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Maximize Your Profits

Phase Space Analog Projection

Expert Advisor Documentation

PLATFORM	TYPE	TIMEFRAME	WEBSITE
MetaTrader 5 (MT5)	Adaptive Nonlinear Forecast	Any (H1 recommended)	www.algobot.live

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Overview

Phase Space Analog Projection is a first-principles Expert Advisor built entirely from raw price (OHLC) data — it uses no traditional indicators, chart patterns, support/resistance, or discretionary price-action concepts. Instead, it treats the market as the observable output of an unknown *dynamical system* and asks a single question: *"When has the market looked geometrically like it does right now, and what happened next?"*

The EA reconstructs the market's internal state directly from the data using **delay coordinates**. Each moment is represented as a vector of the most recent one-bar log returns. Two moments in history that occupy nearly the same point in this reconstructed space are called **dynamical analogs**: locally the system was in the same condition, so the analog's realised future is informative about what may come next now.

To generate a signal, the strategy finds the K closest historical analogs to the current state, then forms a **distance-weighted average of what those analogs actually did next** over a fixed forecast horizon. That projected move — measured against realised volatility and filtered by two independence safeguards — becomes the trade decision. Crucially, nothing is hard-coded to "trend" or "revert": the same machinery follows momentum in a persistent regime and fades it in a reverting regime, depending only on what the historical analogs did.

> **Core idea in one line:** reconstruct the market's state from recent returns, find the nearest historical matches, and trade the distance-weighted average of their known futures — only when those futures agree.

How It Works

1. State reconstruction (delay coordinates)

The EA converts closes into one-bar log returns and builds the current state vector from the most recent `EmbedDim` (m) returns. This vector is the market's "position" in an m-dimensional reconstructed phase space.

```
r_t   = ln( C_t / C_{t-1} )               one-bar log return
s(t)  = ( r_t , r_{t-1} , ... , r_{t-(m-1)} )   the m-dimensional state
```

2. Analog search (K nearest neighbours)

Every past state `s(a)` whose future is already known is compared to the current state `s*` by Euclidean distance. Candidates are ranked, and the closest matches are kept as analogs.

```
D(a) = || s(a) - s* ||        smaller distance = better geometric match
```

3. The forecast (distance-weighted projection)

For each selected analog the EA already knows its realised forward log return over the horizon `Horizon` (h). The projected move **F** is the distance-weighted average of those known futures, so closer analogs get exponentially more influence.

```
f(a) = ln( C_{a+h} / C_a )                the analog's realised h-bar future
w_k  = exp( -D(a_k) / d0 ),  d0 = mean neighbour distance
F    = ( Σ w_k · f(a_k) ) / ( Σ w_k )    expected h-bar log return now
```

4. Two independence safeguards

- **Theiler window** — selected analogs must be separated in time by at least `max(h, m)` bars. This prevents one overlapping stretch of history from being counted K times, so every analog is a genuinely distinct episode.
- **Agreement gate** — the fraction of analogs whose future shares F's sign must exceed `MinAgreement`. A confident-looking average built from an even long/short split is treated as noise and rejected.

5. Volatility-scaled entry threshold

The signal threshold is not a fixed number of pips — it is expressed in units of realised volatility, so it breathes with the market. The projected move must clear `ThresholdSigma × σ × √h`, where σ is the standard deviation of one-bar log returns across the analog library.

```
Long  when  F > +ThresholdSigma · σ · √h   AND analogs agree
Short when  F < -ThresholdSigma · σ · √h   AND analogs agree
```

6. Self-adaptation

Because the edge is simply "whatever the historical analogs actually did next," the strategy adapts to the local geometry of the market. In a persistent (trending) regime the analogs' futures point with the recent move; in a reverting regime they point against it. The *same* code flips behaviour as the manifold's local geometry changes — there is no explicit trend/revert switch.

