Using Artificial Intelligence to identify inherent errors in medical data that even experts can't detect
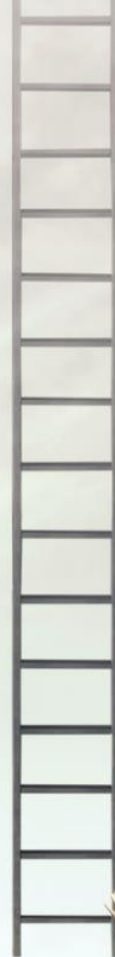
Presagen
A.I. Enhanced Healthcare

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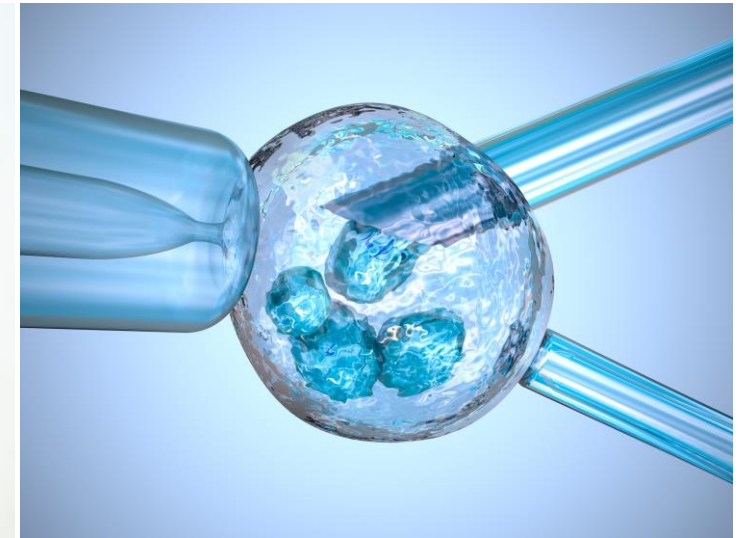
Medical data is inherently poor quality

Subjectivity

Uncertainty

Unknown Confounding Factors

Poor quality data negatively impacts many areas of healthcare and reliable treatment for patients

Artificial Intelligence

Precision Health

Clinical trials

Example: What if we wanted to identify symptoms associated with COVID patients?

COVID Patients

Non-COVID Patients

Symptom Data

Common cold and flu

... and what if Rapid Antigen Tests (RAT) were used to diagnose whether a patient has COVID?

COVID Patients

Non-COVID Patients

Symptom Data

Common cold and flu

RAT used to diagnose COVID

The high error rate in the test will produce a large proportion of inherent errors in the data

COVID Patients

Non-COVID Patients

Symptom Data

>20% error in detecting COVID

RAT used to diagnose COVID

<3% error in detecting Non-COVID

Experts cannot manually detect these inherent errors

Many assume errors can be detected manually

Other barriers to manual verification of data:

- *Scalability*: sheer scale of data to be reviewed

- *Privacy*: privacy regulation preventing manual review

- *Context*: lack of contextual information about the data

Artificial Intelligence can be used to automatically and reliably detect inherent errors in medical data

AI algorithm called UDC

Identifies inconsistencies or errors in data

Preserves privacy: no manual verification needed

Turning AI onto itself…

Consider AI trained to detect cats and dogs

Cats

Dogs

AI learns patterns and features from historical data to distinguish between cats and dogs

Cats   **Dogs**

Data needs to be labelled as 'Cat' or 'Dog' to train the AI

Errors in data creates inconsistencies during AI training

Cats

Dogs

AI can't match
the features that
look different

Cat??

More often during training the AI
will match the features associated
with "Dogs" and think it is incorrect

Like trying to fit a square peg into a round hole!!

'Untrainable' consistently incorrect data are likely errors

Cats
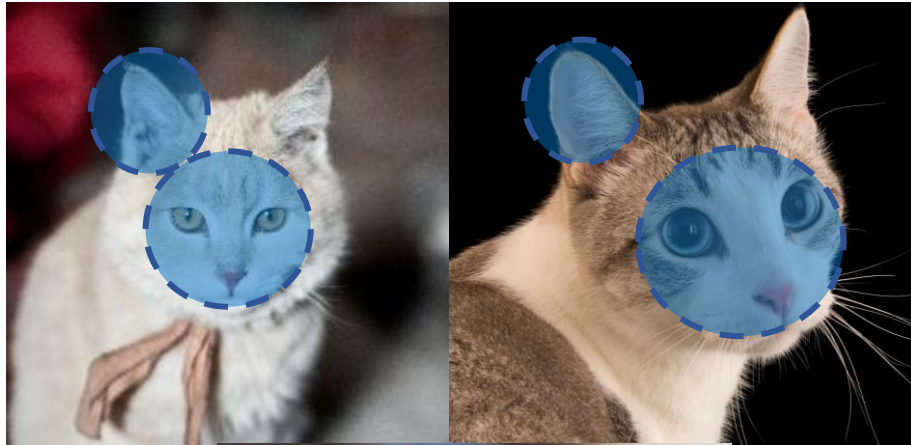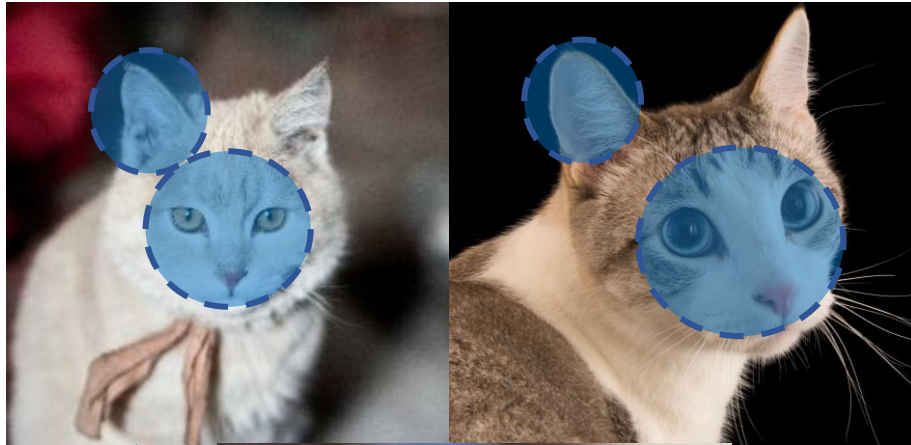
Dogs

