COMPASS LITEPAPER DRAFT

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ABSTRACT

Compass Labs is building the AI infrastructure to optimize and automate decision-making on DeFi protocols. We combine the on-chain, code-based nature of the blockchain, with statistics, novel machine learning and recent advances in compute to tackle optimization opportunities. As a first product, we are developing CompassV1, a one-click interface using intelligent algorithms under the hood to automate and optimize dynamic liquidity provisioning to DeFi protocols. Right now, providing liquidity is complex and investors are not able to quantify risks such as impermanent. As a result, decentralized exchanges face significant liquidity risk because liquidity is concentrated to a few actors. Compass Labs solves this by leveraging the open source infrastructure of blockchain systems through our decision making engine, powered by Bayesian inference, agent-based simulation and reinforcement learning, to simplify the user experience and reduce barriers to entry for liquidity provisioning.

***K*eywords** Liquidity Provisioning · Machine Learning · DeFi

1 Introduction

Decentralized finance (DeFi) has grown to manage over $150 billion of assets from 2019 to 2021. DeFi aims to provide a trustless system of finance by replacing third-parties who control liquidity flows with smart contracts that manage rules for issuing debt and trading. The largest applications within the DeFi ecosystem are decentralized exchanges (DEXs). DEXs coordinate large-scale trading of crypto assets in a non-custodial manner through automated algorithms, as opposed to a centralized exchange (CEX) which requires the an intermediary to facilitate the transfer and custody of funds.

Generally, there are two requisites for any exchange: 1) matching of buyers and sellers; 2) ensuring a counterparty for each trade. On a CEX, buyers and sellers can submit prices (limit orders) at which they want to trade an asset. These orders are recorded on a limit order book, which matches buyers and sellers together to execute trades. Market makers are third party entities who buy and sell assets, thereby providing liquidity and reducing counterparty risk.

A DEX uses the idea of a liquidity pool to replace the limit order book. A liquidity pool is a collection of assets with which buyers and sellers can interact to execute trades. Each trade has a fee associated with it, a proportion of which is paid out to liquidity providers (LPs) as a reward for providing assets to the pool. LPs are therefore crucial to reduce counterparty risk, and in order to encourage LPs to invest on their platform, DEXs often provide high yields. Figure 1 summarises the interactions of the different agents with a liquidity pool.

In order to ensure liquidity within the pool, an automated market maker (AMM) is used to determine prices. Automated market makers are used to enable automatic trading of digital assets, and rely on a mathematical formula to price assets. For example, the first DEX, Uniswap, uses a constant product market maker rule to calculate prices [1]. However, AMMs come with discrepancies for both traders and LPs, such as slippage and impermanent loss.

Slippage refers to the difference between the expected price of an order and the price when the order actually executes. The slippage percentage indicates how much the price for a specific asset has moved. Due to the volatility of the token, the price of an asset can fluctuate depending on trade volume and activity. Slippage can be optimized for by using concentrated liquidity, where LPs provide liquidity in a specified price range [2]. However, whilst this improves the experience for traders, it makes providing liquidity more complicated.

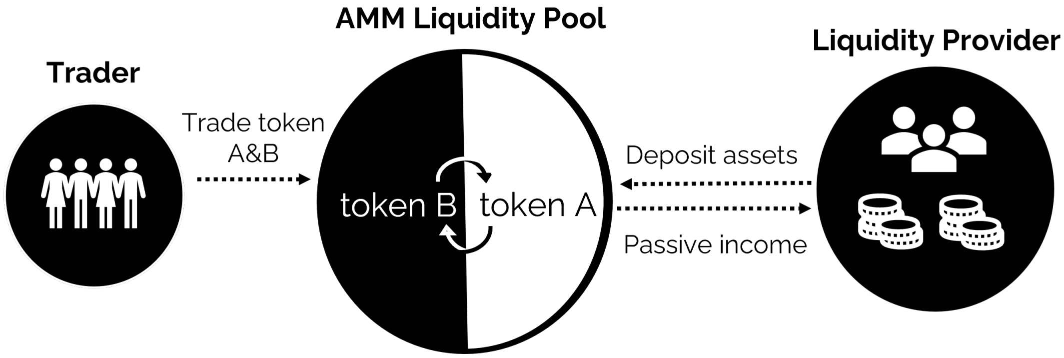

Figure 1: Liquidity pool interactions obeying an AMM rule

Impermanent loss is the unrealised loss that occurs when the share of an LP position becomes uneven compared to its original position. Effectively, this is the difference in profit between providing liquidity and simply holding the assets as a result of market movements. In an equal-ratio pool, such as Uniswap's liquidity pool, impermanent loss is driven by the volatility between the two assets. The Balancer protocol, for example, allows users to decide the level of impermanent loss by offering liquidity pools that can have up to 8 assets with different ratios. An LP position in a 95/5 pool will experience a much smaller impermanent loss compared to an LP position in a 50/50 pool.