7. Exit logic

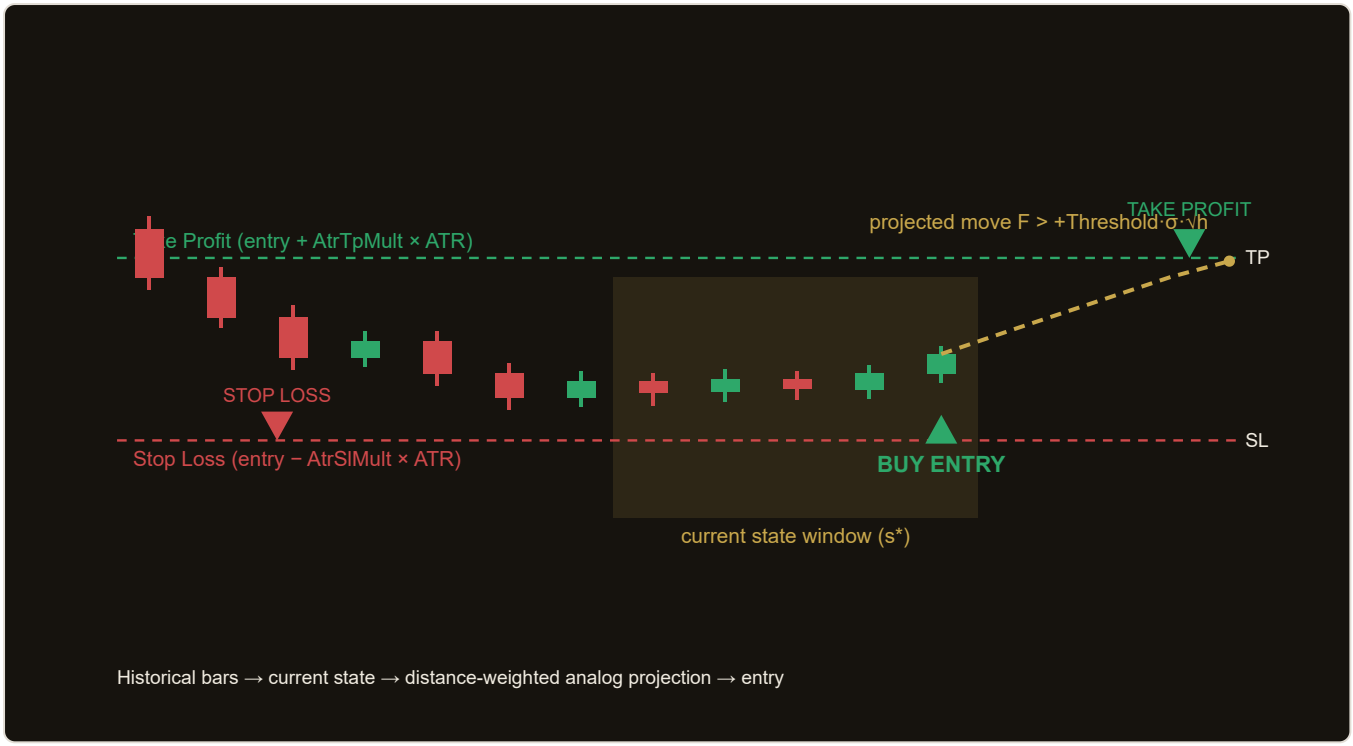
Once in a trade, the position is managed by three complementary exits:

- **ATR stop & target** — a protective stop at `AtrSlMult × ATR` and a profit target at `AtrTpMult × ATR`, both set at entry from the current ATR.
- **Adaptive flip exit** — if a freshly computed live projection points the opposite way to an open trade, the position is closed immediately (the geometry no longer supports it).
- **Time stop** — once the forecast horizon `h` has elapsed since entry, the position is closed. The projection has a limited shelf life; beyond h bars it is no longer the basis for the trade.

> **Note:** the EA evaluates once per newly-closed bar and holds at most one position at a time. It runs on a single primary timeframe and is suited to any liquid, continuously-priced instrument — FX pairs, metals, indices, or crypto.

