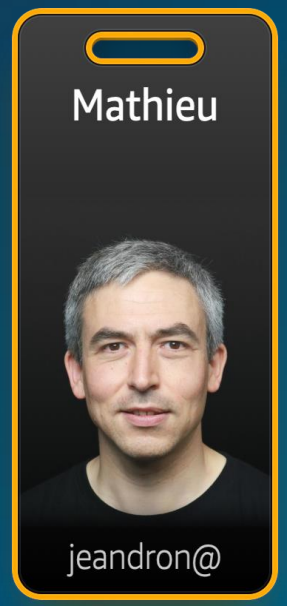
L’IA en santé, vision d’un industriel



Mathieu Jeandron

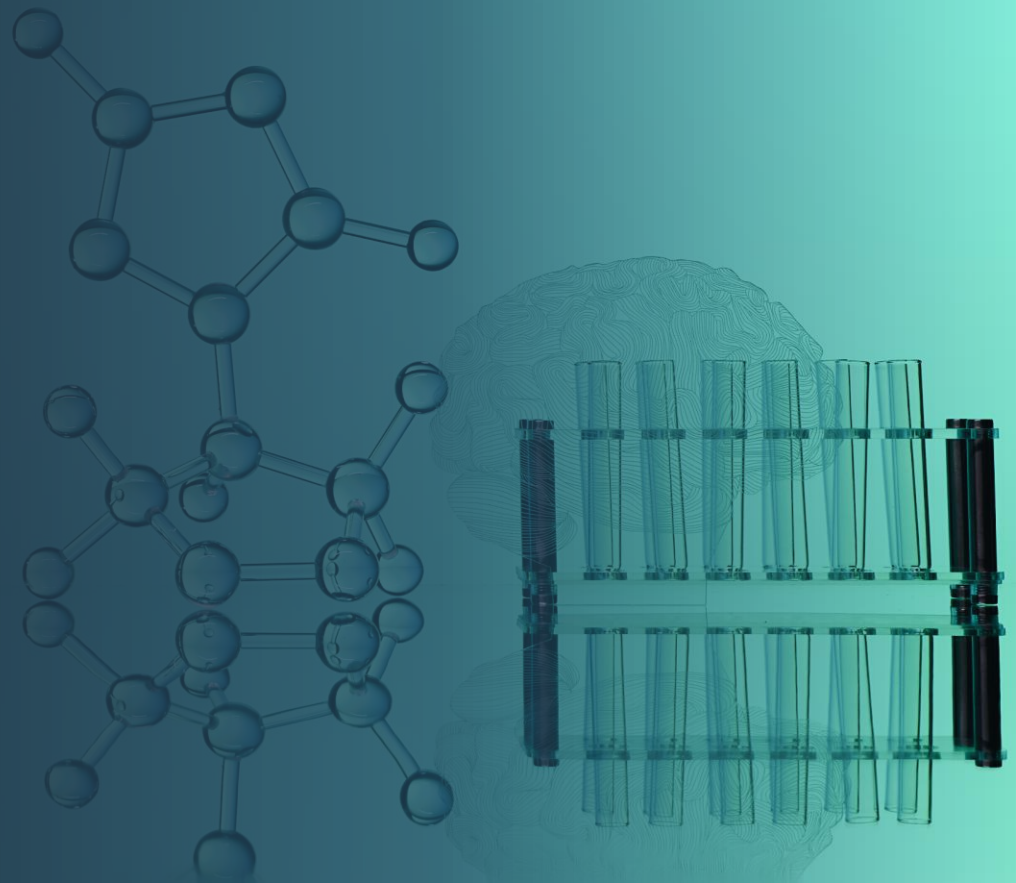
Solutions Architecture
Secteur Public France
Amazon Web Services

Agenda

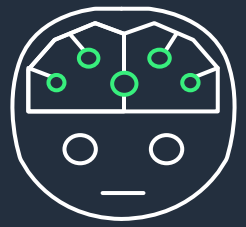
- IA et cloud, de quoi parle-t-on ?

- Cas d'usage
  - -> Domaines d'application matures
  - -> Domaines en développement
  - -> Des pistes pour l'avenir

- Critères de confiance
  - -> Fiabilité
  - -> "human in the loop"
  - -> Confidentialité des données



Un peu de vocabulaire...



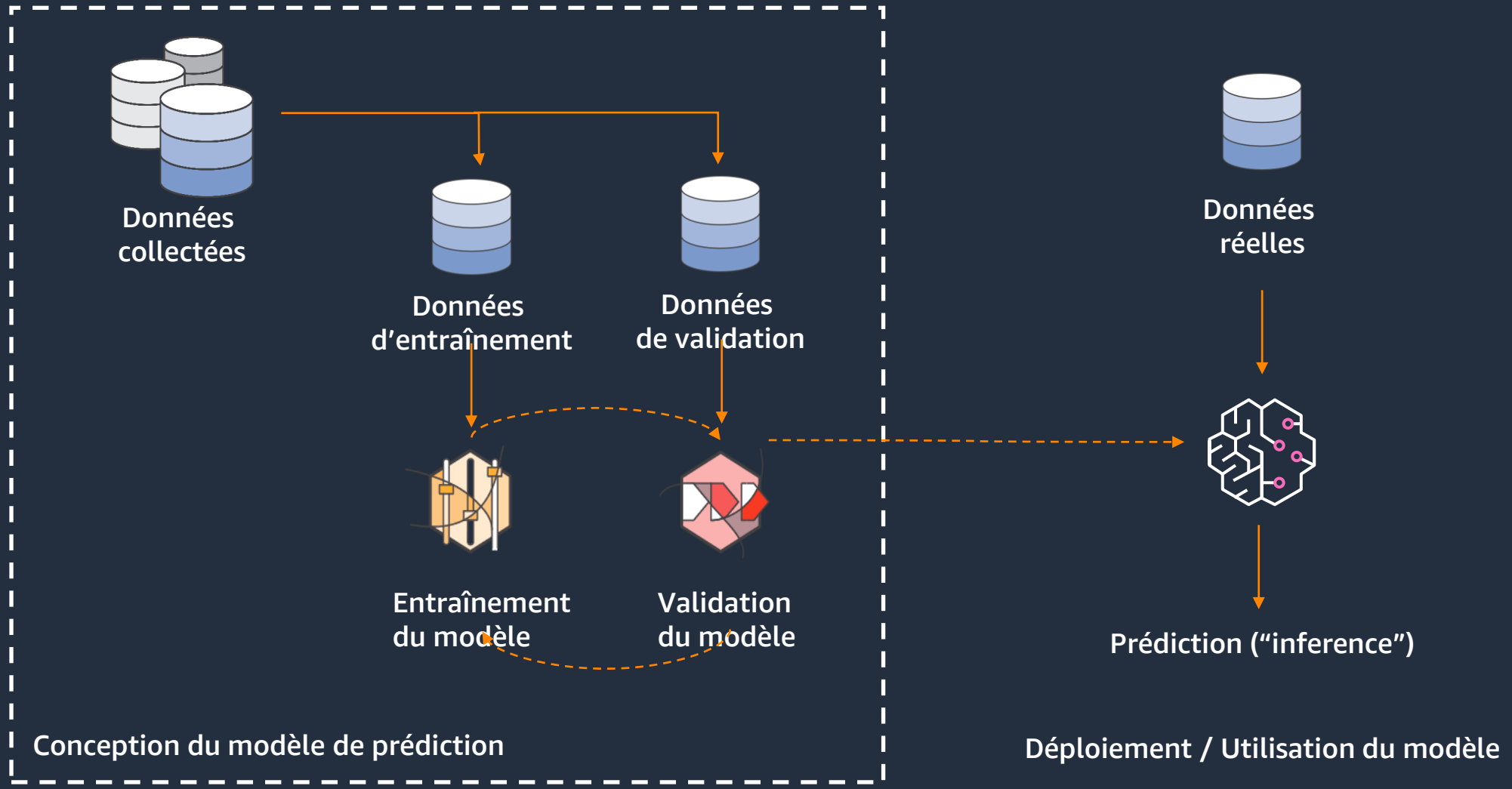
Intelligence artificielle (IA) / Artificial intelligence (AI)