2 Problem

Currently, providing liquidity is complex and constrained to high-net-worth individuals and institutional investors. For example, the average LP provides $\sim$ \$195k to the Balancer platform [3]. This presents a significant liquidity risk for DEXs, since a large proportion of the total value locked (TVL) is made up by a small percentage of LPs. Liquidity is therefore becoming concentrated in the hands of a few actors, which reduces the resistance of a DEX to censorship and manipulation.

The DeFi space lacks tools that quantify the risks LPs face. These risks are based on several factors related to FX price, protocol and liquidity pool type and gas price. Furthermore, the noise and information overload presented on DeFi platforms leads to decision fatigue and analysis paralysis.

Impermanent Loss Investors looking for passive investment via liquidity provisioning are not able to quantify the risks of impermanent loss when considering which pool they should provide liquidity to. While the APY earned via trading fees operate at a fairly regular rate, the loss of funds experienced by LPs because of the volatility in a trading pair can move unlimited downside. A recent study on impermanent loss conducted by crypto consultancy Topaze Blue found that around 50% of users staking their tokens in Uniswap V3 are suffering negative returns, and in certain pools, the percentage of users who lost more from impermanent loss than they gained in trading fees was as high as 70-75% [4].

Pool Complexity A decision must be made for which pool or combination of pools to provide liquidity to. Whilst this is simplest on DEXs with equal-ratio pools, the risk tolerance is yet to be chosen. For example, an investor can choose to provide liquidity for a stable coin pool, but there are many variants, each with a different APY. This process becomes even more difficult on DEXs such as Balancer which allow for multiple asset pools with different ratios, where there is further control over impermanent loss using asset mixes and optionality for pool creation.

Fee Optimisation Additionally, chain-dependent fee optimisation must be considered (e.g. gas fees). This can strongly inform decisions on portfolio rebalancing, where it is possible for fees to overcome the benefits of adjusting an investment position.

Smart Contract Risk A significant manual effort is required to understand and monitor the inner workings of smart contract systems; for example, with pegs and wrapped tokens. In the worst case, this can lead to disaster, such as the recent Terra ecosystem collapse [5], the signs of which were available to those who were actively looking.

Concentrated Liquidity As AMMs move towards concentrated liquidity, a decision must be made over which price range to provide liquidity [2]. This adds another layer of complexity for investors to navigate.

Solving for the optimal path with high yields hedged against large impermanent loss without an active management system is a laborious task for any investor.

3 Solution

We are developing CompassV1 to solve the issues outlined under Section 2. CompassV1 is a proprietary AI research stack to optimize and automate decision making for dynamic liquidity provisioning on DeFi protocols.

For CompassV1 we use a combination of on-chain transaction data and smart contract code to simulate how a protocol will behave in response to our actions. We then run agent-based simulations to train a Bayesian model together with reinforcement learning to derive a policy that maximized risk-adjusted returns, where the risk profile depends on a user-selected risk parameter.

Bayesian learning allows us to quantify uncertainty in our model to give explainability for the end user, which we communicate through analytics on our dashboard.

The nature of the machine learning algorithms we use allows the strategy we have developed to be easily adaptable across chains and protocols.

We present a simulation of our strategy on Balancer liquidity pools in Figure 2. This includes an illustration of the user tunable risk parameter, and clearly outperforms benchmarked solutions.