Strategy in Action

The illustration below shows an example of how the strategy identifies a setup and triggers its entry and exit. This is a simplified, illustrative example for educational purposes — not real market data.



Illustrative example only. Actual market behaviour varies.

In this example the last few bars form the current state `s*`. The K nearest historical analogs to that geometry mostly rose over the next `h` bars, so the distance-weighted forecast **F** is positive and clears the volatility-scaled threshold, and the analogs agree on the sign. The EA opens a long, places an ATR stop below and an ATR target above, and will additionally exit early if the live projection later flips short or once the horizon has elapsed.

Parameters

Parameter	Default	Description
EmbedDim	`4`	Embedding dimension *m* — how many recent log returns define the state vector. Range 2–12 (step 1). Higher values describe a more detailed local geometry but require more history to populate.
Neighbors	`10`	K — the number of nearest analogs pooled into the projection. Range 3–40 (step 1). More neighbours smooth the forecast; fewer make it more specific.
Horizon	`6`	Forecast horizon *h* — the number of bars ahead over which analog futures are measured. Range 1–30 (step 1). Also acts as the trade's time-stop (shelf life).
ThresholdSigma	`0.5`	Signal threshold in volatility units. The projected move |F| must exceed `ThresholdSigma × σ × √h`. Range 0.0–3.0 (step 0.1). Higher = fewer, stronger signals.
MinAgreement	`0.60`	Fraction of selected analogs whose future must share the projection's sign. Range 0.5–1.0 (step 0.05). Higher demands more coherent analogs.
LibraryBars	`1000`	Size of the searchable analog library (bars retained). Range 300–4000 (step 100). A larger library offers more potential matches at the cost of memory and search time.
AtrPeriod	`14`	ATR period used to size the stop and target. Range 7–40 (step 1).
AtrSlMult	`2.0`	ATR multiplier for the protective stop-loss distance. Range 0.8–5.0 (step 0.1).
AtrTpMult	`3.0`	ATR multiplier for the take-profit distance. Range 1.0–6.0 (step 0.5).
Lots	`0.10`	Fixed trade volume in lots. Range 0.01–1.0 (step 0.05).
Magic	`5138`	Magic number used to identify and manage this EA's own positions.

Recommended Settings

The defaults provide a balanced starting point. Because the strategy is data-driven and self-adapting, the most important tuning decisions concern how much history it searches and how selective it is.

LIBRARY & EMBEDDING

- **LibraryBars 1000–2000** — enough episodes for meaningful analog matches. Allow warm-up time so the library fills before the first trades appear.

- **EmbedDim 3–5** — low dimensions find matches more readily; raise only when a longer library supports it (the phase space grows sparse as *m* increases).

SELECTIVITY

- **ThresholdSigma 0.5–1.0** — raise to trade only stronger projections in noisier instruments.
- **MinAgreement 0.60–0.75** — raise to demand more coherent analogs; lower to trade more often.
- **Neighbors 8–15** — a middle ground between a specific and a smoothed forecast.

Example starting configuration (H1, liquid FX pair)

EmbedDim = 4, Neighbors = 10, Horizon = 6, ThresholdSigma = 0.6, MinAgreement = 0.65, LibraryBars = 1500, AtrPeriod = 14, AtrSlMult = 2.0, AtrTpMult = 3.0, Lots = 0.10.

> **Tip:** always backtest and forward-test any parameter set on your chosen symbol and timeframe before considering live use. Give the EA sufficient bars of history so the analog library is fully populated — signals only appear once enough closed bars are available.

How to Install on MetaTrader 5

1. Copy `PhaseSpaceAnalogProjection.ex5` to your MT5 `MQL5\Experts\` folder
2. Restart MetaTrader 5 and refresh the Navigator panel
3. Drag the EA onto a chart matching the recommended symbol and timeframe
4. Configure the input parameters and click **OK**
5. Enable **Algo Trading** in the MT5 toolbar

Risk Warning

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