Merlyn.AI
Unleash the Wizard

Merlyn.AI®
Index Methodologies

- **WIZ Bull-Rider Bear-Fighter®**
- **DUDE SectorSurfer® Momentum**

Rules, Objectives, and Guiding Principles
for Managing These Merlyn.AI® Indexes

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Merlyn.AI Index Methodology

I. Introduction

A. Index Overview

MAI Indexes is a service of SumGrowth Strategies, LLC (SGS), the "Index Provider" and "Index Administrator." SGS was launched in 2009 to integrate the merits of the cross-disciplinary sciences of Matched Filter Theory, Differential Signal Processing, and AI Genetic Algorithms into rules-based investment models seeking to improve the signal-to-noise ratio for investment selection and reduce remnant hindsight selection bias during its evaluation process. This document describes the methodology and construction of the following Indexes (the "Index" or "Indexes"):

- **Merlyn.AI® WIZ Bull-Rider Bear-Fighter® Index**
- **Merlyn.AI® DUDE SectorSurfer® Momentum Index**

Based on transparent and objective rules, Merlyn.AI Indexes are dynamic multi-asset indexes seeking to deliver higher returns and lower risk than a static portfolio composed of comparable assets. They are non-traditional Indexes that employ a combination of adaptive momentum filtering, active and passive risk reduction, integrated bear market strategies, quantitative analysis, digital signal processing, and complex feedback control system algorithms. They are fully automated, passively managed Indexes that produce their periodic investment selections without any discretionary input from an active manager. Eligible securities are limited to U.S. publicly traded ETFs deemed suitable to maintain the investability of the Index.

II. Index Construction Rules

A. Index Construction Overview

An Index consists of a portfolio of underlying momentum strategies, each with a particular thematic Category and an assigned allocation weight, as illustrated in Table 1. Each momentum strategy selects one ETF from within its thematic Category of candidate ETFs to represent the strategy in the portfolio. Momentum strategies seek to identify ETFs having the highest expected subsequent monthly return performance (the "Momentum Leader") relative to other candidates within its thematic Category.

Each Index additionally employs a proprietary Bull/Bear Indicator that seeks to determine whether U.S. equity markets appear to be in an advancing market (a "Bull" indicator) or appear to have an elevated risk of market decline (a "Bear" indicator). When a Bull market is indicated, the Index identifies a portfolio of ETFs, one selected by the momentum strategy associated with each of its thematic Categories. When a Bear market is indicated, each underlying momentum strategy automatically switches its model to a Bear market strategy by replacing the thematic candidate ETFs with a set of defensive candidate ETFs that generally perform better in Bear markets. The Index then identifies a portfolio of ETFs, one selected by the Bear market strategy associated with each of its thematic Categories. Bear market strategies seek to avoid the punishing losses of a market crash while striving for returns better than sitting on the sidelines in cash.

Table 1. Merlyn.AI® Indexes, their Thematic Categories, and Allocation Weights

WIZ Bull-Rider Bear-Fighter	
Category	**Weight**
Sectors-I	20%
Sectors-II	15%
Countries	15%
Regions	10%
Factors	10%
StyleMix	10%
Bonds-I	10%
Bonds-II	10%

DUDE SectorSurfer Momentum	
Category	**Weight**
Sectors-I	20%
Sectors-II	20%
Sectors-III	15%
Sectors-IV	15%
Geopol.Sectors-I	15%
Geopol.Sectors-II	15%

WIZ Bull-Rider Bear-Fighter - Summary

During Bull markets, the WIZ Bull-Rider Bear-Fighter Index selects a portfolio of eight thematic Category ETFs that approximate the 80/20 stocks/bonds ratio of a classic growth portfolio. Categories include Sectors (2), Countries, Regions, Factors, StyleMix, and Bonds (2). Its eight underlying strategies seek to improve returns by owning only the Category Momentum Leaders. During Bear markets, the Index seeks to avoid risk and secure a positive return by selecting at least four Momentum Leaders from among a broad selection of bond, treasury, and gold defensive ETFs.

DUDE SectorSurfer Momentum - Summary

During Bull markets, the DUDE SectorSurfer Momentum Index selects a portfolio of six thematic Category ETFs that approximate the 70/30 domestic/foreign equities ratio of a classic aggressive portfolio. Categories include Sectors (4), and Geopolitical Sectors (2). Its six underlying strategies seek to improve returns by owning only the Category Momentum Leaders. During Bear markets, the Index seeks to avoid risk and secure a positive return by selecting at least four Momentum Leaders from among a broad selection of bond, treasury, and gold defensive ETFs.

B. Bull/Bear Index Construction Process

The Index employs a proprietary market risk indicator (the Bull/Bear Indicator) that seeks to determine whether U.S. equity markets appear to be in an advancing market (a “Bull” indicator) or appear to have an elevated risk of market decline (a “Bear” indicator).

The Bull/Bear Indicator is an algorithm that assesses the risk of U.S. equity markets using four primary metrics: Price-Trend, Market Momentum, Value Sentiment, and Market Volatility (per section III-I). Price-Trend indicates the degree to which U.S. market securities prices are trending higher or lower. Market Momentum indicates the volume-adjusted price-trend of U.S. equity market securities to assess investor conviction. Value Sentiment indicates the recent proportion of U.S. equity market securities making 52-week highs against those making 52-week lows. Higher Market Volatility is correlated with a higher probability of declining markets and may indicate the possible onset of an extreme market decline.

The Bull/Bear Indicator algorithm additionally employs a set of secondary Validation tests to confirm the primary Bull/Bear indication and reduce the potential generation of whipsaw losses when market conditions suddenly shift in a direction opposite to that indicated by the primary metrics, or change character as a bear market deepens. These proprietary confirmation tests involve complex technical analysis, but may be summarized as follows:

- **False Alarm:** A Validation exception test checking for a recent new market high or various forms of near-term sharp market rebound that is used to prevent the Bear Indicator from false triggering.