AI can't match the features that look different

More often during training the AI will match the features associated with "Dogs" and think it is incorrect

C̶a̶t̶??

**Label 'Cat' is an error.
Likely to be a 'Dog'.**

How well does it work?

Cats and Dogs

Vehicles

Non-Image Record Medical Data

X-Ray images to detect pneumonia

Embryo images to predict viability/pregnancy

Detecting errors in Cats and Dogs

Intentionally introduced up to 50% errors in cat image labels, and up to 30% error for both cats and dogs

UDC automatically identified incorrectly labelled images

AI accuracy improvement after UDC was between **20% to 30%**

Detecting errors in Vehicles (four labels)

Intentionally introduced up to 70% error across all four types of vehicle images

UDC automatically identified incorrectly labelled images.

AI accuracy improvement after UDC was up to **45%**

Detecting errors in embryo images

PGT-A is an invasive technique where an embryo is biopsied and genetically tested for abnormalities like down syndrome

Nature of PGT-A testing can result in "errors": overestimation of embryos being genetically abnormal and thus unnecessarily discarded

UDC identified 37% of embryo images that were likely mis-labelled

AI accuracy improvement after UDC was up to 10%.

Detect Genetic Integrity

Beyond errors: detecting difficult to assess X-Ray images

UDC identified 'noisy' images that were difficult for both expert radiologist and AI algorithms to identify pneumonia

Noisy images had a negative impact on AI training, accuracy and generalizability

AI accuracy improvement after UDC was up to 25%

Useful as a triage tool to identify scans that may be difficult to diagnose and may need additional tests

Detect pneumonia

Works on any data…

UDC applied to non-image record-based medical data

UDC identified errors that were intentionally introduced

UDC can be applied non-AI healthcare use cases, e.g. errors in clinical trial data, or other data used in the treatment of patients
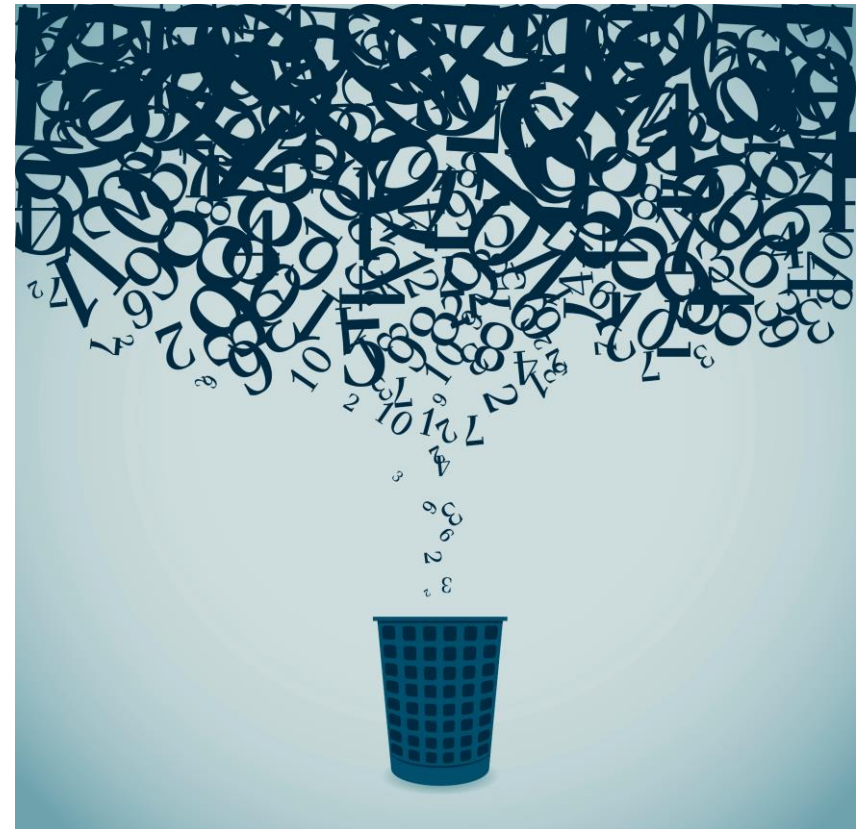
Non-Image Record Medical Data

Other potential applications of the UDC?

Error detection of private data that can't be manually verified

Scalable and practical error detection of massive datasets

Detection of anomalies in data

Labeling or prediction of difficult to detect or predict data

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