Apprentissage machine / Machine learning (ML)

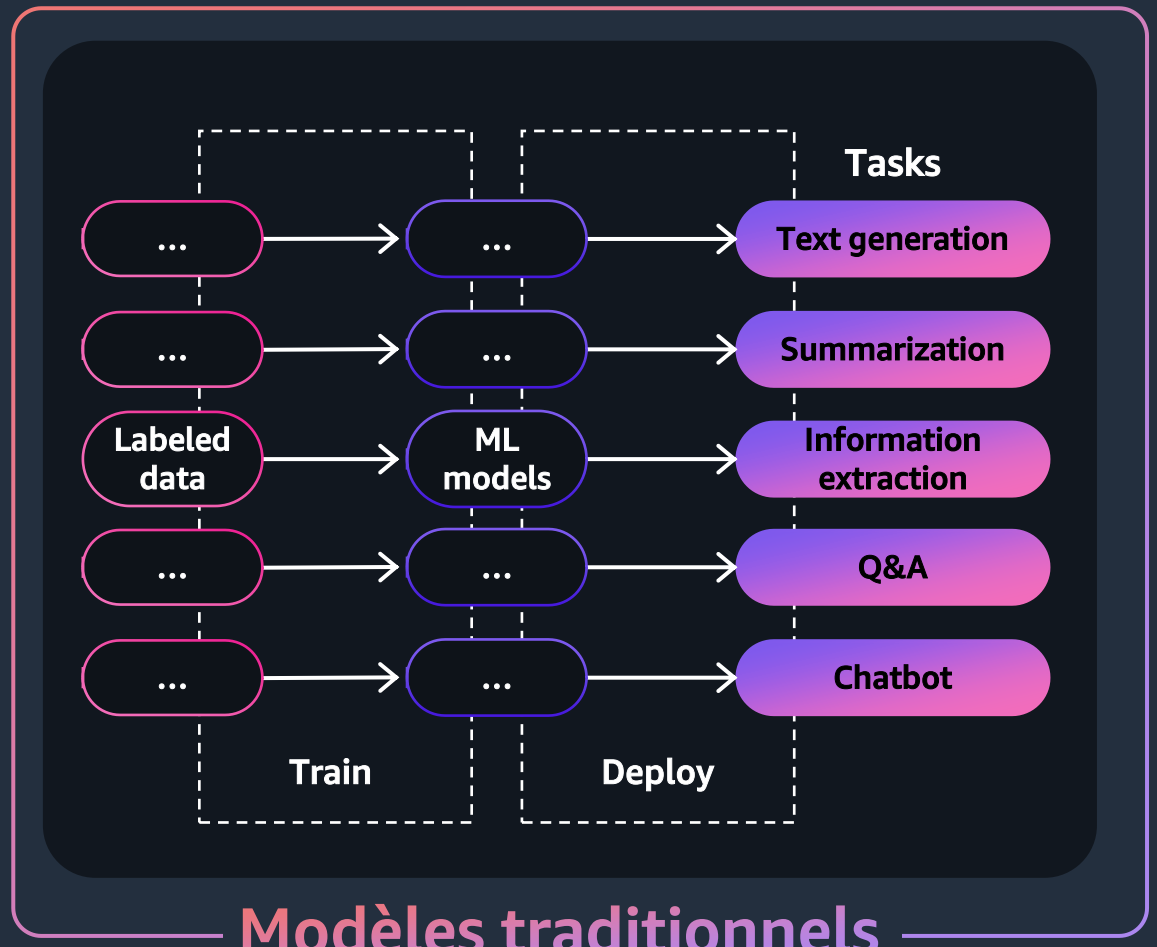
Apprentissage profond / Deep learning (DL)

