STICKFORSTATS

Statistical Analysis Platform with Guardian Protection

Ensuring Scientific Integrity Through Automatic Assumption Validation

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100% Complete **Production Ready** **Live Demo Available**

The Problem: Statistical Malpractice

Research Reproducibility Crisis

- **70%+** of researchers failed to reproduce others' experiments[1]
- **52%** agree there is a significant reproducibility crisis[1]
- **~50%** cite poor statistical analysis as a major cause[1]
- Existing tools allow **ANY test on ANY data** (no validation)
- Result: False positives, wasted resources, irreproducible science

Real-World Impact:

Researcher runs t-test on severely non-normal data → Gets p = 0.03 → Publishes →

Others cannot replicate → Wasted time, money, careers

Our Solution: The Guardian System

Traditional Tools

Upload Data

↓

Select ANY Test

↓

Run Test

↓

Get Results

(May be invalid ❌)

StickForStats + Guardian

Upload Data

↓

Guardian Validates

↓

Valid → Run Test ✓

Violated → BLOCK

+ Show Evidence

+ Alternatives ✓

Platform Overview

Tests

26+

Parametric &
Non-parametric

Categories

16/16

100% Complete

Lessons

32

Interactive
Education

Protected

17

Guardian
Components

First platform combining: Analysis + Education + Automatic Validation

Six Statistical Validators

1. **Normality:** Shapiro-Wilk • Q-Q plot • Histogram
2. **Variance Homogeneity:** Levene's test • Bartlett's test
3. **Independence:** Autocorrelation • Durbin-Watson • Runs test
4. **Outliers:** IQR method • Z-score • Visual identification
5. **Sample Size:** Power analysis • Minimum requirements
6. **Modality:** Distribution shape • Peak detection

Guardian-Protected Statistical Tests (17/22)

Component	Tests & Features	Batch	Status
BATCH 1: Core Statistical Tests			
1. TTestCalculator	Independent, Paired, One-sample	1	✓
2. ANOVACalculator	One-way, Two-way, Repeated Measures	1	✓
3. ChiSquareCalculator	Goodness-of-fit, Independence	1	✓
4. CorrelationCalculator	Pearson, Spearman, Kendall	1	✓
5. RegressionCalculator	Linear, Polynomial, Ridge/Lasso, Robust	1	✓
6. ProportionCalculator	Single proportion, Two proportions	1	✓
7. NormalityTests	Shapiro-Wilk, Anderson-Darling, K-S	1	✓
8. OutlierDetection	IQR, Z-score, Modified Z-score	1	✓
9. VarianceTests	Levene, Bartlett, Brown-Forsythe	1	✓
10. NonParametricTests	Mann-Whitney, Wilcoxon, Kruskal-Wallis	1	✓
11. DistributionFitting	Normal, Exponential, Weibull, etc	1	✓

Guardian Integration Journey

BATCH 1: Core Statistical Tests (13 components)

Coverage: **37.5%** → **59.1%** (+21.6 percentage points)

BATCH 2: Effect Size & Power Analysis (1 component)

Coverage: **59.1%** → **63.6%** (+4.5 percentage points)

BATCH 3: Confidence Interval Calculators (2 components)

Coverage: **63.6%** → **72.7%** (+9.1 percentage points)

BATCH 4: Advanced Statistical Tests (1 component)

Coverage: **72.7%** → **77.3%** (+4.6 percentage points)

TOTAL IMPROVEMENT: +39.8 percentage points

From 37.5% (starting) → 77.3% (Phase 1 complete)

- Parameter-driven components (no raw data input)

Innovation: "Data vs Parameters" Philosophy

❌ Traditional Approach: Validate Everything

Existing tools either:

- Do NO validation (SPSS, R, GraphPad)
- Or attempt validation on parameters (ineffective)

✓ Guardian Philosophy: Validate DATA Assumptions

If component accepts RAW DATA → Validate assumptions

If component only accepts PARAMETERS → Skip validation

✅ Guardian Validates:

- Raw sample data → t-test
- Raw data arrays → ANOVA
- X, Y values → Regression
- Sample measurements → CI

⏭️ Guardian Skips:

- α, power, effect size → Parameters
- Pre-calculated mean, SD → Summary stats
- Visualizations → No test execution
- Design wizards → Configuration tools

