensing
- Outcome-based reimbursement
- Pay for diagnostic and data
- Post-market surveillance

Conclusion

- Opportunities and challenges are tightly connected
- Technology and regulation/governance are tightly connected
- Accuracy and reliability of outcome matter most
- The problem of algorithmic biases must be addressed
- When may institutional actors automate their decision (legitimacy)?
- Defining accountability, engineering digital trust and developing social trustworthiness. Key questions to those who use ML in healthcare:
  - What goal are you pursuing with what you are doing?
  - Who benefits?
  - How sure are you that what you are doing is right?

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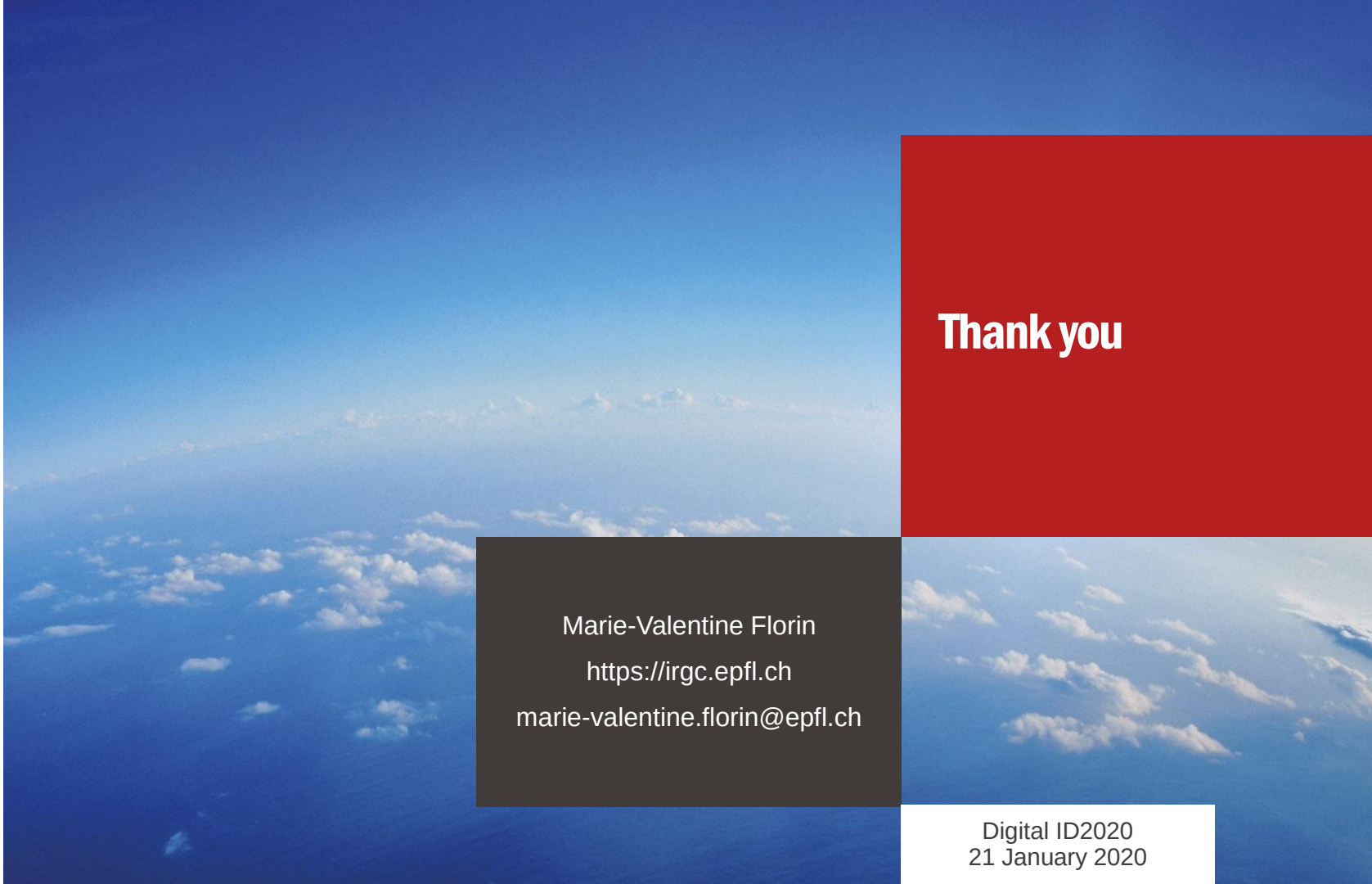

Thank you

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