- **Early Return:** A Validation exception test checking for various forms of sharp market rebounds during a Bear Indication that may warrant invalidating the Bear Indication and shifting to a Bull Indication. Tests additionally employ enabling conditions and proportionality of thresholds, for example a rebound >10% of the S&P500 resulting in its highest value in over 30 days, and an S&P500 rebound >75% in seven days following a recent drop of at least 5%.

- **Prolonged Bear:** When Prolonged Bear is negative it indicates that the current Bear market has been particularly long and thus (a) the above Validation tests are to be ignored and (b) that Price-Trend must now become positive before a shift from Bear to Bull can occur.

Each Index remains constructed using a "Bull" or "Bear" Index Construction Methodology, as the case may be, until a subsequent event triggers a change. Shifts generally occur at month-end, but may also occur by exception on any other day of the month (sometimes referred to as "mid-month") as described below. The Index is reconstructed and rebalanced at each month-end and following each shift of the Bull/Bear Indicator.

- **Bull to Bear:** The "Bear" indicator will be triggered (a) at month-end if any one of the three primary metrics Price-Trend, Market Momentum, and Value Sentiment is negative in value, declining further, and there are no Validation exceptions, or (b) at any time during the month when excess Market Volatility is indicated. Excess Market Volatility is measured with both a short-term SMA (simple moving average) and EMA (exponential moving average) measures of the VIX (volatility index) and confirmed by a strong flight to safety as indicated by the short-term differential movement between treasuries and equities.

- **Bear to Bull:** When the Prolonged Bear is positive, the "Bull" indicator is triggered (a) at month-end if any one of the three primary metrics Price-Trend, Market Momentum, and Value Sentiment is positive in value and the others are all increasing, or (b) at any time during the month when the Early Return Validation test becomes "True". When the Prolonged Bear is negative the "Bull" indicator is triggered at month-end if both Price-Trend and Market Momentum are positive in value.

The Bull/Bear Indicator is published online daily by the Index Provider as StormGuard-Armor at:
https://www.alphadailybrief.com/Pages/RiskAvoidance.aspx

C. Bull Index Construction Methodology

Step 1:
The Index Provider first identifies a set of broad investment Categories (listed below) having generally divergent investment objectives, and further divides each category into a set of Subcategories. A Category may also include a "broad U.S. equity markets" Subcategory that seeks to provide a performance floor for the Momentum Leader. Categories and Subcategories are viewed as general guidelines. The scope of each is interpreted broadly as many Categories and Subcategories of ETFs inherently overlap. As a result, a single ETF may be included in multiple Categories and Subcategories.

- The "Sectors" Category includes ETFs that invest primarily in one of several economic sector Subcategories, such as healthcare, energy, technology, and finance.

- The "Global/Regions" Category includes ETFs that invest primarily in one of several broad geopolitical region Subcategories, such as global, Europe, Asia Pacific, North America, and emerging markets.

- The "Countries" Category includes ETFs that invest primarily in a single country, which can be any country in the world.

- The "Geopolitical Sectors" Category includes ETFs that invest primarily in one of several broad geopolitical region Subcategories, such as global, Europe, Asia Pacific, North America, emerging markets, an individual country, or one of several global economic sectors.

- The "Factors" Category includes ETFs that invest primarily based on one of several investment factor Subcategories, such as value, growth, dividends, earnings, size, and momentum.

- The "Dividends" Category includes ETFs that invest primarily based on one of several dividend Subcategories, such as general, high, quality, achievers, and growth.

- The "Style Mix" Category includes ETFs that invest primarily based on one of several investment style Subcategories, such as large-cap, large-cap growth, large-cap value, mid-cap, mid-cap growth, mid-cap value, small-cap value, equal weight, growth, and value.

- The "Bonds" Category includes ETFs that invest primarily in one of several bond Subcategories, such as treasuries, aggregate bonds, corporate bonds, mortgage bonds, muni bonds, and high-yield bonds.

The Bull Universe excludes, among others: (1) certain small ETFs (based on assets under management); (2) currency ETFs; (3) leveraged ETFs; (4) inverse ETFs; (5) utility ETFs; (6) commodity ETFs; (7) global/foreign fixed income ETFs; and (8) ETFs with less than one year of operating of history. The foregoing exclusions are viewed as general guidelines based on the relevant ETF's name and investment objective. The Fund's underlying ETFs may, from time to time, hold the foregoing types of securities in their portfolios. This is required as some ETFs do not follow a pure investment strategy or the investment strategy is subject to interpretation.

Step 2:

In the second step of the Bull Index Construction Methodology, the Index Provider determines the Bull Universe of ETFs for each Category and Subcategory. The Index Provider initially screens ETFs based on information provided by the ETF's name and investment objectives to identify candidates for membership in a particular Category and Subcategory. The Index Provider then further screens each candidate by conducting a correlation test with other Subcategory members or candidates to confirm that the candidate being evaluated is sufficiently similar to become a member of the Subcategory's Universe of ETFs.

Correlation screening over a 10-year period is employed where possible, with a period of one year considered as the minimum for sufficient confirmation of categorization implied by the ETF's name and investment objectives. Visual performance correlation is preferred to simplistic correlation calculations because important nuances are often lost in an agnostic computation resulting in a single number. Numerically, a minimum correlation between 70% and 90% is required to confirm membership in a Subcategory. The level of the minimum correlation depends on the homogeneity of the respective Subcategory, with for example individual Style Factors ETFs being at the 90% threshold, Medium- or Long Term Bonds ETFs at 80% and more heterogenous categories such as Short-Term Bonds as well as Style Mix ETFs at 70%.

