

# Indian Institute of Technology Kanpur

## Intellectual Property Disclosure Form

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### Title of the invention:

**Open-Data Based India VIX Forecasting and Regime-Aware Equity Timing Engine**

### Innovator(s):

Innovators who have contributed to the conception, design, implementation and validation of the proposed India VIX forecasting and regime-aware equity timing framework.

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#### **Non-Confidential description of the invention (Layman's language):**

The invention is a software and analytics engine that uses freely available India VIX data (a measure of expected stock market volatility) to forecast short-term risk conditions and classify the market into easy-to-understand regimes such as “calm”, “normal” or “stressed”. Instead of using expensive data feeds or opaque models, the system converts minute-level India VIX quotes into weekly indicators and then uses transparent machine learning methods to predict whether volatility is likely to rise or fall next week. The output is a simple, explainable risk-on / risk-off signal that can help investors, brokers, funds and risk managers systematically adjust equity exposure, hedging or overlays without needing complex infrastructure.

#### **Abstract in 100 words:**

This invention presents an open-data driven, regime-aware forecasting engine for India VIX and derived equity risk signals. Minute-level India VIX quotes are cleaned, validated and aggregated into daily and weekly features capturing level, momentum, realized volatility, volatility-of-volatility and drawdowns. Two complementary models, Elastic Net and gradient boosting, are trained (without lookahead) to predict next-week VIX returns. Their outputs are blended through a volatility-regime based scheme into a single interpretable signal that classifies weeks as risk-on, risk-off or neutral. The framework is transparent, modular and implementation-ready, enabling low-cost, explainable volatility-timing and hedging solutions for brokers, funds and fintech platforms.

#### **Use Case:**

- Brokerages and wealth platforms can plug this engine into their systems to dynamically flag high-risk weeks and suggest protective index options or reduced leverage.
- Asset managers and treasury desks can use the regime-aware signal to scale equity, long-volatility or hedge ratios systematically instead of relying on ad-hoc views.
- Fintech and robo-advisory platforms can provide retail investors with a clear, explainable risk-on / risk-off indicator built purely on public data.
- Exchanges or data providers can offer this as an analytics add-on to enhance derivatives usage and risk education.

#### **Keywords:**

India VIX; Volatility Forecasting; Regime Detection; Machine Learning; Open Data; Risk-On / Risk-Off; Equity Timing; Elastic Net; Gradient Boosting; Systematic Strategy

### **Detailed technical description:**

The engine ingests historical minute-level India VIX data and standardizes timestamps and OHLC fields. It computes minute returns, then aggregates them into daily OHLC, realized intraday volatility and range measures. These are resampled into weekly OHLC bars and feature sets including multi-horizon momentum, rolling volatility-of-volatility, 52-week drawdown of VIX, and discrete VIX regime buckets. A supervised dataset is constructed where each week's feature vector uses only past information to predict next-week VIX return. An Elastic Net regression (regularized linear baseline) and a LightGBM regressor (non-linear model) are trained under strict chronological splits. A regime-aware blender assigns dynamic weights to both models based on current VIX regime, producing a single forecast and an interpretable categorical signal. The full pipeline is modular, auditable and directly implementable in production environments.

### **What is Novel in the invention?**

- A self-contained, single-source framework that relies solely on open India VIX data from minute level to deployment-grade weekly signals.
- Integrated feature engineering explicitly tailored to volatility behavior: realized vol, vol-of-vol, structural drawdowns and discrete VIX regimes.
- A codified regime-aware blending mechanism combining linear and non-linear models, tuned to behave differently in calm vs stressed volatility conditions.
- Emphasis on explainability and leak-free design as a core constraint, not an afterthought.

### **Inventive step and non-obviousness:**

The inventive step lies in combining (i) high-frequency microstructure of India VIX, (ii) disciplined, interpretable feature engineering, and (iii) a regime-conditional model blending scheme to produce robust forward-looking risk states from a single public source. While VIX forecasting and ML are individually known, this specific architecture—from minute-level ingestion to regime-aware blended signal framed for open-data deployment in Indian markets—is not obvious to a skilled person, especially under strict no-leakage, explainability and cost-constrained design requirements.