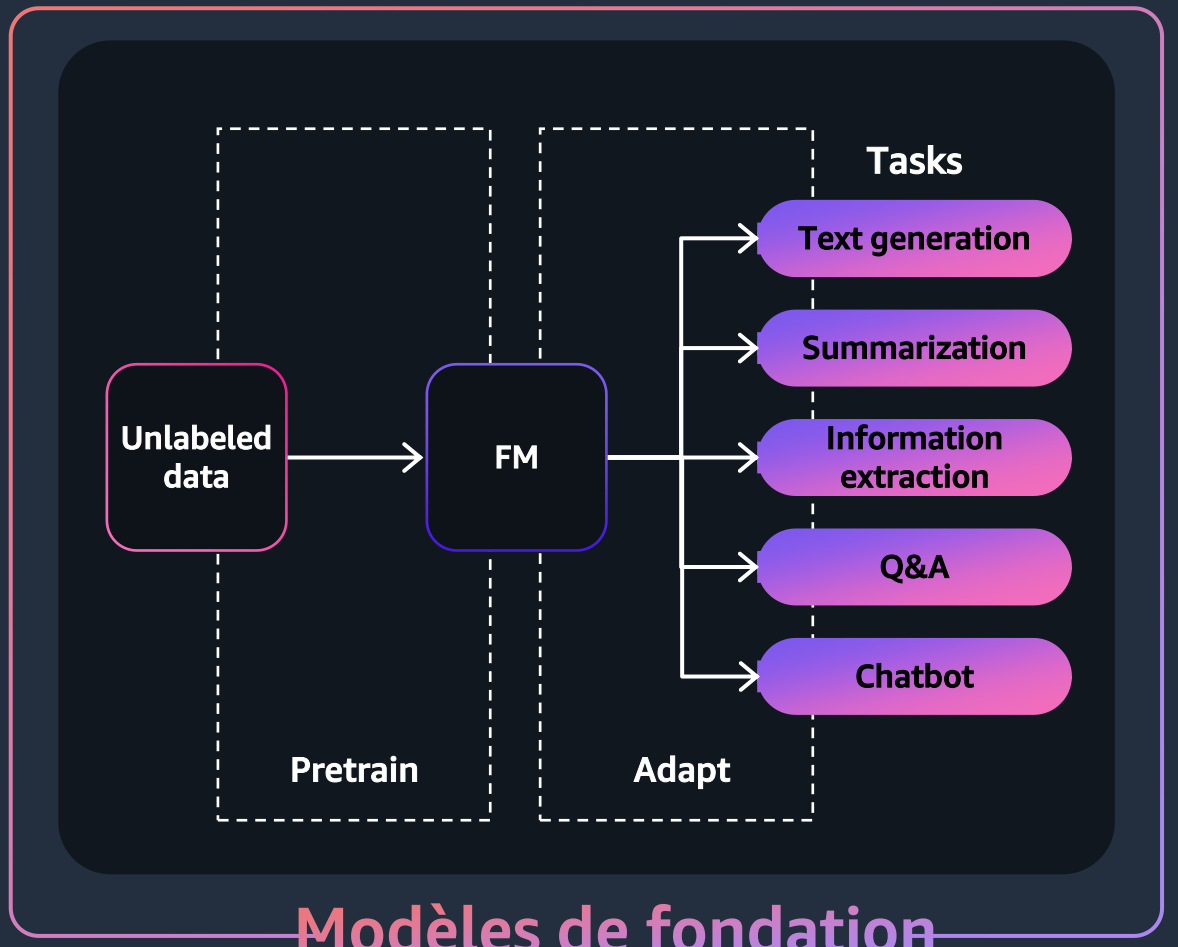
IA générative / Generative AI

Les étapes (simplifiées) du machine learning



Et l'IA générative ?





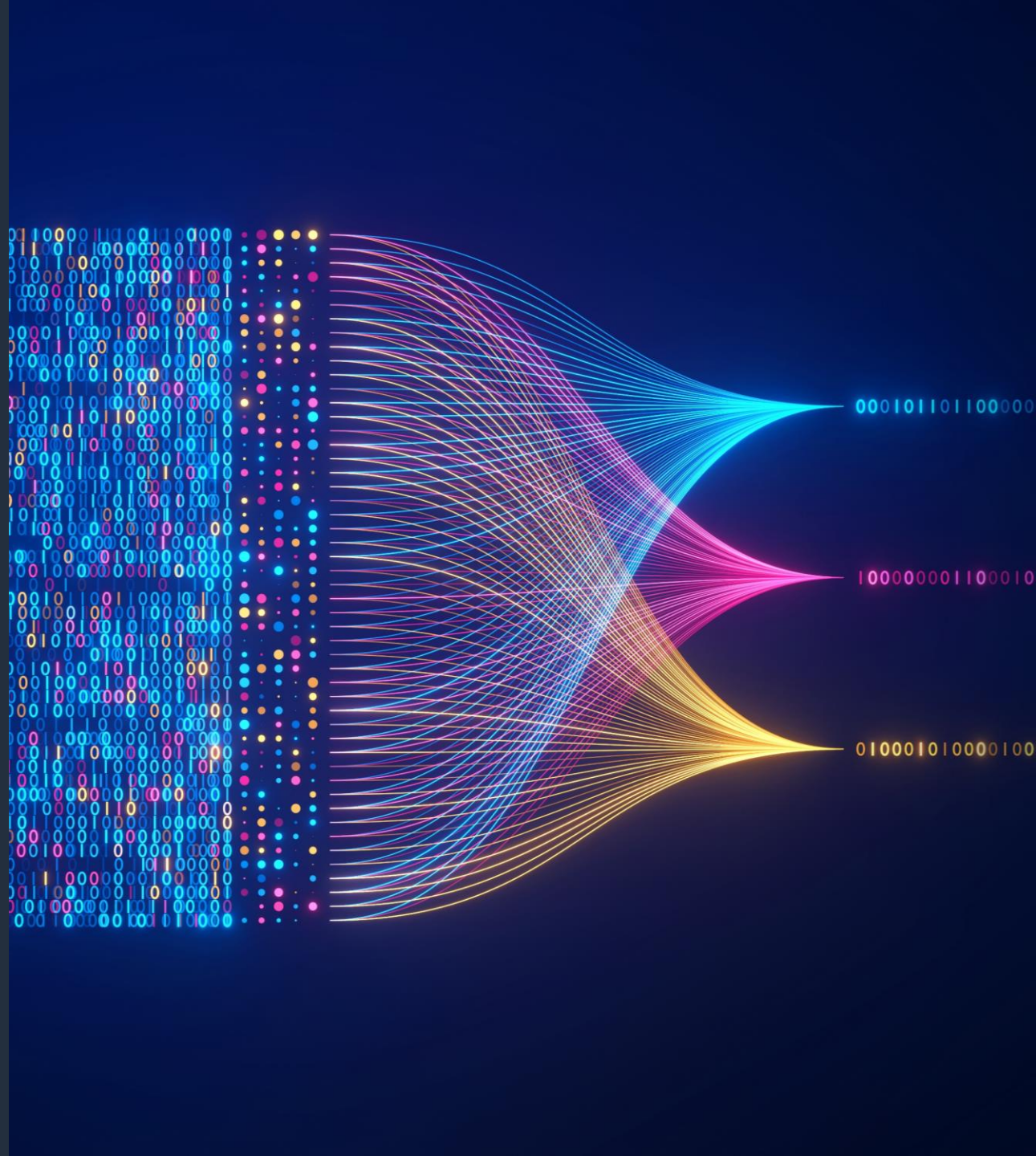
L’IA générative repose sur les modèles de fondation

Pré-entraînés sur des (très) grandes quantités de données

Comportent de très nombreux paramètres pour pouvoir traiter des concepts complexes

Peuvent avoir plusieurs domaines d’application

Peuvent être spécialisés pour répondre à des besoins particuliers



aws

Pourquoi IA et cloud vont bien ensemble ?

Créer un modèle, un algo

Crée son propre modèle en partant de ~zéro

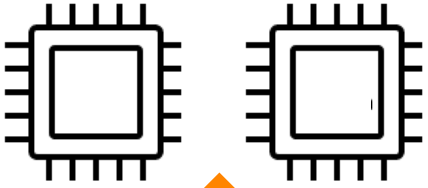
Adapter des modèles

Adapte et personnalise un modèle existant pour un domaine

IA clé en main

Utilise un modèle existant mis à disposition

Capacité de calcul



Studio

Hub de modèles

Service API

Apps SaaS

Plateforme de données

Données d'entraînement

Sécurité : contrôle d'accès, chiffrement, ...
Qualité, format, indexation, ...

Capture, transmission temps réel...