On an annual basis, the Index Management Committee will screen non-excluded ETFs for possible inclusion in one or more Subcategories. For logistical and incremental value reasons, the target number of members in a Subcategory is a maximum of 15 ETFs. The following factors will be considered by the Index Management Committee when determining inclusion:

- Length of data history
- The fund's AUM
- Relative volatility
- Expense ratio

In addition to the above rules, expert judgement is applied by the Index Provider in the selection of the funds ETFs. This is required as cutoff threshold for correlation or the period over which it is measured do not hold for all different asset classes and periods of time. In case the sanity checks of the Index Provider flag such cases, a judgement call is required to resolve possible misclassifications and to determine whether a fund is included or not. This can lead to a Subcategory (such as the Healthcare sector) optionally including subsector funds (such as Pharmaceuticals), which are more narrowly focused and may form an additional Subcategory membership group against which a candidate's correlation can be evaluated and confirmed.

Step 3:
In the third step of the Bull Index Construction Methodology, the Index seeks to improve the performance of its portfolio of thematic Category momentum strategies, each of which selects a single ETF to represent the Category in the Index. Multiple instances of some Categories may be employed to increase diversification or improve trading logistics. The Index develops up to 12 unique evaluation Models for each of its Categories. Each Model is comprised of a different mix of candidate ETFs from its associated Subcategory. (Figs. 1a - 1d). At month-end, each Model selects the ETF having the highest expected subsequent monthly return performance relative to its other candidate ETFs (the "Momentum Leader"), and each Category selects the overall Momentum Leader from among the selections made by its underlying Models.

The Index employs a proprietary AI Genetic Algorithm to periodically evolve the set of candidate ETFs associated with its set of evaluation Models. The AI Genetic Algorithm seeks to eliminate hindsight selection bias and adapt the Models to changing market conditions (Section II-I). To identify the Momentum Leader, each of the twelve Models employs a Progressive Tuning algorithm (Section II-J) that aims to adapt to the market's evolving character and eliminate classic tuning hindsight bias.

Step 4:
In the final step of the Bull Index Construction Methodology construction, a Duplicate Reduction algorithm (Section III-K) identifies instances of duplicate selections and attempts to find suitable alternatives from the same Subcategory. If a suitable alternative cannot be found, duplicate ETF selections are permitted. Nevertheless, at least the minimum number of unique Bull ETFs specified in Table 2 will be selected.

Table 2. Bull Categories and ETF Selections

Index Name	Thematic Categories	Unique ETFs Selected
Bull-Rider Bear-Fighter	8	6 to 8
SectorSurfer Momentum	6	4 to 6

