

Me, TRT, and probability

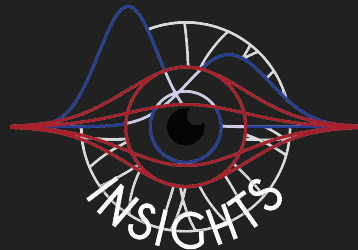
Nathan Simpson



LUND
UNIVERSITY



ATLAS
EXPERIMENT



Disclaimer: this talk
didn't exist until
yesterday night.

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So please be nice <3

Talk layout:

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- Overview of my PhD and where it's (probably) heading

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- Brief peek at TRT qualification work

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- Overview of my PhD and where it's (probably) heading
- Brief peek at TRT qualification work
- Something useful (I hope)
 - Bayes vs Frequentist

TAYLOR SWIFT



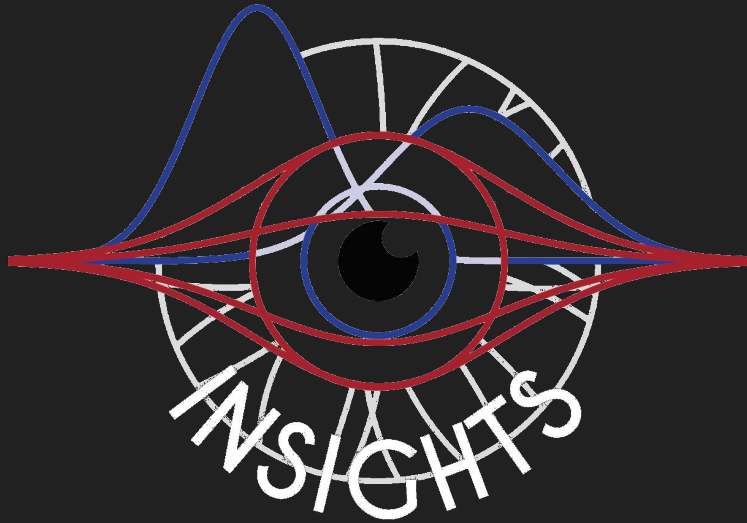
Caterina Doglioni

Me

Else Lytken

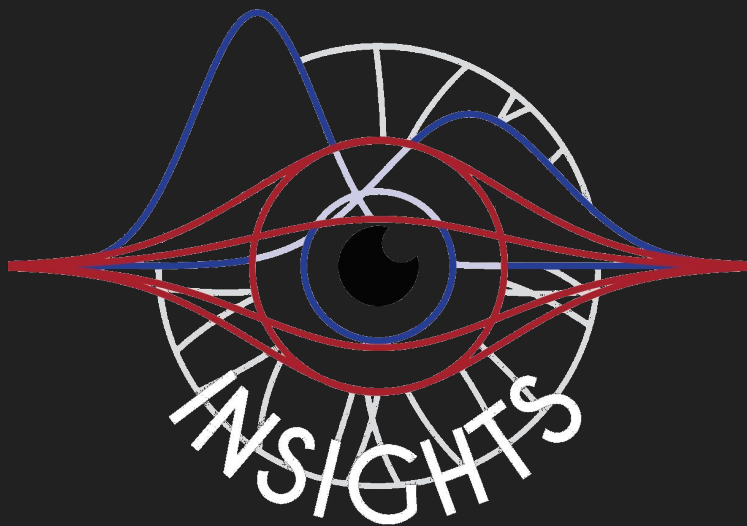


Pictured: Me signing my soul away to qualification tasks.



International Training Network of
Statistics for High Energy Physics
and Society

In no particular order...