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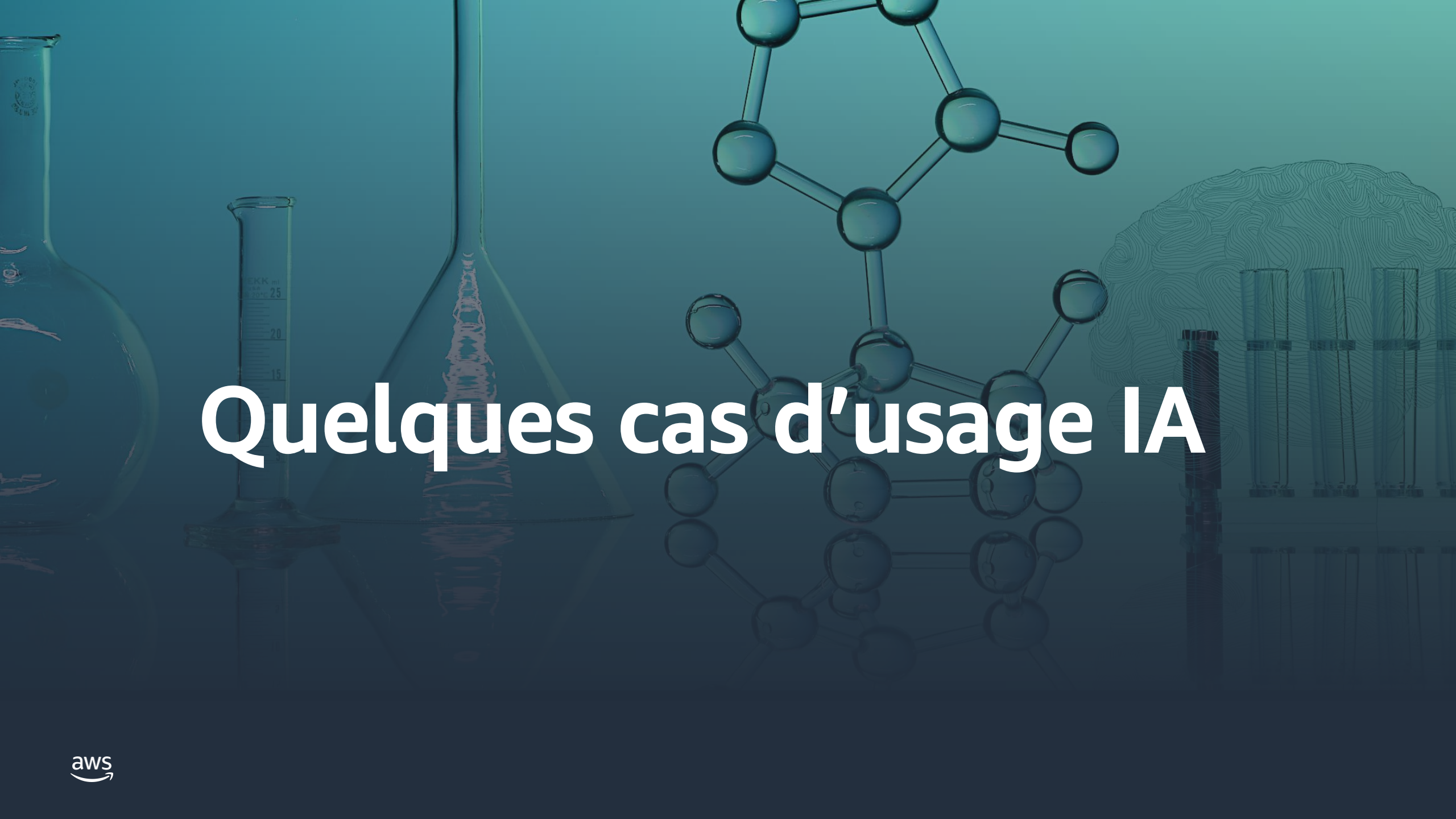
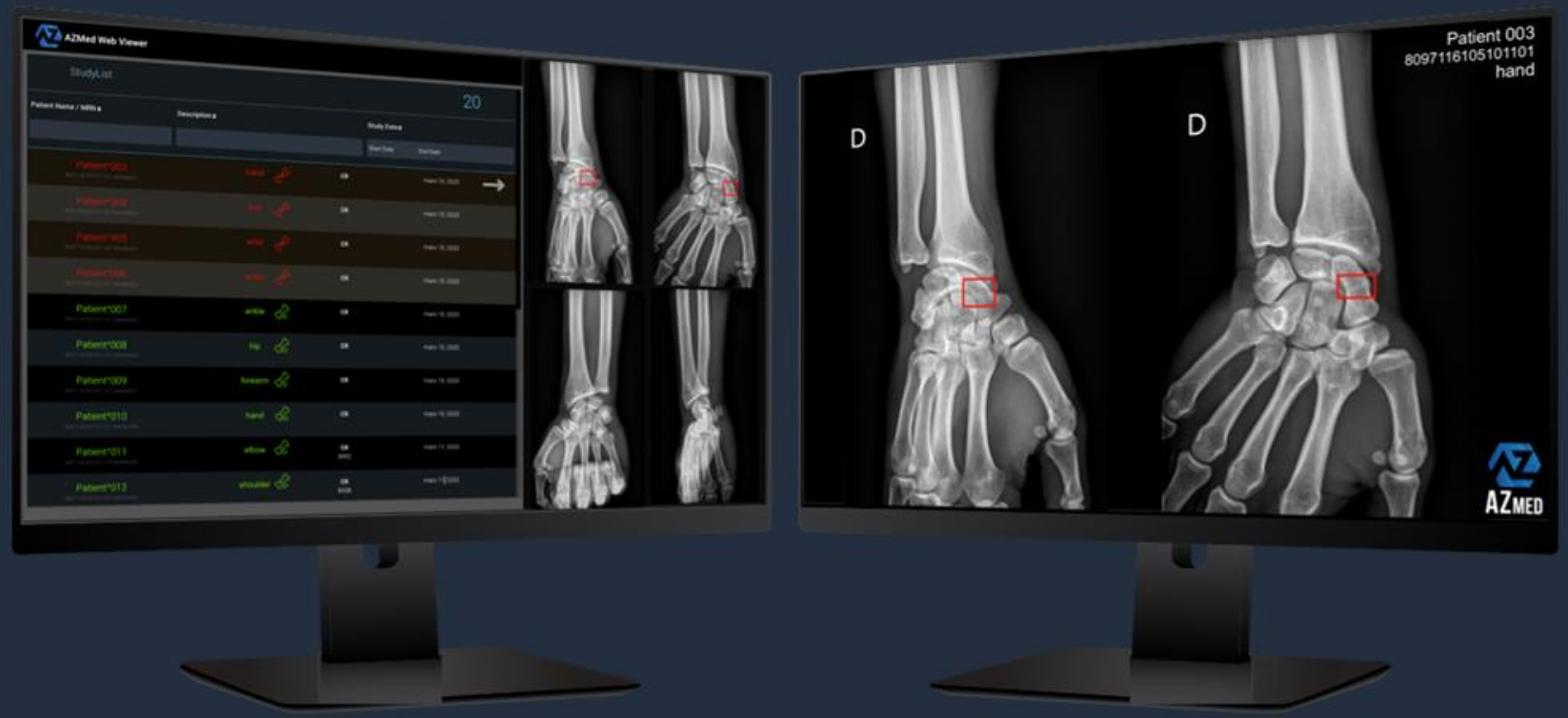


Quelques cas d’usage IA

Rayvolve by AZmed

The powerful computer-aided diagnosis tool that detects all types of fractures on X-rays