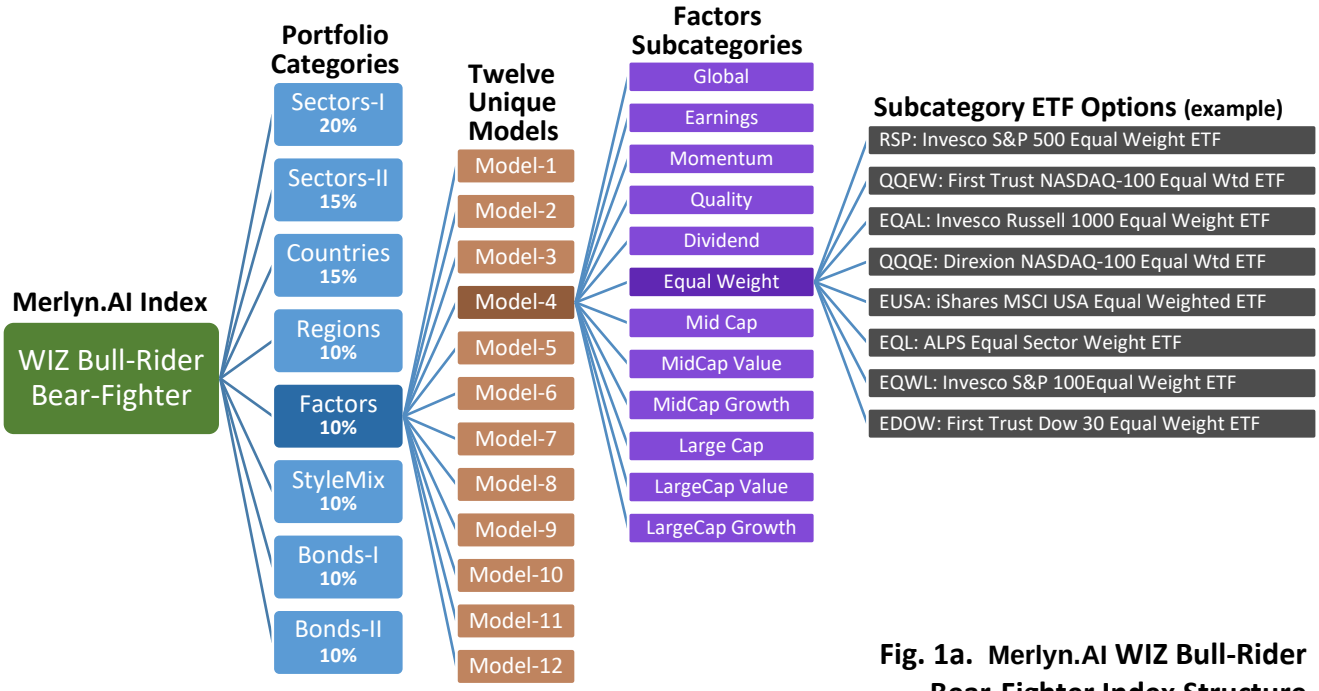

Fig. 1a. Merlyn.AI WIZ Bull-Rider Bear-Fighter Index Structure

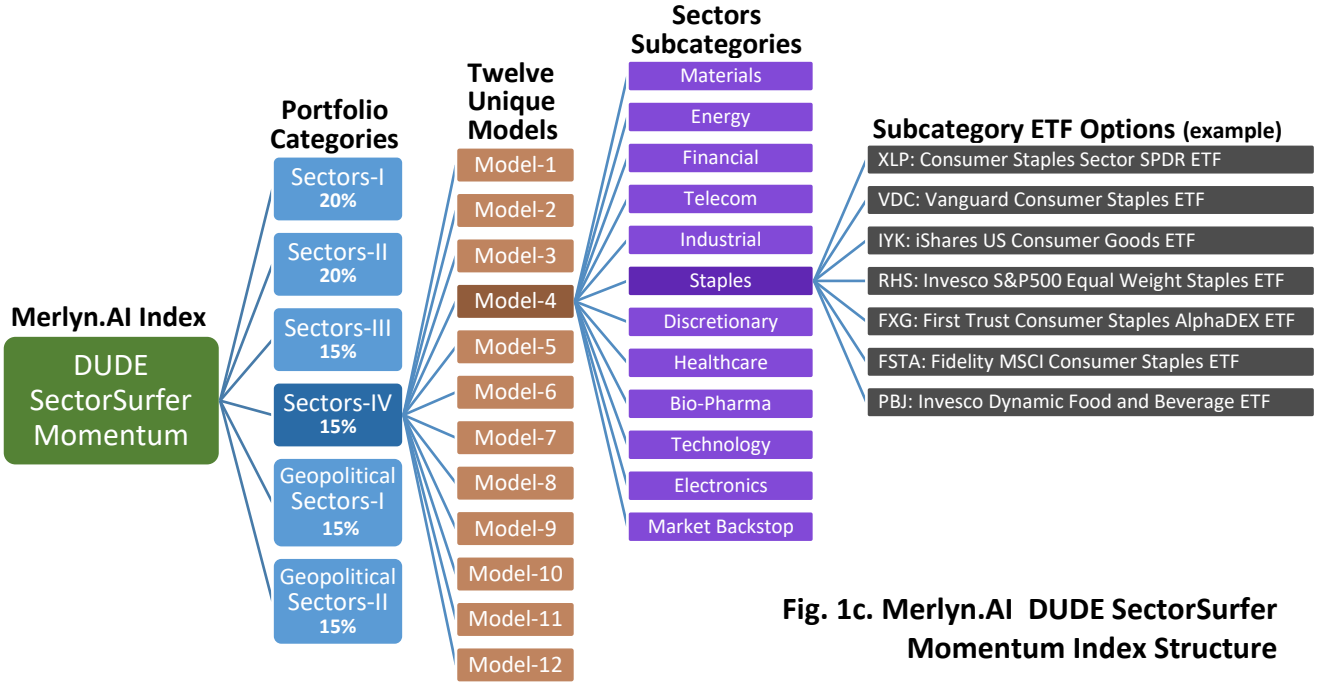

Fig. 1c. Merlyn.AI DUDE SectorSurfer Momentum Index Structure

D. Bear Index Construction Methodology

Step 1:
The Index Provider first identifies a set of investment Subcategories for the Bear Market Category having generally defensive investment objectives. The Bear Universe Subcategories include (1) inflation-protected treasury; (2) US treasury; (3) aggregate bond; (4) short- and long-term bond; (5) corporate bond; (6) high-yield bond; (7) gold; and (8) broad-based U.S. equity market index (seeking better returns during a bear market rebound). However, if the Bear Indicator was triggered due to excess Market Volatility, the Index's Bear Universe will include only US Treasury ETFs.

The Bear Universe excludes, among others: (1) leveraged ETFs; (2) inverse ETFs; (3) currency ETFs; (4) short-term treasury and money market ETFs; (5) global/foreign fixed income ETFs; (6) commodity ETFs (except gold); (7) equity ETFs (except broad-based U.S. equity market index ETFs); (8) ETFs with less than $500 million of assets under management; and (9) ETFs with less than one year of operating of history. Each of the foregoing exclusions is based only on the relevant ETF's name and investment objective; and as a result, the Fund's underlying ETFs may, from time to time, hold the foregoing types of securities in their portfolios. This is required as some ETFs do not follow a pure investment strategy or the investment strategy is subject to interpretation. As a result, a single ETF may also be included in more than one Subcategory.

In addition to the above rules, expert judgement is applied by the Index Provider in the selection of the funds ETFs. This is required as cutoff threshold for correlation or the period over which it is measured do not hold for all different asset classes and periods of time. In case the sanity checks of the Index Provider flag such cases, a judgement call is required to resolve possible misclassifications and to determine whether a fund is included or not.

Step 2:
In the second step of the Bear Index Construction Methodology, the Index creates two defensive Bear Models, each incorporating a different mix of Bear Universe ETFs. One will typically select more conservative ETFs from the Bear Universe (the "Conservative Model") and the other will select more aggressive ETFs from the Bear Universe (the "Aggressive Model"). Each Index Category is assigned one of these two Bear Models, and thus each Index Category will select its Bear Momentum Leader. Because there are so few defensive fund options, the Categories of an Index will generally select one or more duplicate defensive ETFs.

Step 3:
In the final step of the Bear Index Construction Methodology, a Duplicate Reduction algorithm (Section III-K) identifies instances of duplicate selections and attempts to find suitable alternatives from the same Subcategory, by selecting the one with the highest correlation in the past two months. If a suitable alternative cannot be found, duplicate ETF selections are permitted. Nevertheless, at least the minimum number of unique Bear ETFs specified in Table 3 will be selected.

Table 3. Defensive models and ETF Selections

Index Name	Thematic Categories	Unique ETFs Selected
Bull-Rider Bear-Fighter	2	4 to 8
SectorSurfer Momentum	2	4 to 6

E. Polymorphic Momentum – Forward-Walk Progressive-Tuning

"Poly," meaning many, and "morph," meaning change, describe the nature of the momentum filter design for the Indexes. Momentum filters may be either double exponential moving average (DEMA) or triple exponential moving average (TEMA) in form and are progressively re-tuned each month-end when the Index is reconstructed and rebalanced.

Progressive Tuning allows the Models to automatically adapt to (1) the ever-changing character of the market, and (2) the very different combinations of ETFs each Model may present for analysis. At each re-tuning interval, past performance (in-sample data) over a range of momentum filter time constants is reviewed to determine the parameters to be used during the subsequent month (out-of-sample data). This "forward walk" optimization process is widely used in model design to eliminate hindsight bias in tuning algorithm parameters. The filter time constants typically range from 11 days to 105 days depending on the absolute and differential noise characteristics of the candidate ETF daily data. The Index Provider sometimes refers to this process as "Progressive Tuning" or as "Forward-Walk Progressive-Tuning."