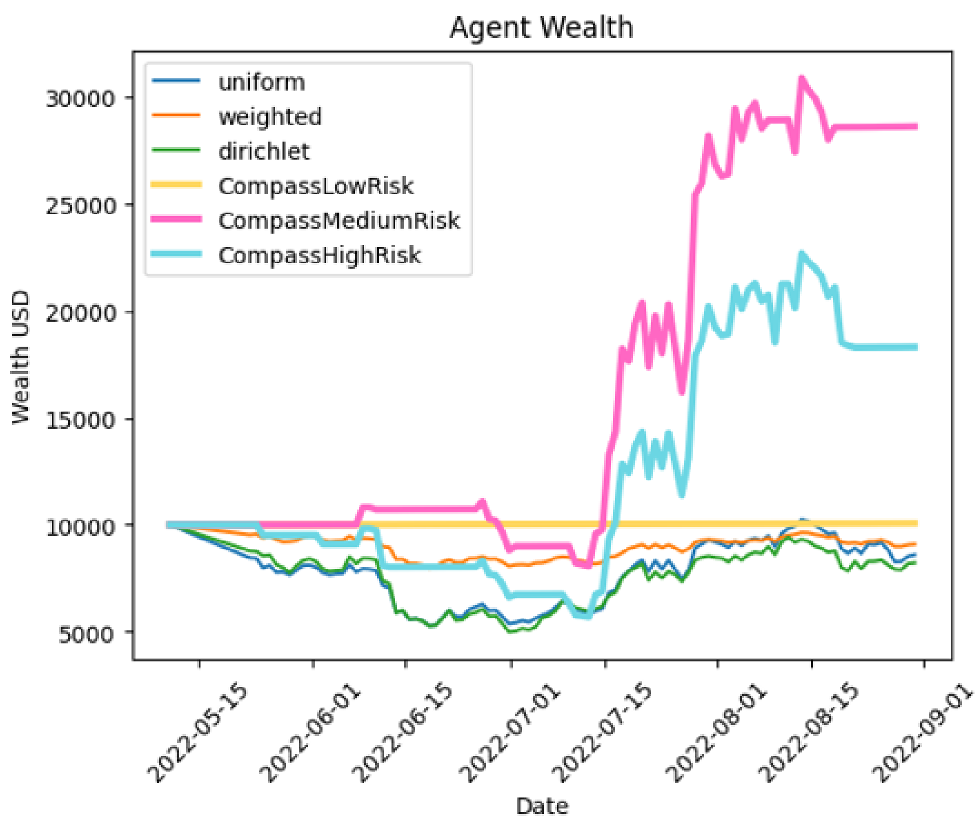

Figure 2: a) Simulation on Balancer liquidity pools with user-tunable risk parameter.

Compass' uses on-chain vaults that dynamically manage the end-users LP position. Each vault can be thought of as an intelligent optimization layer sitting between the liquidity provider and the corresponding liquidity pool on the DEX to enable non-uniform liquidity distribution strategies which are more capital efficient. Each vault has a strategy driven by novel machine learning and statistics that minimizes risk for a target APY. In order to maximise APY, all vaults have an auto-compounding component for yield farming rewards to be automatically sold and re-added to the vault. Each user that deposits funds into a vault will receive a share LP token which corresponds to the asset and fee share within the vault. A schematic is depicted in Figure 3 Such a system abstracts away the complexity of providing liquidity and enables all investors to participate in liquidity provisioning with a one-click experience.

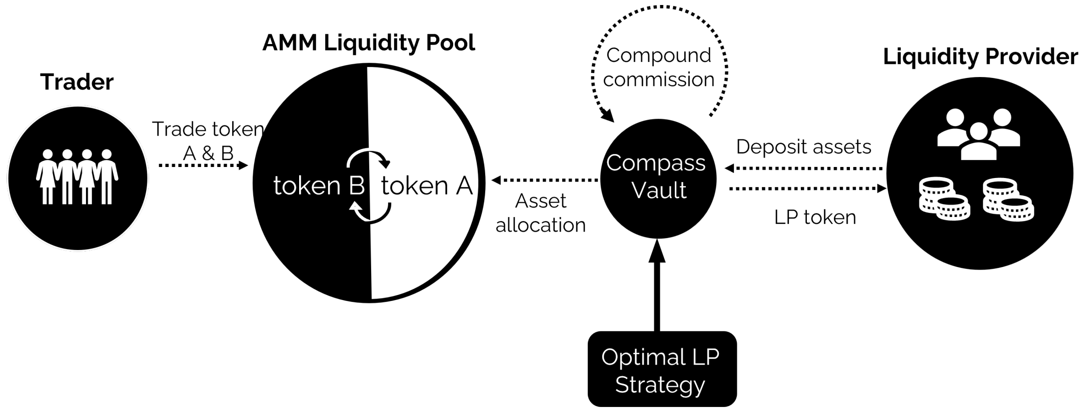

Figure 3: Active liquidity management systems using Compass vaults

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