20 % errors avoided

36 % time saved

Imagerie médicale : l'IA est devenue un standard

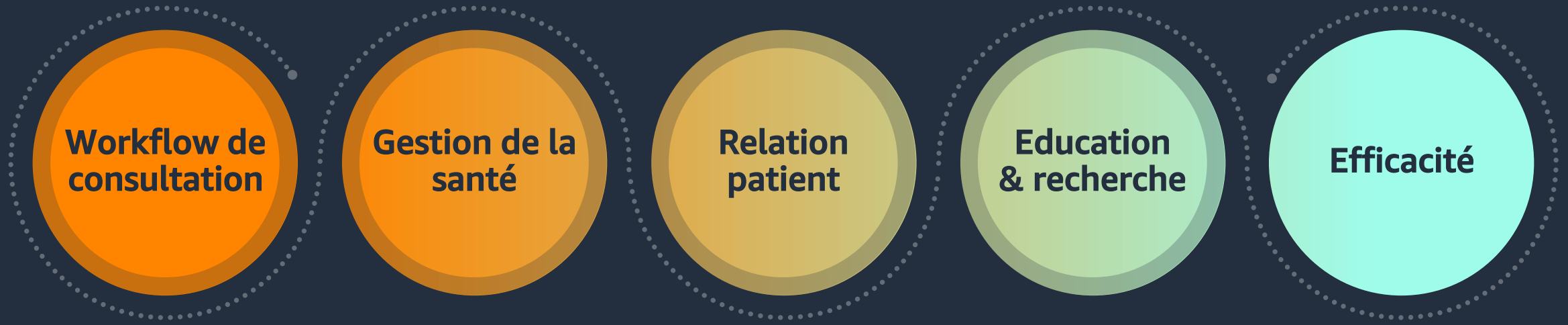
PHILIPS FUJIFILM Hyland

AMBRA VISAGE IMAGING PROSCIA

Radpoint. aidoc viz.ai

Paige EMERGENT CONNECT SMART REPORTING ...

L’IA générative ouvre de nouvelles possibilités



Prise de note directe du dialogue avec le patient

Résumé dans le dossier patient

Suggestion de diagnostics complémentaires

Résumé et enregistrement dans les outils de suivi

Identification de risques à l’échelle du patient / de cohortes

Segmentation des populations à risque pour des campagnes de prévention

Recommandations self-service

Communication proactive et conseil de mise en oeuvre des soins

Génération de rapports compréhensibles par le client

Amélioration de l’identification de clients pour les essais cliniques

Résumé de publications

Q&A sur des documents médicaux de référence

Gestion et optimisation de l’agenda, call centers

Moteurs de recherche avancés

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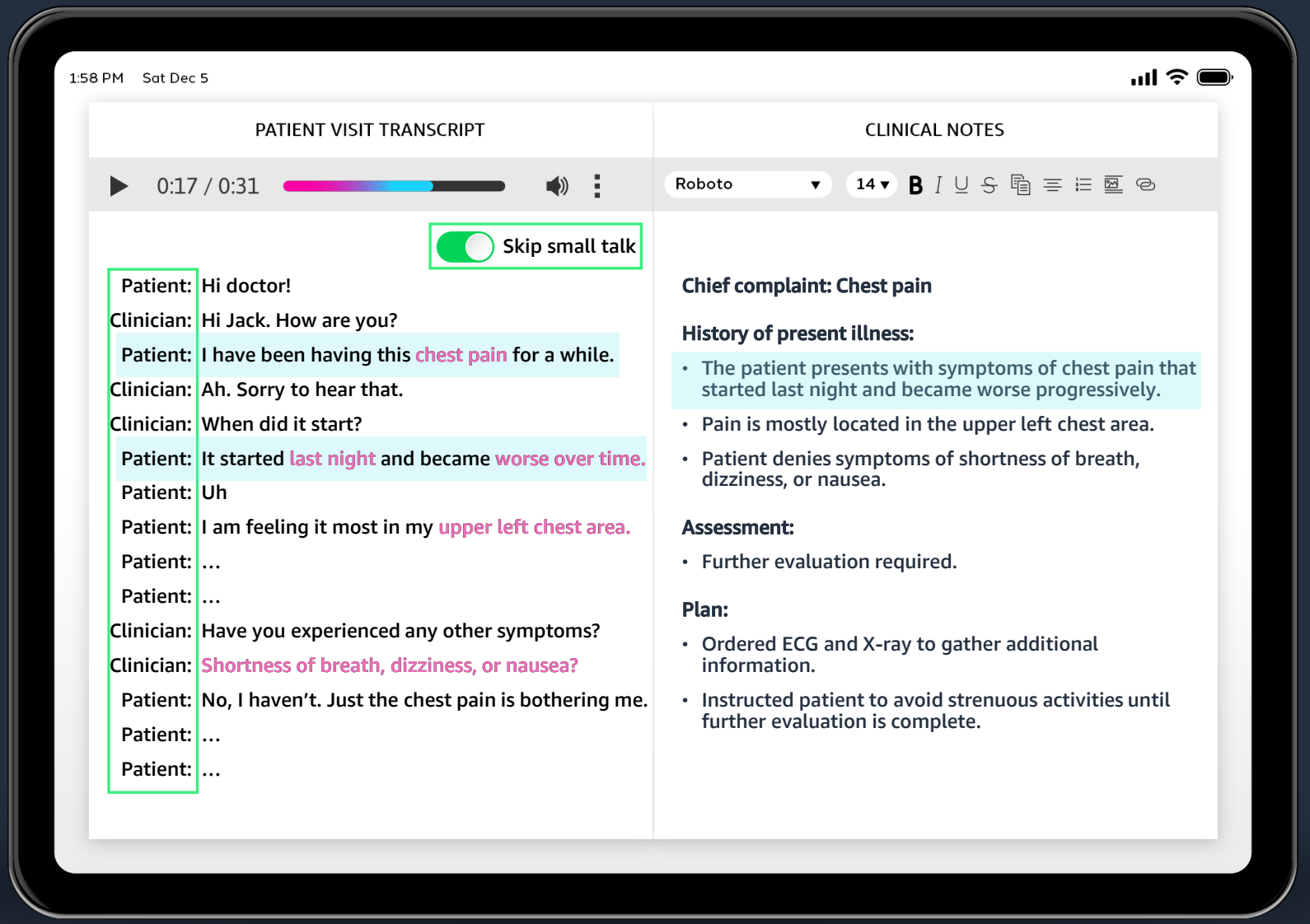
1:58 PM Sat Dec 5
PATIENT VISIT TRANSCRIPT
CLINICAL NOTES
0:17 / 0:31
Roboto
14
Skip small talk
Patient: Hi doctor!
Clinician: Hi Jack. How are you?
Patient: I have been having this chest pain for a while.
Clinician: Ah. Sorry to hear that.
Clinician: When did it start?
Patient: It started last night and became worse over time.
Patient: Uh
Patient: I am feeling it most in my upper left chest area.
Patient: ...
Patient: ...
Clinician: Have you experienced any other symptoms?
Clinician: Shortness of breath, dizziness, or nausea?
Patient: No, I haven't. Just the chest pain is bothering me.
Patient: ...
Patient: ...
Chief complaint: Chest pain
History of present illness:
• The patient presents with symptoms of chest pain that started last night and became worse progressively.
• Pain is mostly located in the upper left chest area.
• Patient denies symptoms of shortness of breath, dizziness, or nausea.
Assessment:
• Further evaluation required.
Plan:
• Ordered ECG and X-ray to gather additional information.
• Instructed patient to avoid strenuous activities until further evaluation is complete.

