COPULA RISK PORTFOLIO MANAGER

SIDDHI NAGVEKAR

DIRECT LINK- HTTPS://RISK-COPULA-NAVIGATOR.LOVABLE.APP/APP

LINK TO GITHUB -HTTPS://GITHUB.COM/SIDDHIDN/RISK-COPULA-NAVIGATOR

RESEARCH PAPERS USED–
1.HTTP://URN.KB.SE/RESOLVE?URN=URN:NBN:SE:LNU:DIVA-123109
2.HTTPS://WWW.MATH.VU.NL/~SBHULAI/PAPERS/PAPER-HABIBOELLAH.PDF
3.HTTPS://STATMATH.WU.AC.AT/~FREY/PUBLICATIONS/COPULA-CREDIT.PDF
PS: I DIDN'T SET UP THE AUTH PAGE COMPLETELY - SO TYPE THIS AS A PLACEHOLDER-
NAME@NAME
OTP - 111111

WHAT IS THIS SYSTEM?

THE COPULA PORTFOLIO RISK MANAGER IS A SOPHISTICATED FINANCIAL TOOL THAT ANALYZES HOW RISKY YOUR INVESTMENT PORTFOLIO IS. THINK OF IT AS A ADVANCED CALCULATOR THAT PREDICTS POTENTIAL LOSSES IN YOUR STOCK INVESTMENTS.

CORE PURPOSE

INSTEAD OF BLINDLY INVESTING AND HOPING FOR THE BEST, THIS SYSTEM USES MATHEMATICAL MODELS TO ANSWER THE CRITICAL QUESTION: "HOW MUCH MONEY COULD I LOSE, AND WHAT'S THE PROBABILITY OF THAT HAPPENING?"

HOW DOES IT WORK?

DATA INPUT
1. SELECT PREFERRED COPULA MODEL , CONFIDENCE LEVEL AND TIME HORIZON
2. CHOOSE 4 STOCKS AND THEIR ASSET ALLOCATION
3. PERFORM ANALYSIS
4. VIEW HISTORIC AND SIMULATED RISK METRICS
5. OTHER PARAMETERS LIKE - MAX DRAWDOWN ,SIMULATED SHARPE RATIO , HISTORIC RETURNS ETC.
6. DIAGNOSTICS AND OPTIMIZATION GIVES BEST FIT OPTIMIZATION FOR YOU PORTFOLIO .

FRONT END FEATURES

THE FRONTEND OF THE COPULA PORTFOLIO RISK MANAGER IS BUILT USING REACT AND TYPESCRIPT, UTILIZING THE TAILWIND CSS UTILITY FRAMEWORK FOR RESPONSIVE AND MODERN STYLING. IT ALSO INTEGRATES SHADCN/UI COMPONENTS FOR POLISHED UI ELEMENTS AND DARK/LIGHT THEMING VIA `NEXT-THEMES`.

KEY FEATURES:

1. ASSET SELECTION INTERFACE: -
DROPDOWNS TO CHOOSE UP TO 4 ASSETS FROM A SUPABASE-STORED ASSET LIST
. - DYNAMIC UPDATE OF ASSET CHOICES, WITH FALLBACK BEHAVIOR IF FEWER THAN 4 ASSETS EXIST.

2. PORTFOLIO WEIGHT CONFIGURATION:
- REAL-TIME INPUT FIELDS TO ASSIGN WEIGHTS TO SELECTED ASSETS.
- AUTO-NORMALIZATION OF WEIGHTS TO ENSURE THEY SUM TO 1.

3. COPULA TYPE & RISK PARAMETER SETTINGS:
- DROPDOWN TO CHOOSE AMONG GAUSSIAN, STUDENT-T, CLAYTON, AND GUMBEL COPULAS.
- SLIDER OR INPUT FIELDS TO SET CONFIDENCE LEVEL (VAR/CVAR) AND TIME HORIZON.