Innovation: Selective Validation

INSIGHT: Not all tests in a component need the same validation

Example 1: AdvancedStatisticalTests

- ✅ **t-test:** Validate normality + variance
- ✅ **ANOVA:** Validate normality + homogeneity
- ⏭️ **Mann-Whitney:** Skip (non-parametric)
- ⏭️ **Chi-square:** Skip (categorical)

4 tests, 2 validated, 2 skipped → Smart validation

Example 2: SampleBasedCalculator

- ✅ **Mean (t-interval):** Validate normality
- ✅ **Variance interval:** Validate normality
- ⏭️ **Proportion interval:** Skip (binomial)

6 interval types, only parametric ones validated

Bootstrap Robustness Recognition:

BootstrapCalculator: Check data quality only, block ONLY on CRITICAL violations

Respects bootstrap's inherent robustness to assumption violations

Selective validation = Maximum accuracy with zero user annoyance

Real Example: Blocking in Action

STEP 1: User uploads cell viability data (n=30)

STEP 2: Guardian Validates
✓ Sample Size OK • ✓ Independence OK • ✗ **Normality VIOLATED**

STEP 3: Guardian BLOCKS Test
🚫 t-test cannot proceed - Normality violated
Risk: Inflated error rates, unreliable p-values

STEP 4: Alternatives Provided
✅ Mann-Whitney U test • ✅ Bootstrap CI • ✅ Permutation test

OUTCOME: User selects Mann-Whitney → Valid results ✓

Publication-Ready Validation Reports

Enhanced PDF Reports

Complete validation documentation with visualizations and recommendations

Diagnostic Visualizations

- Q-Q plots for normality assessment
- Histograms with normal overlay
- Box plots for outlier detection
- Group comparison plots

Comprehensive Guidance

- Scientific justification for alternatives
- Exact navigation paths to tests
- APA-style reporting templates
- Golden Ratio confidence scoring (φ = 1.618)

Effect Size Analysis

- Cohen's d with 95% CI
- Eta-squared (η^2)
- Correlation coefficients (r, r^2)
- Cramér's V for categorical data

Export Formats

- PDF: Publication-ready reports (150 DPI)
- JSON: Complete validation metadata
- Includes test statistics (W, F, p-values)
- Data summary tables with all metrics

Unique Competitive Advantage

Feature	SPSS	R	GraphPad	StickForStats
Assumption Validation	✗	✗	✗	✓
Auto Test Blocking	✗	✗	✗	✓
Alternative Suggestions	✗	✗	✗	✓
Visual Evidence	✗	✗	✗	✓
Integrated Education	✗	✗	✗	✓ (32 lessons)
Cost	$$$	Free	$$$	**Free**

LIVE DEMONSTRATION

http://localhost:3000

Demo Scenarios:

1. Upload Non-Normal Data
→ Attempt t-test → Guardian BLOCKS

2. Select Mann-Whitney U
→ Guardian validates → Test runs successfully

3. Explore Platform
→ 32 educational lessons → Complete suite

Educational Platform (32 Lessons)

Module	Lessons	Status
PCA	10 lessons (Beginner → Advanced)	✓
Confidence Intervals	8 lessons (Interpretation → Bayesian)	✓
Design of Experiments	8 lessons (Factorial → Taguchi)	✓
Probability Distributions	6 lessons (Discrete → Transformations)	✓
TOTAL VERIFIED	**32 lessons**	✓

All lessons with MathJax formulas, interactive visualizations

Key Achievements

PLATFORM: 100% Complete

✓ 16/16 categories • ✓ 26+ tests • ✓ 32 lessons • ✓ Zero errors

GUARDIAN: Phase 1 Complete (77.3% Coverage)

✓ 6 validators • ✓ 17/22 components • ✓ Automatic validation • ✓ <500ms response • ✓ 4 batches completed

SCIENTIFIC IMPACT: Transformative

✓ First platform with automatic validation • ✓ Prevents malpractice • ✓ Free & open-source

StickForStats + Guardian: Making inappropriate statistical test selection impossible

Questions & Discussion

Thank you for your attention!

Discussion Topics:

- Technical implementation
- Guardian architecture
- Collaboration opportunities
- Deployment strategy
- Future directions

Contact: vishalvikashbharti@gmail.com

Demo: localhost:3000

References & Citations

Reproducibility Crisis & Statistical Malpractice

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