MedAlign: données de benchmark pour les LLM spécialisés santé

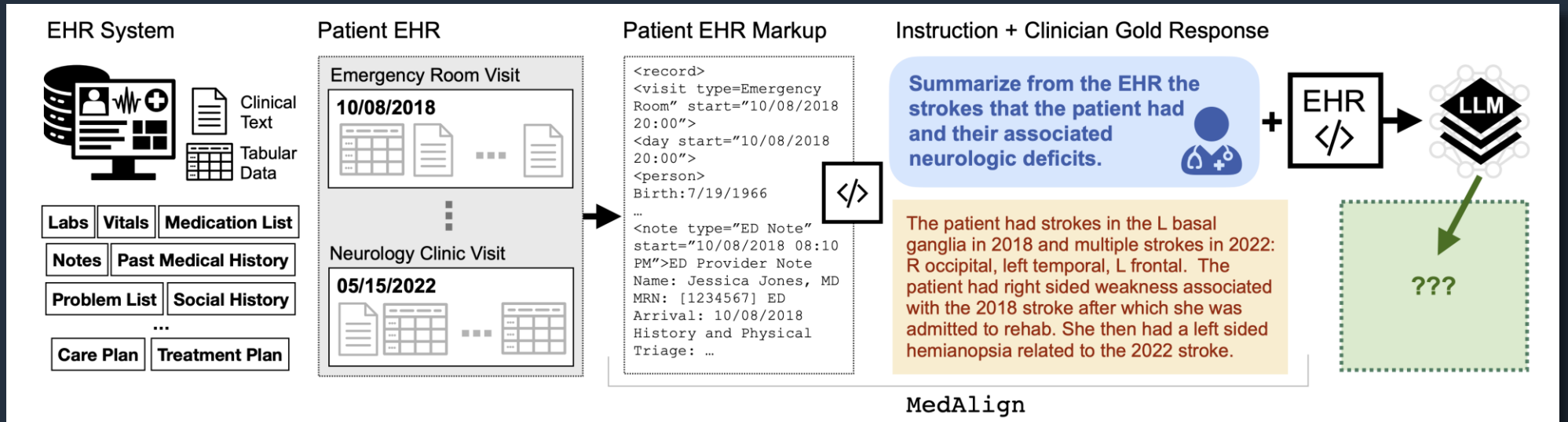

Figure 1: Instruction following with electronic health record (EHR) data. In MEDALIGN, individual patient EHRs are transformed into XML markup (example provided in Figure S3) and paired with clinician-generated instructions (blue) and responses (orange) to evaluate language models.

S. L. Fleming et al., "MedAlign: A Clinician-Generated Dataset for Instruction Following with Electronic Medical Records." arXiv, Aug. 27, 2023. Accessed: Sep. 13, 2023. [Online]. Available: http://arxiv.org/abs/2308.14089

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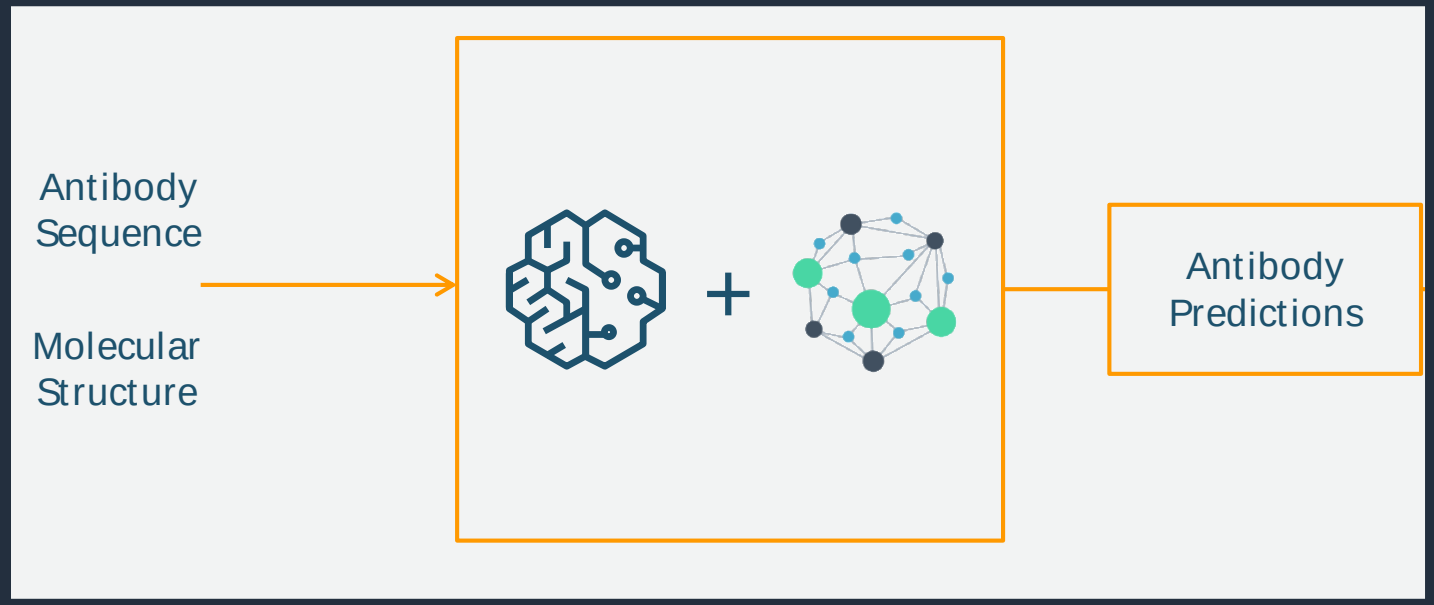
Accélérer le cycle de développement des molécules

1Md€ par molécule de la conception à la mise sur le marché

Jusqu'à 10 ans de délai

aws

Prédiction des attributs des molécules



Applied deep learning

1. Paratope prediction (clonotyping → paratyping)
2. PTM prediction
3. Thermostability prediction
4. Immunogenicity prediction
5. In silico developability assessment

