TOPO: Trustless Blinded Data Verification in Astrophysics

Introduction

`TOPO` (Time-Ordered Provable Outputs) improves reproducibility and data integrity via blinded analysis using public cryptography.

Methodology

Deterministic Hashing: Ensures data/result integrity.
Merkle Trees: Efficient, trustless verification.
Cryptographic Signatures: User authentication.

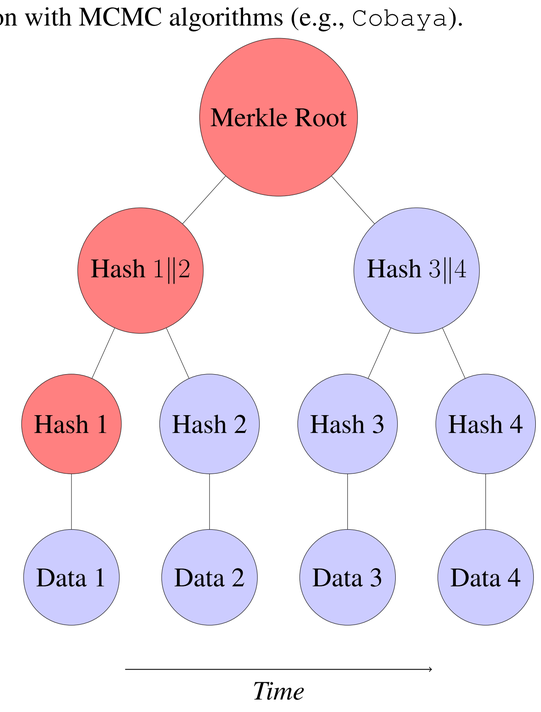
Steps

- **Step 1**: Freeze analysis pipeline (signatures/hashes).
- **Step 2**: Perform analysis.
- **Step 3**: Publish proof (Merkle Tree, verification).

Results

TOPO allows:

- Cryptographic verification of unmodified analysis pipeline.
- Integration with MCMC algorithms (e.g., `Cobaya`).



Conclusion

TOPO enables blinded analysis without bias, ensuring reproducibility through cryptographic validation.

Key Takeaway

TOPO sets a new standard for reproducibility in astrophysics.