F. Genetic Algorithm – Eliminating Hindsight Selection Bias

Hindsight selection bias can be problematic in simple backtested investment models because funds that made a model perform well in the past may not continue to do so in the future. These Indexes employ Merlyn.AI Genetic Algorithms designed to both expand the universe of candidate ETFs and evolve a population of candidate momentum Models on a monthly basis seeking to continuously adapt to the market's evolving character while eliminating hindsight bias in the ETF selection process.

The Merlyn.AI Genetic Algorithm typically evolves a population of 12 Models through mutation and crossover in much the same way as populations of plants and animals naturally evolve. Consider the analogy where each ETF Subcategory represents a different animal body part. When animals evolve, their child's legs might be different in some way, but they will not have turned into arms or heads. The same concept applies to the Index Category Models – meaning that if the Subcategory evolved happened to be energy, then the child Model will have a different energy Subcategory ETF than its parent. As a result, the child Model will perform slightly better or worse than its parent.

In evolution through crossover, the child gets some of its genes from one parent and some from another parent. Here, the child Model starts with the Subcategory ETFs of its parent but then replaces one of its Subcategory ETFs with the ETF of the same Subcategory used by one of the other 12 Category Models. In evolution through mutation, the child Model starts with the Subcategory ETFs of its parent but then replaces one of its Subcategory ETFs with an alternative ETF that is a member of the same Subcategory.

If the child Model evolves (through mutation or crossover) to have a better Fitness (a measure of risk-adjusted return performance, see Section III-F) than the parent Model, then the child Model replaces the parent Model going forward. Otherwise, the child Model is discarded and the parent Model continues forward.

Index Categories employing the Genetic Algorithm create and evolve an underlying population of 12 unique Models. Each month, the Genetic Algorithm utilizes the following process steps to evolve each of the unique Models attempting to improve their overall Fitness. Together, the 12 Models vote to determine which one of their momentum-leading ETFs will represent the Category in the Index.

The steps include:

- For each of the 12 underlying evaluation Models:
  - Select one of its candidate ETFs for possible genetic mutation
  - Create a list of potential substitute ETFs from its Subcategory
  - Rank the list according to their current momentum value
  - Substitute the highest-ranking one for the ETF selected for mutation
  - Evaluate the mutant child Model for its Fitness (return and risk)
  - If the mutant child Model has better Fitness, the child replaces the parent

- For each of the 12 underlying evaluation Models:
  - Select one of its candidate ETFs for possible genetic crossover
  - Select a different underlying strategy as the donor for the genetic crossover
  - Substitute the corresponding ETF from the donor into the recipient child
  - Evaluate the crossover child Model for its Fitness (return and risk)
  - If the crossover child Model has better Fitness, replace the parent with the child

- Create a voting strategy for determining the Momentum Leader among the 12 Models
  - Create a list comprised of the Momentum Leaders from each of the 12 Models
  - Use the list of Momentum Leaders as candidate ETFs for the voting strategy
  - Evaluate the voting strategy to determine the ultimate Momentum Leader
  - The ultimate Momentum Leader represents the Category within the Index

III. Calculations and Rules

A. EMA, DEMA, TEMA

EMA is the exponential moving average, DEMA the double exponential moving average, and TEMA is the triple exponential moving average of a data series computed as follows:

$$\boldsymbol{EMA(n)} = \frac{Val(n)}{d} + EMA(n-1) * \left(1 - \frac{1}{d}\right)$$

$$\boldsymbol{DEMA(n)} = \frac{EMA(n)}{d} + DEMA(n-1) * (1 - \frac{1}{d})$$

$$\boldsymbol{TEMA(n)} = \frac{DEMA(n)}{d} + TEMA(n-1) * (1 - \frac{1}{d})$$

Where:

- d = the EMA filter time constant in days.
- $V(n)$ = the value of raw data on the nth day.
- $EMA(n)$ = the EMA value on the nth day
- $DEMA(n)$ = the DEMA value on the nth day
- $TEMA(n)$ = the TEMA value on the nth day

B. Trend Leader vs Momentum Leader

The trend leader is the fund with the highest DEMA or TEMA of its daily return data series. The choice between the DEMA or TEMA filter is determined by the performance/Fitness of the strategy. The Momentum Leader is the fund with the highest expected subsequent monthly return performance. Generally, the Momentum Leader is the Trend Leader. However, following an overbought or oversold condition, mean reversion principles may apply for a period of time resulting in the projected Momentum Leader being the opposite of the Trend Leader.

$$\boldsymbol{TrendLeader} = IndexOfMax\big(Trend(i)\big) \ \ldots \ for\ i = 1\ to\ 12$$

Where:

- i = the index, 1 to 12, of a strategy's candidate funds
- $Trend(i)$ = the trend value of the i^{th} candidate fund
- $IndexOfMax(f(i))$ = the index of fund(i) having the highest trend

C. CAGR – Compound Annual Growth Rate

The CAGR is the annualized return for an investment.

$$\boldsymbol{CAGR} = \left(\frac{EndPrice}{StartPrice}\right)^{\frac{1}{yrs}} - 1$$

Where:

- yrs = the number of years the investment was held

D. Quarterly Downside Deviation

The underlying measure of risk used herein will be the Quarterly Downside Deviation (QDD), which is calculated as the root mean square of negative quarterly returns, sampled daily over the portfolio's data span. More specifically:

$$\boldsymbol{Quarterly\ Downside\ Deviation} = \sqrt{\frac{\sum_{i\,=\,1+3mo}^{Total\ Days}\left[Min\left(\frac{p(i)}{p(i-3mo)} - 1,\ 0\right)\right]^2}{Total\ Days - 3mo}}$$

Where:

- $Total\ Days$ = the number of market days in the evaluation period.
- $3mo$ = one quarter of a year, typically 63 market days.
- $p(i)$ = the equity curve value on day i.

