

# BLOCKCHAIN-BASED ALGORITHMS FOR SECURE, COLLABORATIVE RISK ASSESSMENT AND DECISION MAKING

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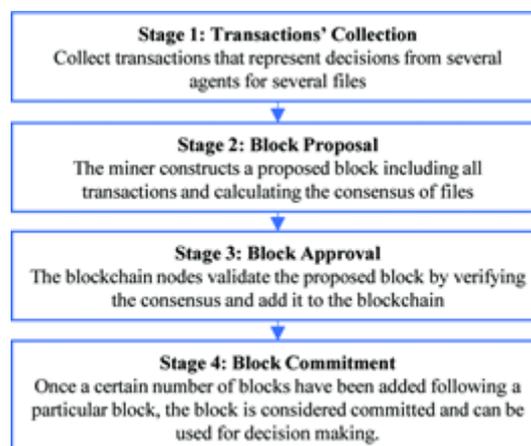
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## Technology Description

Researchers in Prof. Raj Jain's laboratory have developed a new type of algorithm that extends the security of decentralized blockchains from consensus validation to efficient group decision making. This technology, called "probabilistic blockchains", provides weighted analysis and risk assessment based on opinions that have only a certain probability to be true (as opposed to traditional blockchains which have a binary yes/no input to validate transactions). This enables distributed, collaborative decision making, with input from multiple parties (e.g., crowd sourcing, multiple companies, multiple nodes of a computer network) even if the participants are untrusting and may not completely agree on the outcome.

This technology is particularly useful for risk assessment where decisions need to be made based on imperfect information. For example, with stock market predictions, different agents provide a prediction of the future price and the probabilistic block chain could determine the consensus prediction by weighting their input based on past performance. The distributed architecture and continuous updating of this blockchain platform makes it provably secure against attackers who try to control the decision traditionally achieved with centralized controllers. In addition to financial services, the basic workflow could be applied to a wide variety of end user applications such as machine learning, recommendation systems or cybersecurity.



*Schematic of workflow for probabilistic blockchain*

## Stage of Research

*Proof of principle* - The inventors have developed software that implements the probabilistic blockchain

algorithm and demonstrated its feasibility and efficiency in cybersecurity for detecting intrusion in computer networks. They plan to further test the concept for risk assessment in additional multi-trust domains, such as financial decision-making and other networking applications.

## Applications

- **Decision-making and risk assessment tool** – decentralized blockchain-based analysis that enables crowd-sourcing, multi-company or in-company collaborative decision making, with end-user applications such as:
  - financial services – stock market predictions, allocating resources for investments
  - insurance – pricing based on risk assessment
  - cybersecurity – detecting network intrusion and spam
  - recommendation systems
  - machine learning – systemic feedback and learning to update models

## Key Advantages

- **Efficient and reliable:**
  - algorithms expedite decision-making and analysis, saving time and money for participating parties
  - collaborative/crowd-sourced decisions based on the opinions of many participants are more reliable than individual decisions
- **Secure and resilient to attack** – compared to conventional decision-making solutions, decentralized probabilistic blockchains provide protection against:
  - fraud - blocks and transactions are replicated in many nodes which makes it extremely difficult for malicious agents or miners to manipulate decisions
  - Distributed Denial of Service (DDoS) – there is no single point of vulnerability that can be attacked by requests, so the system is guaranteed to be available

## Publications

- Salman, T., Jain, R., & Gupta, L. (2018, November). [Probabilistic Blockchains: A Blockchain Paradigm for Collaborative Decision-Making](#). In 2018 9th IEEE Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON) (pp. 457-465). IEEE.

## Patents

- US 11,392,613

## Website

- [Raj Jain Profile](#)