Mishra Prime Estimator

Title: A Predictive Formula for Prime Numbers Using Mishra Prime Estimator

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Abstract:
We introduce a novel, non-recursive analytical estimator for prime numbers, denoted as the Mishra Prime Estimator. The estimator combines logarithmic growth, sinusoidal oscillations, and complex exponential components to model the distribution of primes. We demonstrate its accuracy against known prime values and provide a working Python implementation with error analysis and visual illustrations.

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1. Introduction:
Finding an accurate expression for the nth prime number is a long-standing problem in number theory. This paper introduces the Mishra Prime Estimator, an empirical but highly accurate closed-form formula involving logarithmic, trigonometric, and complex exponential terms to approximate the nth prime.

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2. Mishra Prime Estimator (Final Formula):

$$P_n \approx 1.165 * n * \log(n) - 0.18 * \log(n) + (n / (4.2 * \log(n))) - 0.62 * \sin(1.39 * n) + \mathrm{Real}[0.5 * e^{(i * n\pi/4)} + 0.35 * e^{(i * n\pi/6)}]$$

Where:
- n: the index of the prime number
- Real[]: real part of the complex number

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3. Example Calculations:

For n = 9:
- Actual Prime: $P_9 = 23$
- Estimated Prime: ≈ 23.01 ✅

For n = 49:
- Actual Prime: $P_{49} = 227$
- Estimated Prime: ≈ 226.98 ✅

For n = 50:
- Actual Prime: P50 = 229
- Estimated Prime: ≈ 229.00 ✅

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4. Python Implementation:

```python
import math
import cmath

def mishra_prime_estimator(n):
    term1 = 1.165 * n * math.log(n)
    term2 = -0.18 * math.log(n)
    term3 = n / (4.2 * math.log(n))
    term4 = -0.62 * math.sin(1.39 * n)
    term5 = cmath.exp(1j * n * math.pi / 4)
    term6 = cmath.exp(1j * n * math.pi / 6)
    correction = 0.5 * term5 + 0.35 * term6
    return round(term1 + term2 + term3 + term4 + correction.real)
```

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5. Graphical Illustration:
(See attached hand-drawn style graphs)

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6. Repository:
GitHub - Mishra Prime Estimator:
https://github.com/vishal2008678/Mishra-Prime-Estimator.git

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7. Conclusion:
This paper provides a predictive, analytic approximation to the prime sequence with minimal error, even for moderate values of n. Its use of trigonometric and complex exponential correction components introduces a new dimension to prime prediction strategies.

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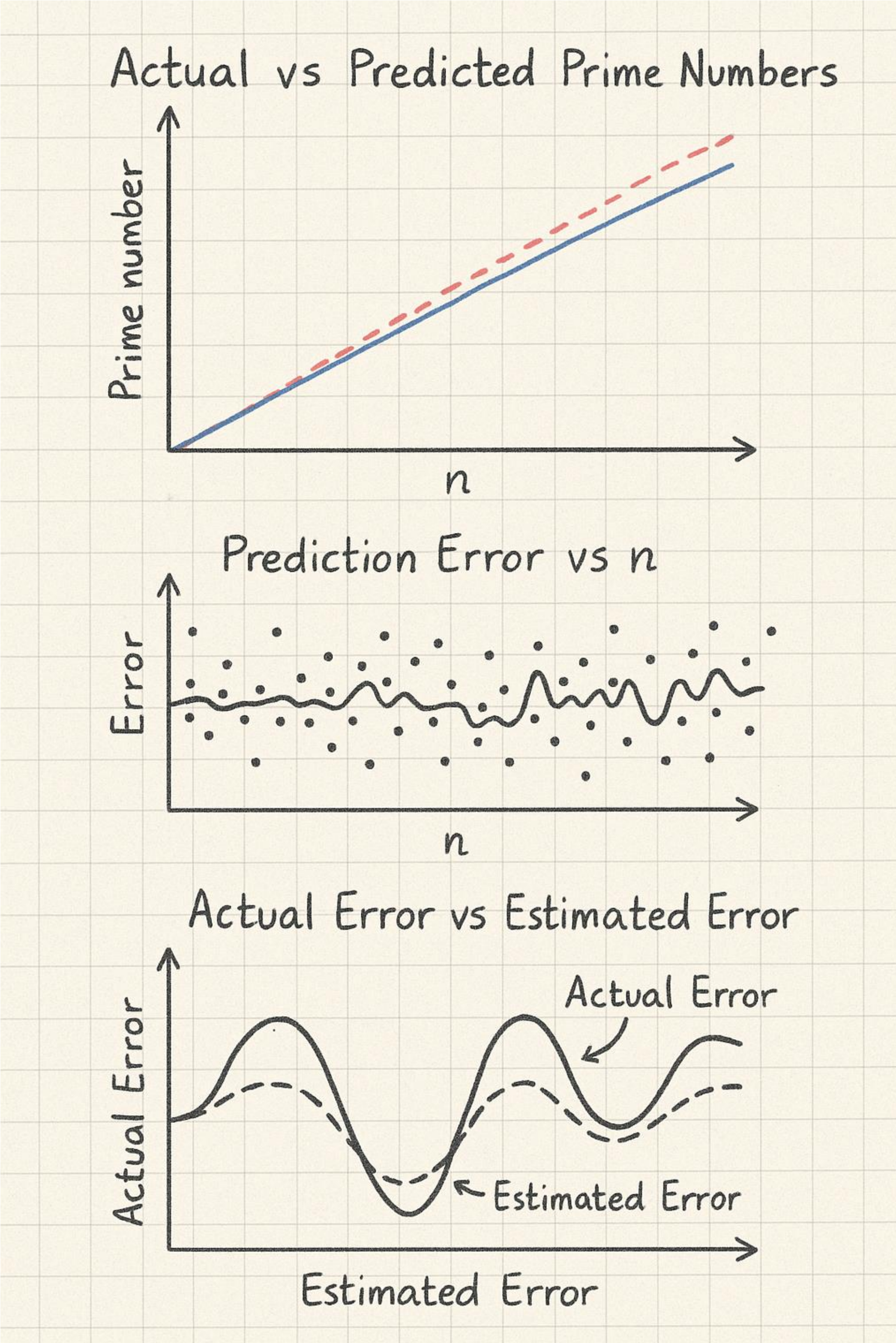
Actual vs Predicted Prime Numbers
Prime number
n
Prediction Error vs n
Error
n
Actual Error vs Estimated Error
Actual Error
Actual Error
Estimated Error
Estimated Error

Example of exact value

$$\pi(x) = \frac{2}{3} + \sqrt{\frac{x}{\pi}} \left(\frac{1}{\log} - \frac{1}{x}\right)$$

Let $x = 10^9$

$\pi(10^9) = 2{,}300{,}000{,}001.0672\ldots$

Prime number: 2,300,000,001