E. Relative Risk

Relative Risk is a ratio between the Quarterly Downside Deviation (QDD) of a strategy versus the Quarterly Downside Deviation of a very aggressive traditional portfolio consisting of 70% VFINX and 30% VTRIX measured from 1/2/2004 to the present.

$$\boldsymbol{RelativeRisk} = QDD_{TestPortfolio}/QDD_{AggressivePortfolio}$$

F. Fitness

Fitness is a Genetic Algorithm term used to judge the relative performance/value of a population member. The Fitness value used in the MAI Categories is the 5yr CAGR divided by its Relative Risk.

$$\boldsymbol{Fitness} = CAGR_{5yr}/RelativeRisk$$

G. Score

The Score value for a strategy is a risk-adjusted return that includes the CAGR for all years, the CAGR for the most recent three years, and the RelativeRisk value for the Strategy.

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$$\boldsymbol{Score} = (CAGR_{AllYrs} + CAGR_{3Yrs} / 2) / (40\% + RelativeRisk)$$

H. Progressive Tuning

At each six-month interval, the Tuning Time Constant for the momentum filter is re-evaluated by evaluating the ***Score*** of a strategy's performance over a range of 20 time constants ranging from 11 days to 105 days with an interval determined by a geometric ratio step size of 1.125. The tuning time constant producing the best ***Score*** will be used for the momentum filter algorithm for the subsequent six-month period of time.

$$\boldsymbol{TimeConstant}(i) = 10 * 1.125^{i} \quad \ldots \quad for\ i = 1\ to\ 20$$

$$\boldsymbol{BestIndex} = IndexOfMax\big(Score(TimeConstant(i))\big) \ \ldots\ for\ i = 1\ to\ 20$$

$$\boldsymbol{TuningTimeConstant} = TimeConstant(BestIndex)$$

Where:

- *i* = the index, 1 to 20, of a strategy's candidate funds
- *TimeConstant(i)* = the momentum filter time constant in market days
- *Score(TimeConstant(i))* = the ***Score*** of the strategy using *TimeConstant(i)*
- *IndexOfMax(Score(TimeConstant(i))* = the index of the one with the best ***Score***
- *TuningTimeConstant* = the final momentum filter time constant in market days

I. Price-Trend, Market Momentum, Value Sentiment, and Market Volatility

The Price-Trend is calculated as the 50d DEMA of the S&P500 composite index daily return, scaled monthly (21 market days), and offset by +0.5%. The Market Momentum is calculated as the 50d DEMA of the Volume-Adjusted S&P500 composite index daily return, scaled monthly, and offset by +0.5%. The Volume-Adjusted S&P500 composite daily return scales the daily return in proportion to the square of the UpVolume/TotalVolume +.5

$$\boldsymbol{PriceTrend} = 21 * DEMA_{50d}(DailyReturnS\&P500) + 0.5\%$$

$$\boldsymbol{VolAdjustedDailyReturnS\&P500} = DailyReturnS\&P500 * [UpVolume/TotalVolume + .5]^2$$
$$\boldsymbol{MarketMomentum} = 21 * DEMA_{50d} * (VolAdjustedDailyReturnS\&P500) + 0.5\%$$

$$\boldsymbol{AvgHighsPlusLows} = EMA_{255d}(NewHighs + NewLows)$$
$$\boldsymbol{ValueSentiment} = EMA_{15d}(2 * NewLows/AvgHighsPlusLows)/66$$

Where:

- *UpVolume and TotalVolume* are trading volume of US Markets
- *NewHighs and NewLows* are rolling 52-week of US Markets

$$\boldsymbol{MarketVolatility} \cong 2 * EMA_{4d}(VIX)/3$$

Where:

- $Trigger\ Threshold = 20$

Trigger Conditions:

- $EMA_{7d}(S\&P500\ Daily\ Return) < -0.15$
- $EMA_{7d}(VUSTX\ Daily\ Return) > 0.05$
- $STA.LTA_{4d}(VIX\ Value) > 3$

J. Duplicate Reduction Rule

When a Category selects the same ETF already selected by another Category, a suitable substitute is identified to improve diversification and trading logistics. The set of candidate substitutes is limited to the set of ETFs belonging to the same Sector/Asset Class. The candidate substitutes are ranked as follows, and the list is searched for the first non-duplicative instance with a *Ranking* > 0.95. Failure to find a suitable substitute generally results in accepting a duplicate selection.

$$\boldsymbol{Ranking} = Correlation_{42d}(1 + Return_{42d})$$

Where:

- *Correlation* is the 42 market-day correlation between the selection and the candidate
- *Return* is the 42 market-day cumulative return of the candidate

K. Prolonged Bear

The Prolonged Bear indicator is calculated as the 90d EMA of the S&P500 composite index daily return. When negative it disables Bull to Bear Validation tests and disables Bear to Bull Cancellation tests.

$$\boldsymbol{ProlongedBear} = EMA_{90d}(DailyReturnS\&P500)$$

L. Minimum AUM Exclusion Rule

The Index Methodology excludes certain ETFs based on assets under management (AUM). Each month-end, candidate ETFs for each underlying Model of each Index Category are checked to ensure their current AUM meets the minimum required. When an ETF fails to meet the minimum required AUM, if a suitable substitute cannot be found using the Duplicate Reduction Rule, the candidate ETF is simply eliminated. The minimum

AUM for Indexes and Categories is identified in the table below. Classification of funds for this purpose is algorithmically determined by its ticker symbol or information gleaned from its name:

ETF Category	Min. AUM
All Bond & Treasury ETFs	$500M
Gold ETFs	$500M
Broad Market Equity Index ETFs	$500M

ETF Category	Min. AUM
Factor ETFs	$250M
Sector ETFs	$150M
Other ETFs	$150M

M. 12(d)-1 Rule Satisfaction

The Indexes (individually or jointly) may occasionally select ETFs with insufficient AUM per Section 12D-1 under the Investment Company Act of 1940 for a fund's trades to be completely executed by the fund advisor. To overcome the 3% max ownership limitation the fund advisor (1) has acquired "Participation Agreements" from many of the larger asset managers, and (2) asked for an automated list of highly correlated suitable alternates that reasonably satisfy the selection allocations of the Index.

