GitHub Repository Description

https://github.com/tk-yoshimura

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Products of individual research and OSS activities

16 pages

TensorShader

GitHub
Nuget

- Neural Network Framework
  - TensorShaderCudaBackend
    Wrapper to call GPU routines from managed code (.NET6)

    NVIDIA cuda　Compile and execute shader programs
    NVIDIA cudnn　Perform layered neural network processing
    NVIDIA cublas　BLAS execution on GPU
  - TensorShader

    GPU memory management, dynamic code generation for shader programs

    Definition of back propagation, optimization of computation flow

MultiPrecision

- Arbitrary floating-point arithmetic library

GitHub

Nuget

  - Vector arithmetic speed-up of computationally expensive products by AVX2

  - Basic functions such as trigonometric and exponential functions to any digit

    Gamma and error functions to 2462 digits

    Bessel functions of real order accurately to 612 digits

  - Huge test cases that take 20 minutes to complete verification.

DoubleDouble

- Double-Double Quasi-Quadruple Precision Floating-Point Arithmetic Library
  - Double-Double arithmetic
    By combining two double precision floating point numbers arithmetic technique to achieve 30-31 significant digits.
  - Number of special function implementations above Boost and below Wolfram (covering mostly A&S†)
    Gamma function, beta function, error function, inverse error function, imaginary error function, Bessel functions, Airy functions, Struve functions, Polylog functions Elliptic integrals, Jacobi elliptic functions, trigonometric integral functions, exponential integral functions Riemann zeta functions on the real number axis, Dirichletta functions, orthogonal polynomials etc.
  - Continuous fractions, Padé approximations, graded formulas, arithmetic geometric averages, Gauss-LeJeandre quadrature, Gauss-Legard quadrature, etc.

GitHub

Nuget

† A&S: “Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables”

DoubleDouble / MultiPrecision Subset

GitHub

Nuget

- Algebra / MultiPrecisionAlgebra
  - Calculate basic matrix and vector calculations such as inverse matrix, pseudo-inverse matrix, LU decomposition, QR decomposition, singular value decomposition, and eigenvalues/eigenvectors with high accuracy.
- CurveFitting / MultiPrecisionCurveFitting
  - Polynomial and Rational Function Approximation by Least Squares Method Arbitrary function parameter estimation by Gauss-Newton, Levenberg-Marquardt methods, robust curve fitting by M-estimation

DoubleDouble / MultiPrecision Subset

GitHub

Nuget

- DoubleDoubleIntegrate / MultiPrecisionIntegrate
  - Gaussian quadrature, Gauss-Kronrod adaptive quadrature, Lomberg integral
- DoubleDoubleDifferentiate / MultiPrecisionDifferentiate
  - Centroid, Forward
- DoubleDoubleRootFinding / MultiPrecisionRootFinding
  - Newton-Raphson, Halley, Secant, Brent method
- DoubleDoubleODE
- DoubleDoubleGeometry
- DoubleDoubleComplex

DoubleDoubleStatistic

GitHub

Nuget

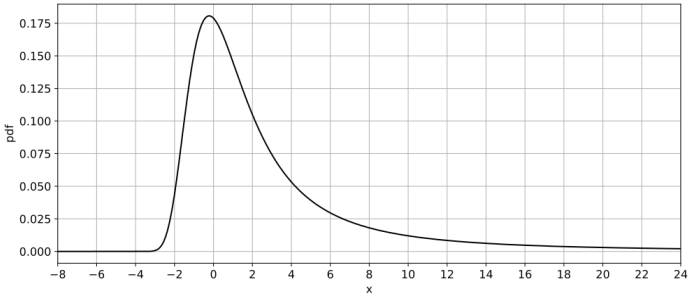
- Statistical Processing Library
  - 98 statistical distributions.
    Probability density distribution, cumulative distribution function, quantile function, median, mode, skewness, kurtosis, entropy, random number generation, fitting
  - Guaranteed calculation accuracy of 28-30 digits
  - Four stable distributions, Landau, Map-Airy, Holtsmark, and SaS α=1/2, which cannot be expressed in simple closed-form expressions and are not implemented in Scipy or Wolfram alpha, are also implemented.
    - Reflected in Boost implementation
  - Comprehensive library of high-precision calculations, special functions, functional interpolation, numerical integration, and complex calculations

