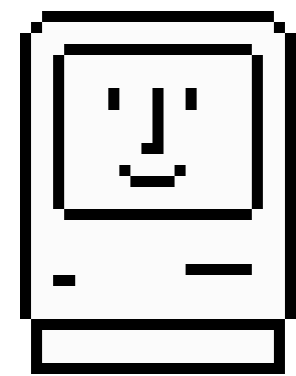# Meet Frank

HELLO, I'M FRANK! AN INCREMENTAL LEARNING SYSTEM. AND AN ASSISTANT.

I DON'T NEED A TRAINING SET. I LEARN LITTLE BY LITTLE FROM YOUR DECISIONS AND I CAN REPLICATE YOUR BEHAVIOUR. I EVOLVE WITH YOU.
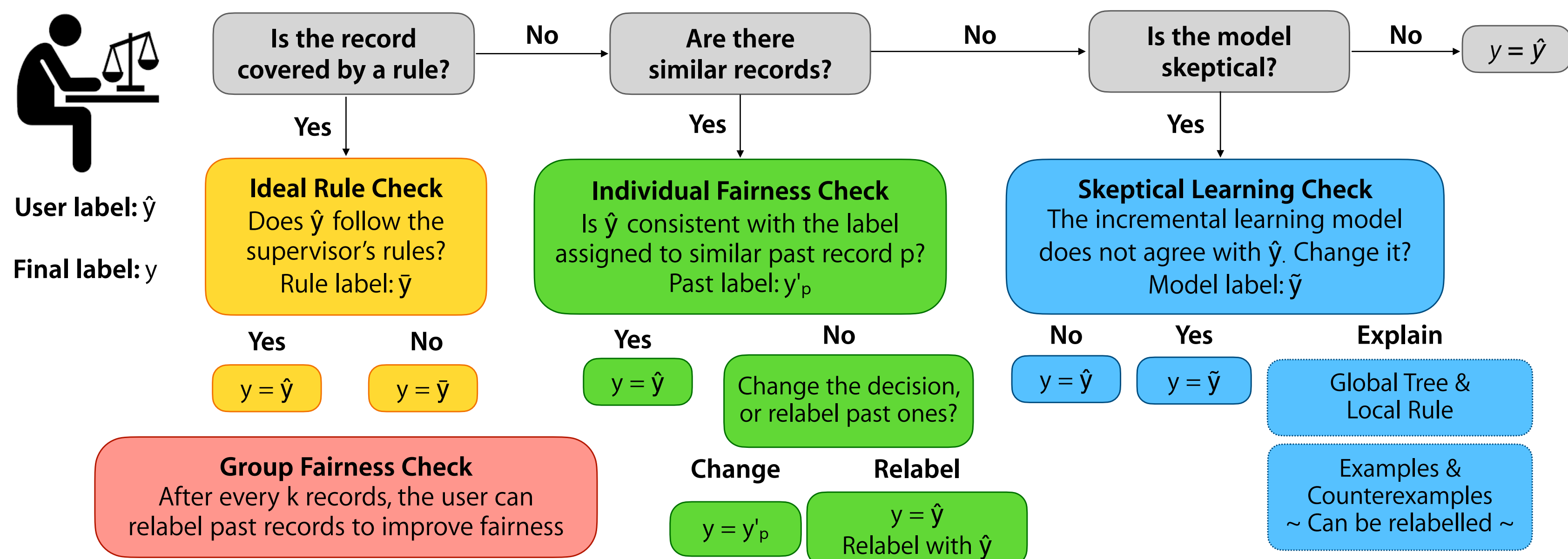
ARE YOU TASKED TO LABEL A DATASET? IF I DON'T AGREE WITH YOUR DECISIONS, I SUGGEST AN ALTERNATIVE TO HELP YOU STAY CONSISTENT.

I CAN ALSO HELP PEOPLE COOPERATE, SIMULATE THEIR FUTURE OR CHALLENGE THEM WITH EDGE-CASES OR INTERESTING SCENARIOS.
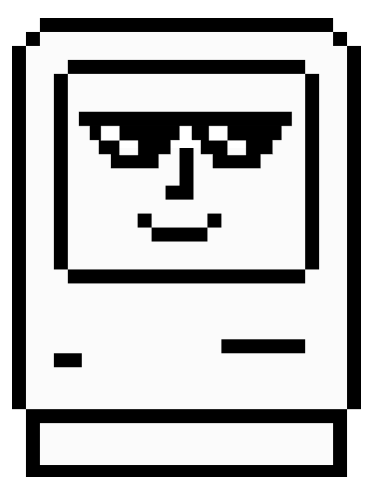
I'M FRANK! A FRIEND.

