How to Integrate Diverse Sources of Evidence

Learnings from the Lens Reputation System

Pedro Alcocer
Staff Data Scientist, Aave Companies / Lens Protocol
How do I integrate diverse sources of reputational evidence?
Represent your beliefs about reputation signals as beta distributions and use Bayesian updating to combine them.
What not to do:

\[
\begin{align*}
W_1 & \times S_1 \quad S_2 \quad S_3 = \text{Reputation}
\end{align*}
\]
What not to do:

\[ W1 \times S1 + W2 \times S2 + W3 \times S3 = \text{Reputation} \]
Information about the **variance** of your signals is lost.
Variance is how the **quality** of a signal is represented.
You’re throwing away information about quality.
Weighting without variance

The weight
Weighting with variance

A low quality signal

The weight
Weighting with variance

A high quality signal

The weight
The **beta distribution** is bound between 0 and 1 and takes two parameters: **alpha** and **beta**.
Holds rAave POAP (high quality)

\[ \text{Beta}(999, 1) \approx 1 \text{ out of every 1000 is a sybil} \]

Has ENS address (medium quality)

\[ \text{Beta}(99, 1) \approx 1 \text{ out of every 100 is a sybil} \]

Has Twitter account (low quality)

\[ \text{Beta}(9, 1) \approx 1 \text{ out of every 10 is a sybil} \]
Bayesian updating is a way of combining beliefs.
It’s really easy to update the beta distribution. Just add alphas and betas.
\[
\text{Beta}(999, 1) + \text{Beta}(99, 1) + \text{Beta}(9, 1) = \text{Beta}(1107, 3)
\]
Beta(3, 1) \times 50 \text{ signals} = \text{Beta}(150, 50)
Who would you rather trust?
Represent your beliefs about reputation signals as beta distributions and use Bayesian updating to combine them.
Thanks!

Pedro Alcocer
Leaf apps: pealco.lens
Bird app: @pealco
TG: pealco_xyz