janssen | PHARMACEUTICAL COMPANIES OF Johnson & Johnson

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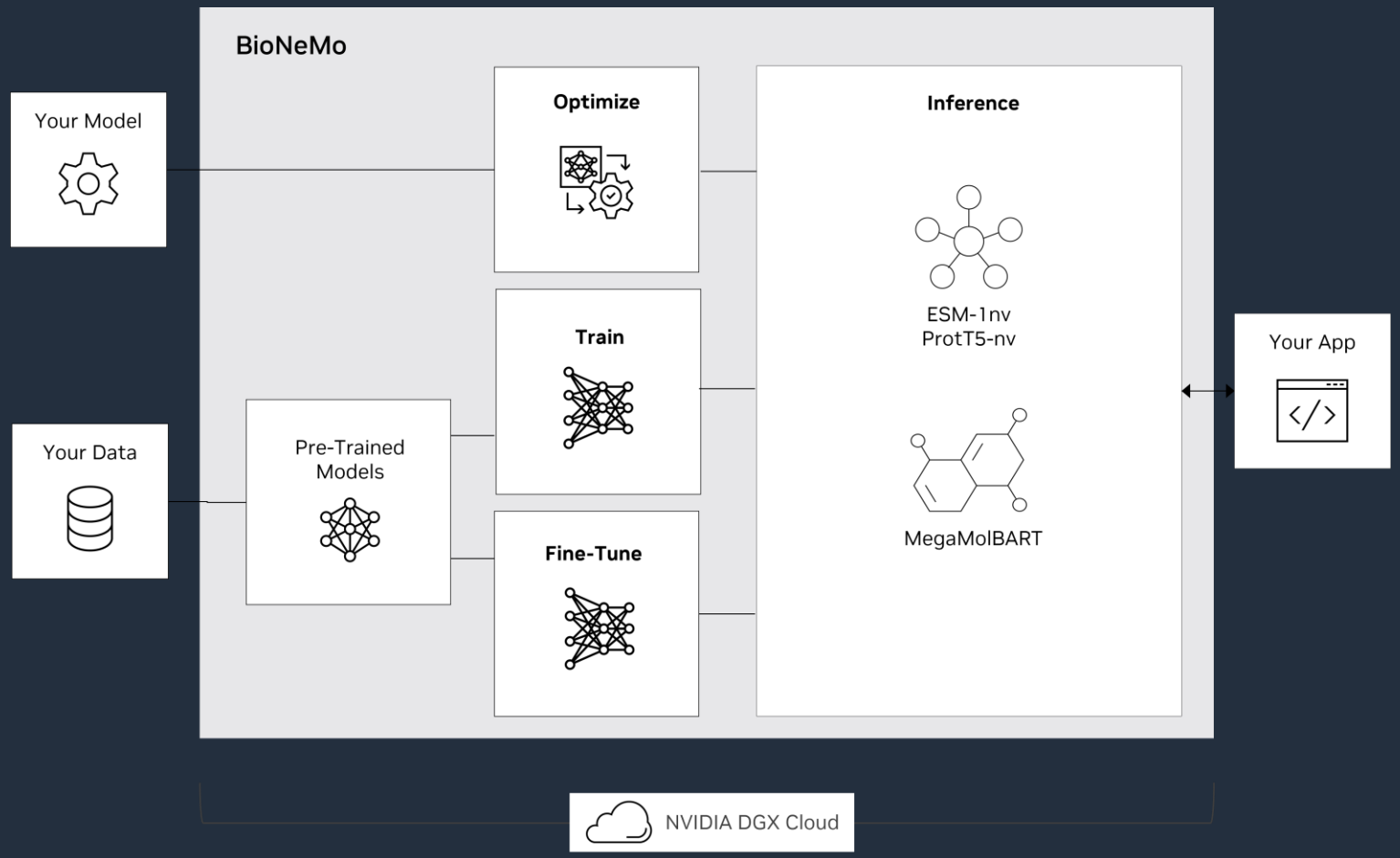
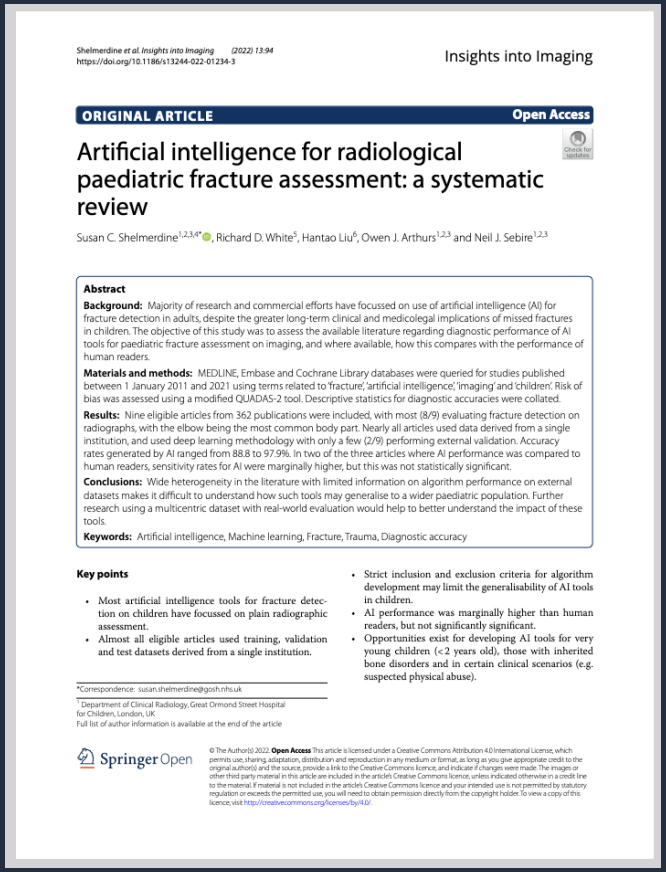
NVIDIA BioNemo



Model	Modality	Uses
DNABERT	DNA	Representation Learning
OpenFold	Protein	Protein Structure Prediction
DiffDock Score Model	Protein + Molecule	Generation of Ligand Poses
DiffDock Confidence Model	Protein + Molecule	Generation of Ligand Poses
EquiDock DIPS Model	Protein	Protein-Protein Complex Formation
EquiDock DB5 Model	Protein	Protein-Protein Complex Formation
ESM-2nv 650M	Protein	Representation Learning
ESM-2nv 3B	Protein	Representation Learning
ESM-1nv	Protein	Representation Learning
ProtT5nv	Protein	Representation Learning
MegaMolBART	Small Molecule	Representation Learning + Molecule Generation

Critères de confiance

Performance : place à la méthode scientifique



Shelmerdine et al. Insights into Imaging (2022) 13:94
https://doi.org/10.1186/s13244-022-01234-3

Insights into Imaging

ORIGINAL ARTICLE Open Access

Artificial intelligence for radiological paediatric fracture assessment: a systematic review

Susan C. Shelmerdine[1,2,3,4*], Richard D. White[5], Hantao Liu[6], Owen J. Arthurs[1,2,3] and Neil J. Sebire[1,2,3]

Abstract

Background: Majority of research and commercial efforts have focussed on use of artificial intelligence (AI) for fracture detection in adults, despite the greater long-term clinical and medicolegal implications of missed fractures in children. The objective of this study was to assess the available literature regarding diagnostic performance of AI tools for paediatric fracture assessment on imaging, and where available, how this compares with the performance of human readers.

Materials and methods: MEDLINE, Embase and Cochrane Library databases were queried for studies published between 1 January 2011 and 2021 using terms related to 'fracture,' 'artificial intelligence,' 'imaging' and 'children.' Risk of bias was assessed using a modified QUADAS-2 tool. Descriptive statistics for diagnostic accuracies were collated.

Results: Nine eligible articles from 362 publications were included, with most (8/9) evaluating fracture detection on radiographs, with the elbow being the most common body part. Nearly all articles used data derived from a single institution, and used deep learning methodology with only a few (2/9) performing external validation. Accuracy rates generated by AI ranged from 88.8 to 97.9%. In two of the three articles where AI performance was compared to human readers, sensitivity rates for AI were marginally higher, but this was not statistically significant.

Conclusions: Wide heterogeneity in the literature with limited information on algorithm performance on external datasets makes it difficult to understand how such tools may generalise to a wider paediatric population. Further research using a multicentric dataset with real-world evaluation would help to better understand the impact of these tools.

Keywords: Artificial intelligence, Machine learning, Fracture, Trauma, Diagnostic accuracy

Key points

- Most artificial intelligence tools for fracture detection on children have focussed on plain radiographic assessment.
- Almost all eligible articles used training, validation and test datasets derived from a single institution.
- Strict inclusion and exclusion criteria for algorithm development may limit the generalisability of AI tools in children.
- AI performance was marginally higher than human readers, but not significantly significant.
- Opportunities exist for developing AI tools for very young children (< 2 years old), those with inherited bone disorders and in certain clinical scenarios (e.g. suspected physical abuse).