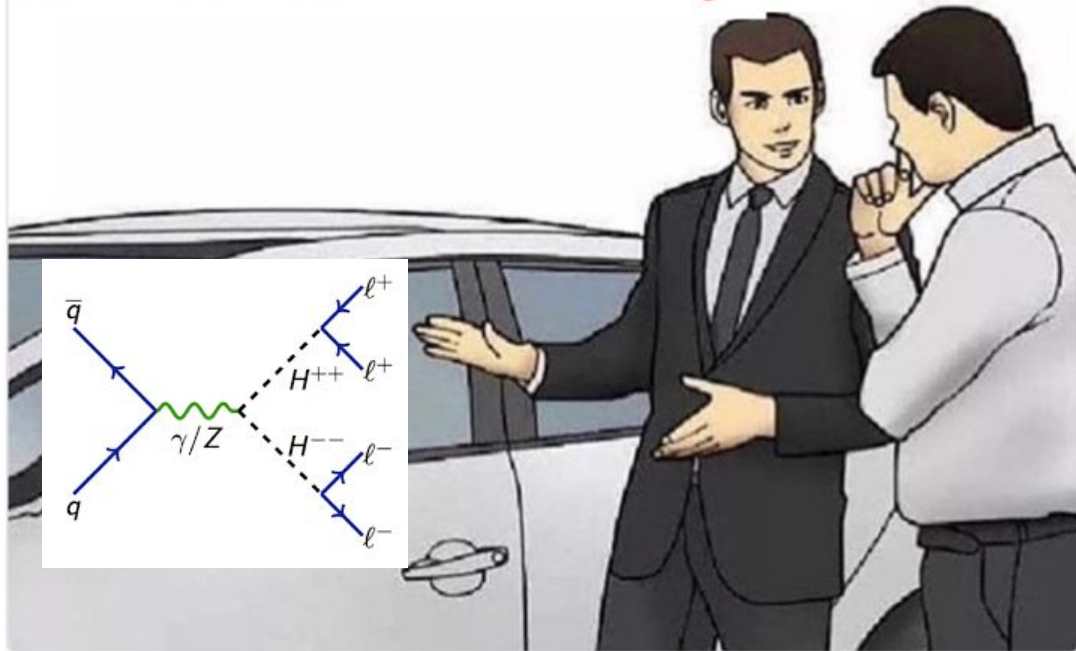
International Training Network of
Statistics for High Energy Physics
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In no particular order...

- 12 early stage researchers across 8 countries
- Many ML + stats schools (DESY, INFN, CERN)
- Wide variety of applications
- Industrial and academic secondments
 - For me: CERN, Pangea Formazione (Roma)

Thesis topic?

car salesman: *slaps roof of same-sign dilepton*
this bad boy
can fit so much machine learning in it



Right now: TRT
qualification task

Probability: Bayes vs Frequentist

$P(\text{SUSY})?$

Take a guess!

$P(\text{SUSY})?$

If you answered, congratulations on becoming a Bayesian ;)

Different interpretations of probability

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$P(\cdot)$ = Limiting fraction of outcomes drawn from an ensemble of similar experiments.

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Bayes:

$P(\cdot)$ = Degree of belief.

Subjective to You.

You can believe whatever you want about SUSY (it would appear people do indeed do this...)

...though one can inform their belief through theory and past experiments.

Inspired by Jonatan

Car = particle physicist



Bayes theorem

$$P(A | B) = \frac{P(B | A)P(A)}{P(B)}$$

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Does Bayes theorem apply only to Bayesian P? **No!**

Comes from axioms of probability theory.

Bayes theorem for Bayesian P

$$P(A | B) = \frac{P(B | A)P(A)}{P(B)}$$

Bayes theorem is a logical *if, then* machine that updates your prior beliefs about your model parameters in light of the data.

Sorry if that was
boring or trivial.

Two super nice resources for
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Two super nice resources for you:

Amazing intro to the fundamentals of statistics and why they matter to us in HEP (Bob Cousins):

<https://arxiv.org/abs/1807.05996>

Glen's PDG:

<http://pdg.lbl.gov/2014/reviews/rpp2014-rev-statistics.pdf>

If you want to
see Bayes in
action in HEP...



Harrison Prosper



The end!

You are now socially
permitted to get coffee.

Thanks for listening :)