The now. Frank for Hybrid Decision Making

A user is tasked to label a dataset. Frank helps them stay consistent and fair.

User label: $\hat{y}$

Final label: y

Is the record covered by a rule? — No → **Are there similar records?** — No → **Is the model skeptical?** — No → $y = \hat{y}$

Yes ↓

Ideal Rule Check
Does $\hat{y}$ follow the supervisor's rules?
Rule label: $\bar{y}$

Yes → $y = \hat{y}$ No → $y = \bar{y}$

Group Fairness Check
After every k records, the user can relabel past records to improve fairness

Yes ↓ (similar records)

Individual Fairness Check
Is $\hat{y}$ consistent with the label assigned to similar past record p?
Past label: y'_p

Yes → $y = \hat{y}$

No → Change the decision, or relabel past ones?

Change → $y = y'_p$

Relabel → $y = \hat{y}$ Relabel with $\hat{y}$

Yes ↓ (model skeptical)

Skeptical Learning Check
The incremental learning model does not agree with $\hat{y}$. Change it?
Model label: $\tilde{y}$

No → $y = \hat{y}$ Yes → $y = \tilde{y}$ Explain → Global Tree & Local Rule

Examples & Counterexamples
~ Can be relabelled ~
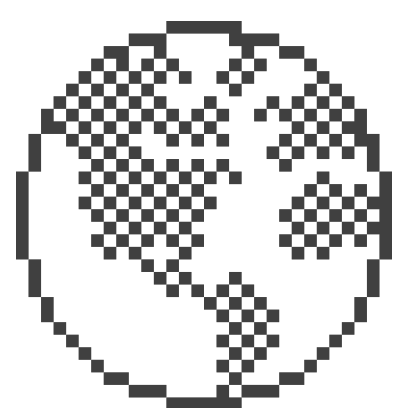
The future. Applications & Enhancements

Frank is in charge now!
Frank makes the decisions and, if unsure, asks the user.

Frank-Human Trust
Frank (dis-)/trusts the user, influencing the behaviour.

Federated Learning
Frank helps multiple users coordinate, and can find the "weakest link".
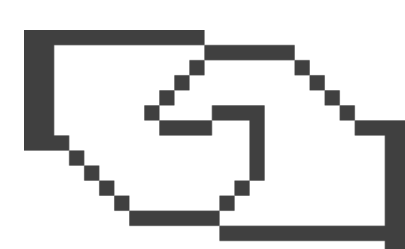
Linguistic Annotation
Frank challenges the two annotators, making them competing on edge-cases.

The endgame. Going further

Psychology
Frank helps with psychological diagnosis, evolving the tests following the patient's answers.

Social Relations
A network of humans is simulated by multiple Franks. How will it evolve?

Last but not least, Frank will also need a good **user interface**.

Frank is a project by Federico Mazzoni.
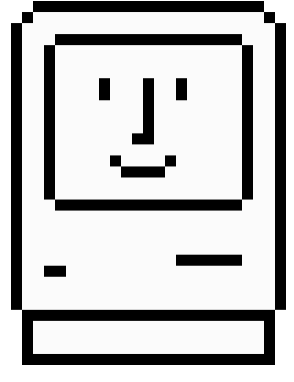Be frank, what do you think? Get in touch!

federico.mazzoni@phd.unipi.it
https://github.com/FedericoMz

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A Frank System for Co-Evolutionary Hybrid Decision-Making