### **Advantages over existing approaches:**

- Avoids dependence on proprietary datasets or complex factor infrastructures.
- Produces transparent, auditable features and model outputs suitable for regulators, risk committees and retail communication.
- Encodes regime-awareness directly in architecture, improving stability in stressed periods where naive models often fail.

- Implementation-ready in Python notebooks, scalable to APIs, with low compute footprint.

### **Experimental testing and data:**

The framework has been backtested on historical India VIX minute data. Intermediate diagnostics (forecast error metrics, feature importance, regime distributions), directional accuracy and an illustrative VIX long/short overlay strategy demonstrate that the blended signal carries economically meaningful information. All experiments respect temporal ordering and realistic constraints.

### **Technology Readiness Levels (TRL):**

#### **Proposed TRL: TRL-2 / TRL-3**

Justification: Core algorithms and proof-of-concept implementation are complete in a functional Python environment using real historical data. The methodology is validated, but packaging as a production-grade product and full-scale live deployment are pending.

### **Need and Demand:**

India's growing derivatives, PMS, AIF and retail participation require robust yet explainable volatility risk signals. Most solutions are either heuristic or depend on costly global feeds. This engine fills a gap by offering a low-cost, transparent, India-focused VIX forecasting and regime classification tool for brokerages, funds, fintechs and risk managers.

### **Market Access Information:**

Potential users include domestic brokerages, discount brokers, PMS/AIF managers, mutual funds, prop desks, risk consultancies and retail-facing fintechs. These segments already use India VIX informally; a formalized, explainable engine can be licensed as an analytics module, API or white-labelled risk advisory layer.

### **Future Developments:**

- Extension to probabilistic forecasts (intervals, tail risk) and stress indicators.
- Integration with open equity, macro and flow-based signals into a multi-factor timing stack.
- Real-time deployment with monitoring, recalibration toolkit and dashboard.
- Scaling to other indices (e.g., sectoral vols) and cross-asset overlays.

### **Applications of the invention:**

- Dynamic equity allocation and de-risking.
- Rule-based hedging strategies using index options/futures.

- Risk budgeting and exposure overlays in institutional portfolios.
- Retail advisory signals and investor education tools.

### **IPR Ownership:**

Was the IP created with significant use of IITK funds/facilities? **Yes.**

(Developed as part of DES646 using IIT Kanpur computational and academic infrastructure.)

Source of funding: **No external sponsored funding; course project work.**

Source of salary/remuneration of inventors: **Self-sponsored students.**

Conference/seminar presentation: **Not yet publicly presented outside IITK coursework at the time of this disclosure.**

Publications: **No external journal/conference publication prior to filing.**

Sponsored/consultancy project with IITK? **No.**

Part of academic research leading towards a degree? **Yes, as a credited course project.**

### **Revenue sharing among inventors:**

S. No.	Name of the Inventor	% Share	Signature
1	Satyam Singh	25%	Satyam Singh
2	Shashwat Gautam	25%	Shashwat Gautam
3	Vansh Mina	25%	Vansh Mina
4	Hashvith	25%	Hashvith

### **Commercial potential:**

#### **Why should organizations procure this innovation?**

It offers an explainable, India-specific, low-cost volatility intelligence layer that can be immediately embedded into trading, risk and advisory platforms to differentiate products, improve client communication and support regulatory-friendly governance.

#### **Steps for commercialization:**

- Package engine as a secure Python/REST microservice or integrated library.
- Co-develop UI dashboards and alerts with interested brokers/AMCs/fintechs.
- Validate on their historical/live data and calibrate risk labels.
- License annually with support, documentation and version upgrades.

**Estimated time to commercial stage:** 6–12 months for a production-grade hosted/API solution with partner integration.

**Indicative companies / segments:** Discount brokers, full-service brokers, PMS/AIFs, fintech robo-advisors, index product issuers, risk advisory firms. (Specific contacts to be identified in collaboration with IITK IPR Cell.)

**Do you want to file Patent under PCT Route? No**

(Being initially targeted to Indian market participants; PCT route may be reconsidered if strong international commercialization interest arises.)

**Declaration:**

I/We declare that the information provided is true to the best of our knowledge and that no public disclosure prejudicial to patentability has been made prior to or during the filing process, except as informed to IIT Kanpur. I/We authorize IIT Kanpur to file, manage, and, where appropriate, showcase this technology for promotion and licensing.

Satyam

Shashwat

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Signature of Inventor

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