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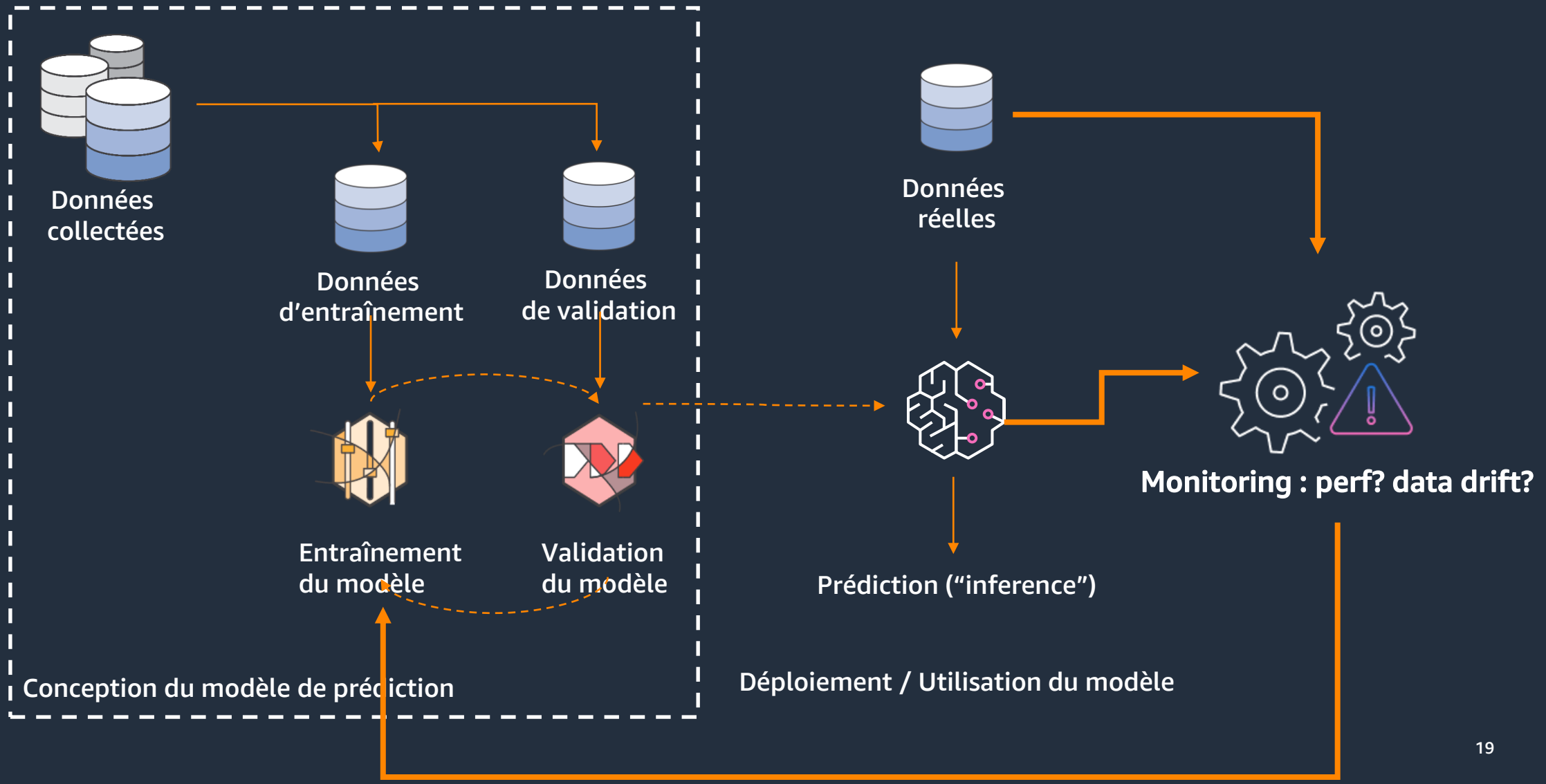
[1] Department of Clinical Radiology, Great Ormond Street Hospital for Children, London, UK
Full list of author information is available at the end of the article

Performance « sur le terrain » dans la durée



Risques et défis émergents (notamment avec l'IA générative)

"hallucinations"

Toxicité

Propriété intellectuelle

Confidentialité

Considérations pour une IA responsable

Contrôlabilité

Mécanismes pour surveiller et piloter le comportement ` du système IA

Sécurité et confidentialité

Obtention et utilisation licite des données d'entraînement / du système IA

Sûreté

Prévenir les mésusages et les réponses dangereuses ou inadéquates

Equité

Prendre en compte les différences entre groupes de patients et l'impact de ces différences

Fiabilité et robustesse

S'assurer de la qualité des résultats

Explicabilité

Faciliter la compréhension des résultats

Transparence

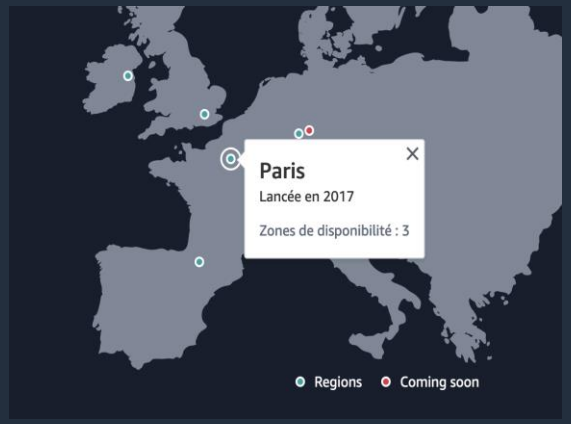
Expliciter les modalités de recours à l'IA

Gouvernance

Respecter et faire respecter ces pratiques à tous les niveaux de la chaîne

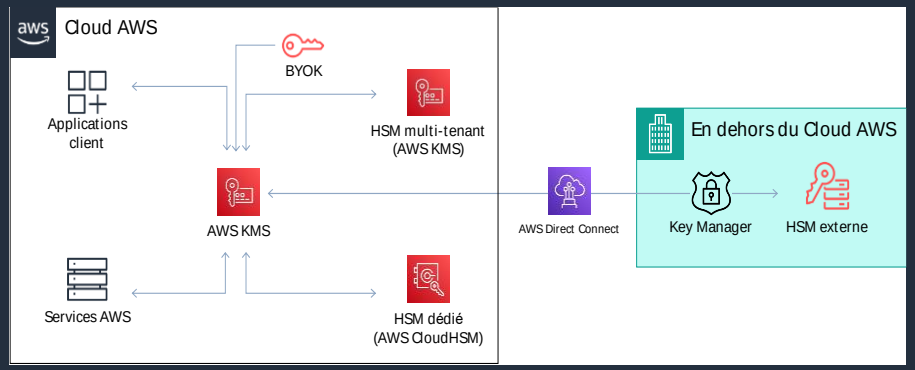
Protection des données dans le cloud

Localisation des données



Protection contre les accès opérateurs

Chiffrement



Engagements légaux

ISO 27001 · ISO 27701 · CISPE · AICPA SOC · HDS · HIPAA · ...

Merci !