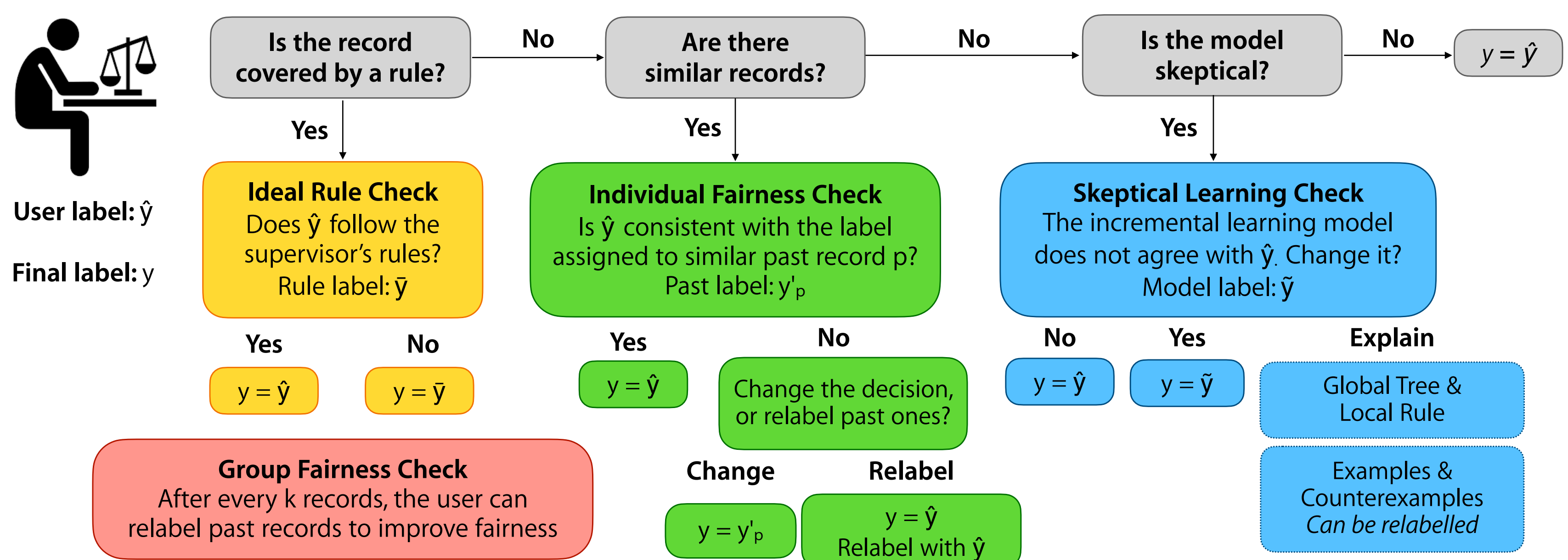HELLO, I'M FRANK! AN INCREMENTAL LEARNING SYSTEM. AND AN ASSISTANT.

I DON'T NEED A TRAINING SET. I LEARN LITTLE BY LITTLE FROM YOUR DECISIONS AND I CAN REPLICATE YOUR BEHAVIOUR. I EVOLVE WITH YOU.

I'M BASED ON SKEPTICAL LEARNING. ARE YOU TASKED TO LABEL A DATASET? IF I THINK YOU ARE INCONSISTENT WITH YOUR PAST BEHAVIOUR, I CAN SUGGEST AN ALTERNATIVE TO HELP YOU STAY CONSISTENT.

BUT I CAN ALSO HELP YOU FIGHTS YOUR HIDDEN BIASES, AND I CAN PROVIDE MORE AND MORE DETAILED EXPLANATIONS.

I'M FRANK. A FRIEND.

A user is tasked to label a dataset. Frank helps them stay consistent and fair.

User label: $\hat{y}$

Final label: y

Is the record covered by a rule? — No → **Are there similar records?** — No → **Is the model skeptical?** — No → $y = \hat{y}$

Ideal Rule Check
Does $\hat{y}$ follow the supervisor's rules?
Rule label: $\bar{y}$
- Yes → $y = \hat{y}$
- No → $y = \bar{y}$

Individual Fairness Check
Is $\hat{y}$ consistent with the label assigned to similar past record p?
Past label: y'_p
- Yes → $y = \hat{y}$
- No → Change the decision, or relabel past ones?
  - Change → $y = y'_p$
  - Relabel → $y = \hat{y}$ Relabel with $\hat{y}$

Skeptical Learning Check
The incremental learning model does not agree with $\hat{y}$. Change it?
Model label: $\tilde{y}$
- No → $y = \hat{y}$
- Yes → $y = \tilde{y}$
- Explain → Global Tree & Local Rule / Examples & Counterexamples *Can be relabelled*

Group Fairness Check
After every k records, the user can relabel past records to improve fairness

Ideal Rules. The user most follows decision rules set by the supervisor. The user cannot refuse.

Individual Fairness. *Similars individuals should be treated similarly (*e.g., a man and woman with the same background should receive the same label). If they aren't, the user is prompted to change either past decision(s) or the current one. The user cannot refuse.

Skeptical Learning. Skepticality is defined following the model's *confidence* (i.e., the prediction probability) and its *certainty* (i.e., its past track record). If the model's skeptical of the user's decision, it asks the user if they want to change it. The user can refuse.

Group Fairness. The distribution of the positive label should follow statistical parity between groups (e.g., 20% of men receives a positive label, 20% of women should too). If it isn't, the user is asked if they want to relabel suspicious past record. The user can refuse.

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