4. RISK METRIC DISPLAY (DASHBOARD):
- PRESENTS HISTORICAL AND SIMULATED VALUES FOR: - VALUE AT RISK (VAR) - CONDITIONAL VALUE AT RISK (CVAR) - VOLATILITY - MAX DRAWDOWN - SHARPE RATIO

5. CHARTS AND VISUALIZATION PANELS:
- HISTOGRAM OF SIMULATED RETURNS
- TIME SERIES OF HISTORICAL RETURNS.
- SCATTER PLOTS AND DIAGNOSTICS TO ANALYZE DEPENDENCY STRUCTURES.

6. BADGES AND SUMMARY HIGHLIGHTS:
- BADGES DISPLAY SELECTED ASSET SYMBOLS AND COPULA TYPES.
- FOOTER SUMMARIZES SUPPORTED MODELING TECHNIQUES.
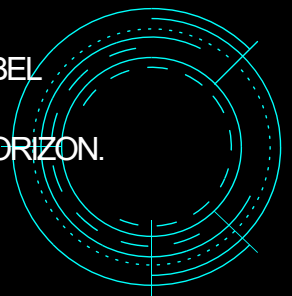
COMPONENTS USED:
- `PORTFOLIO CONFIGURATION`
- `RISKMETRICS DASHBOARD
` - `VISUALIZATION CHARTS`
- `DIAGNOSTICS PANEL`

BACKEND FEATURES-

THE BACKEND LOGIC IS IMPLEMENTED IN PYTHON AND INTEGRATED WITH A SUPABASE DATABASE TO ENABLE DYNAMIC, REAL-TIME FINANCIAL ANALYSIS AND STORAGE. KEY FEATURES:

1. SUPABASE INTEGRATION:
- FETCHES LIST OF TRADABLE ASSETS AND THEIR 1 YR DAILY RETURN HISTORY.
- UPLOADS PORTFOLIO RISK METRICS (VAR, CVAR, ETC.) TO THE SUPABASE `PORTFOLIO_RISK` TABLE.

2. COPULA MODELING ENGINE:
- SUPPORTS MULTIPLE COPULAS: - GAUSSIAN - STUDENT-T - CLAYTON (TAIL-HEAVY LOWER) - GUMBEL (TAIL-HEAVY UPPER)
- GENERATES CORRELATED UNIFORM SAMPLES AND TRANSFORMS THEM TO RETURN SERIES.

3. MONTE CARLO SIMULATION:-
10,000+ RETURN PATHS GENERATED USING COPULA-BASED DEPENDENCY STRUCTURES.
- ADJUSTED FOR TAIL RISK AND MARGINAL DISTRIBUTIONS PER COPULA TYPE.

4. RISK METRIC CALCULATIONS:
- HISTORICAL: VAR, CVAR, VOLATILITY, SHARPE RATIO, MAX DRAWDOWN.
- SIMULATED: SAME METRICS BASED ON MONTE CARLO RETURN PATHS.

5. MATH UTILITIES (`MATHUTILS`):
- FUNCTIONS FOR CORRELATION.
- ADVANCED VAR/CVAR CALCULATIONS FROM EMPIRICAL DISTRIBUTIONS.

6. DIAGNOSTICS AND VALIDATION:
- GENERATES A CORRELATION MATRIX BETWEEN SELECTED ASSETS.
- OFFERS TOOLS TO ANALYZE THE REALISM OF SIMULATED OUTCOMES.

DATA PIPELINE:
- DATA PULLED FROM SUPABASE.
- PROCESSED USING CUSTOM `PROCESSMARKETDATA()`.
- RESULTS STORED IN SUPABASE FOR LATER QUERYING OR AUDIT.
OVERALL, THE BACKEND ENSURES FINANCIAL SOUNDNESS AND STATISTICAL RIGOR, WHILE KEEPING COMPUTE COSTS LOW USING OPTIMIZED NUMPY-LIKE OPERATIONS.