Following each Index reconstruction, the Index Provider employs the algorithms of the Duplicate Reduction Rule to include both a first and second alternate fund selection for each fund selection made by an Index in its Index Construction report to the fund advisor.

N. Golden Rule

An automated algorithmic check automates the process of complying with the US Treasury's diversification rule (Reg M), which mandates that an ETF must hold no more than 50% of its assets in commodities (such as the GLD SPDR Gold Shares ETF). The Index's allocation to such ETFs is algorithmically limited to 40% (to provide margin for differences in the subsequent monthly returns of the selected ETFs). In the event that the additional allocation of an Index's selection would surpass the 40% limit, the best acceptable alternative ETF is automatically substituted as its selection.

III. Index Evaluation and Rebalancing

A. Evaluation and Rebalancing Schedule

All MAI Indexes are normally evaluated following the last trading day of the month. However, the Bull/Bear Indicator may at times change mid-month in response to a significant punctuated event, such as an extraordinary sharp market rebound or a "black swan" excess volatility event, as determined algorithmically. Rebalancing becomes effective at the close of the second subsequent trading day for trades produced by the Index. Each Category typically produces 4 to 5 trades per year.

B. Target Buffer Weights

To help minimize turnover, buffers of +/- 10% of the target weight may be applied to the target weight of each of the Categories. If the weight of any individual Category deviates by more than the buffer amount from its target weight, the Category will be rebalanced back to its target weight at the next monthly evaluation.

C. Index Turnover (approximate annual, including backtest modeling and since inception)

- Merlyn.AI WIZ Bull-Rider Bear-Fighter: 770%
- Merlyn.AI DUDE SectorSurfer Momentum: 770%

IV. Index Calculation, Maintenance, and Management

A. Daily Calculation

The MAI Indexes are produced by SumGrowth Strategies, LLC (the Index Provider), and transmitted to Solactive AG (the Calculation Agent). The Index Calculation Agent is responsible for calculating index ETFs and weights as determined by the Index Provider on a daily basis using the ETF selections provided by the Index. The Index Provider will be the final authority on the Index and the interpretation of the Index Methodology.

The total return indexes are calculated for each MAI Index in US dollars. Total return indexes assume reinvestment of cash dividends across the full index at the open on the ex-date. The ETF compositions of the MAI Indexes are additionally available on the MAI Indexes website (www.maiindexes.com).

B. Inception Date

The MAI Indexes have the following inception dates. Index data before the inception dates are based on backtesting (pre-inception performance).

Index Name and Description	Inception Date
Merlyn.AI WIZ Bull-Rider Bear-Fighter Index	09/01/2019
Merlyn.AI DUDE SectorSurfer Momentum Index	10/31/2020

C. Exceptions to the Methodology Calculation

In the event that the Index Calculation Agent or the Index Provider determines that a material error has occurred in the calculation of the Index, the Index Calculation Agent, having consulted, or having been consulted by, the Index Provider, will endeavor to correct any such error on a date agreed to by the Index Provider. If a material error is corrected, the Index Provider and/or Index will apply the correction from the relevant date forward.

D. Index Management Committee

1. The Index Management Committee is responsible for the management and implementation of the Methodology's rules, for their continuing fitness for purpose, and therefore for any periodic amendments thereto. It is also responsible for overseeing the technical actions of the index Calculation Agent, and in the event of the rules not providing a clear process for the management of any situation, for determining the process to be followed.

2. The Index Management Committee is comprised of a committee chairman and a committee compliance officer, both appointed by the CEO of SumGrowth Strategies. Additionally, a member from Merlyn.AI Corp. is invited to attend in an advisory non-voting capacity. The committee chairman is currently Scott Juds and the acting committee compliance officer is Stephen Gower, who together are responsible for determining potential changes to the Merlyn.AI Indexes Methodology.

3. Members of the Index Management Committee may at any time recommend changes to these Rules (including the Index construction criteria) by submitting any proposed changes for consideration. Meetings will be held quarterly or at any time necessary.

4. Potential changes determined by the Index Management Committee have to be submitted to the independent Index Oversight Committee for approval.

5. Following final approval by the Index Oversight Committee, such changes shall be formally implemented and formally published on www.maiindexes.com and/or www.merlyn.ai.

6. The Index Management Committee convenes quarterly, and as additionally may be necessary. Meeting minutes are created and retained pursuant to record retention requirements.

E. Index Oversight Committee

1. An oversight committee composed of staff from Solactive AG ("Solactive") and its subsidiaries (the "Oversight Committee") is responsible for decisions regarding any amendments to the rules of the Index. Any such amendment, which may result in an amendment of the Index Methodology, must be submitted to the Oversight Committee for prior approval and will be assessed ad processed in accordance with the Solactive Methodology Policy, which shall apply *mutatis mutandis* is available on the Solactive website: https://www.solactive.com/documents/methodology-policy/.

2. The Index Oversight Committee may approve or reject amendments to the Index Methodology.

3. Requests for methodology amendment:

    a. Can be submitted by the Index Management Committee once a year with one additional potential annual adjustment in case of significant changes of the underlying market or the economic reality. More than two methodology changes per year are not considered admissible.
    b. Need to be submitted at least 4 weeks before the change is intended to become effective for the Index Oversight Committee to be able to perform the review.

4. Information to be provided to the Index Oversight Committee in order to assess the proposed change include details on impact and rational for the proposed change. In addition, details on the financial instruments as well as the country or region in which financial instruments are offered and/or distributed that use the affected index as reference value or benchmark need to be provided to the Index Oversight Committee.

F. History of Changes Made to the MAI Index Methodologies

This methodology document is updated when needed to reflect changes approved by the Index Oversight Committee and (as necessary) approved for integration into an associated prospectus by the fund advisor. Below changes made before the introduction of the Index Oversight Committee on Jan 1, 2023 were approved by the Index Management Committee. The history of changes follows.

1. **March 21-24, 2020**
   Bear Indicator Oversold Lockout and Mean Reversion
    a. The severe onset of the Covid-19 Black Swan event produced a record-breaking market crash that triggered the SGS Oversold Indicator well before the pending Bear Indicator would otherwise be set at month-end. The Oversold Indicator's purpose is to provide notification that a strong reversal and buying opportunity is imminent. However, that would conflict with the expected setting of the Bear Indicator at month-end. To resolve this pending logical conflict,

the Index Committee evaluated, approved, and implemented a methodology rule that prevents the triggering of the Bear Indicator if the Oversold Indicator has been recently set.

b. SGS research has confirmed that the principle of "mean reversion" generally applies during an oversold rebound. Thus, the funds that fall the most are generally expected to rebound the most. The Index Committee has evaluated, approved, and implemented an oversold, mean reversion methodology rule such that during the first month after an oversold condition the momentum algorithm works in reverse by selecting the fund that recently fell the most.

2. July 22, 2020
Bull/Bear Indicator Volatility Metric Addition and Momentum Leader Clarification

a. The Bull/Bear Indicator previously employed three primary market metrics: Price-Trend, Market Momentum, and Value Sentiment to assess the probability of a market decline. Following the Covid-19 Black Swan event that triggered the record-breaking market crash in early 2020, an additional metric to assess Market Volatility was developed to detect similar future events should they occur. The Methodology and Prospectus description of the Bull/Bear Indicator was updated to include Market Volatility as follows. "The Bull/Bear Indicator is an algorithm that primarily assesses the risk of U.S. equity markets using four key metrics: Price-Trend, Market Momentum, Value Sentiment, and Market Volatility." The update further includes "Higher market volatility is correlated with a higher probability of declining markets and may indicate the possible onset of an extreme market decline."

b. The phrase defining "Momentum Leader" was updated from "the ETF having the highest recent return performance relative to other ETFs" to "the ETF having the highest expected subsequent monthly return performance relative to other ETFs." While the original phrase is typical of traditional measures of momentum, such as a six-month simple moving average, the updated phrase is more appropriate here because (1) the dynamically tuned DEMA and TEMA momentum filters employed have infinite tails that evaluate more than just recent returns, (2) the true value of a Momentum Leader is inherently determined by its subsequent (not prior) monthly performance, and (3) the method of employing the mean reversion principle to momentum during the initial rebound that follows an excessively sharp drop (such as in early 2020) means that the ETF that recently dropped the most will be the one with the highest expected subsequent monthly return during the initial rebound.

3. Aug 12, 2021
PopNDrop Risk Reduction Upgrade

PopNDrop refers to a fund that has increased in value, "popped up," so much in the prior month that it is more likely to go flat or drop next month than to continue moving higher. In early 2021 we became aware that numerous new thematic ETFs focusing on thinly capitalized disruptive startups (often in clean energy, internet retail, genomics, driverless vehicles, and other thematic niches) were susceptible to self-induced bubbles that later pop. We believe narrow thematic ETFs will remain similarly susceptible in the future. Tests confirm that mean reversion principles apply to excessively overbought conditions just as they do for excessively oversold conditions.

A new set of PopNDrop Risk Reduction confirmation indicators have been developed and deployed to reduce near-term downside risk by excluding or temporarily terminating the selection of ETFs exhibiting excessively overbought characteristics. This improvement is inherently consistent with the

definition of “Momentum Leader” as “the ETF having the highest expected subsequent monthly return performance relative to other ETFs.”

4. **Mar 20, 2022**
   Automated Limiting of Gold Holdings
   An automated algorithmic check has been developed and deployed to simplify the process of complying with the US Treasury's diversification rule (Reg M), which mandates that an ETF must hold no more than 50% of its assets in commodities (such as the GLD SPDR Gold Shares ETF). The Index’s allocation to such ETFs is algorithmically limited to 40% (to provide margin for differences in the subsequent monthly returns of the selected ETFs). In the event that the additional allocation of an Index’s selection would surpass the 40% limit, the best acceptable alternative ETF is automatically substituted as its selection.

5. **April 29, 2022**
   Inclusion of TIPS (Inflation Protected Treasuries)
   The Index Methodology and its corresponding Prospectus have been updated to include TIPs (inflation-protected treasury) ETFs within both the Bear Universe of ETFs and the Bull Universe of ETFs “Bonds” Category. Since its inception, SGS had excluded TIPs as Bear Category ETF candidates because the category was thinly populated and had little history. Today there are 12 with at least 5 years of history. Upon evaluation and testing the Index Committee agreed that TIPs should be included among the candidates that algorithmically compete with other Bonds Category and Bear Category ETFs for potential selection as a Momentum Leader. The update was deployed and the prospectus was revised to cover this change.

6. **Sept 28, 2022**
   Incorporate Recommended Methodology Description Improvements
   This update solely incorporates descriptive improvements into this Methodology document that had been recommended by a few Index stakeholders. There have been no changes to the underlying functionality of the MAI Indexes. This update provides additional information about (1) the Bull Universe update process in Section II-C-Step 2, (2) the Prolonged Bear Indicator in Section III-K, (3) the Minimum AUM Exclusion Rule in Section III-L, (4) the 12(d)-1 Rule Satisfaction in Section III-M, and (5) the Golden Rule in Section III-N. This update further includes improved organization and identification of process step in (1) the Bull/Bear Index Construction Process of Section II-B, (2) the Bull Index Construction Methodology of Section II-C, and (3) the Bear Index Construction Methodology of Section II-D.

V. Disclosures and Disclaimers

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