LandauDistribution

GitHub

DOI

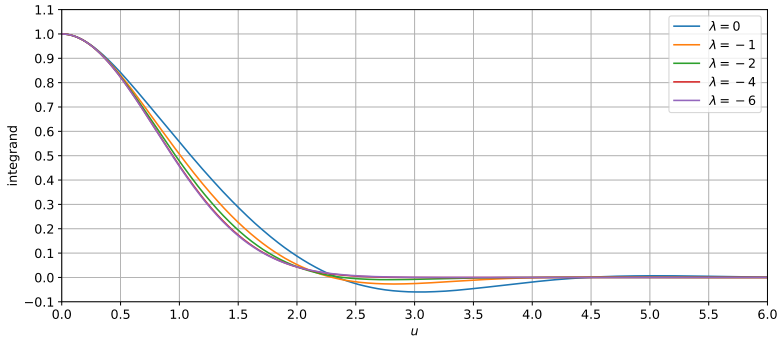
- Distribution of the amount of energy loss caused by energetic particles passing through a metallic foil Lev Landau (1944)
- Validation repository for generating true values of probability density functions and cumulative density distributions
- Difficult to compute because the probability density function is an integral expression
- My implementation has been adopted by Boost and Scipy



Gauss-Kronrod

GitHub

- One of my personal favorite algorithms
- Calculation of zeros and weights of the Stillches polynomial used in adaptive integration methods with guaranteed accuracy
- Using variable transformations, calculations are possible even when the integral interval is infinite.



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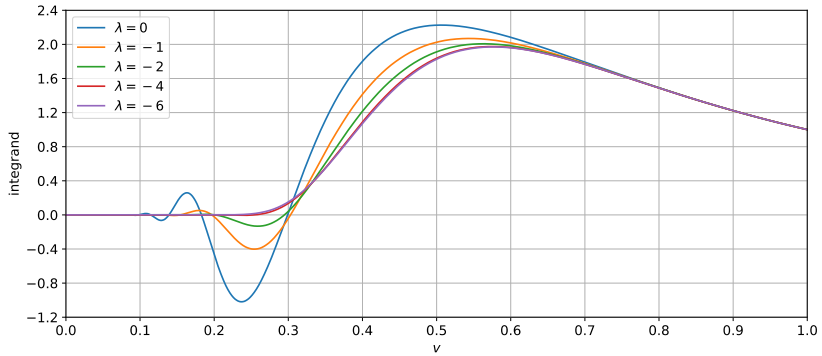


ExRandom

- Probability Variable Generation Library
  - Pseudo-random number generation by Mersenne Twister
  - Continuous probability distribution: 39 types
  - Discrete probability distribution 10 types
  - Multidimensional variable probability distribution: 8 types
  - Time Series Probability Variables
    Color Noise Generation

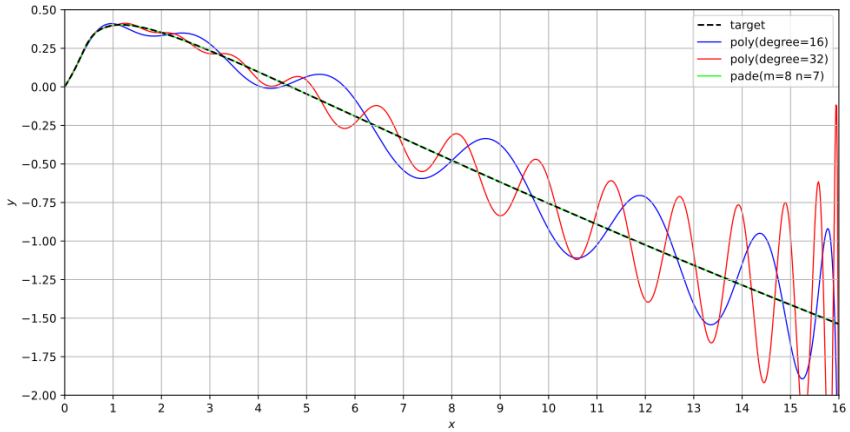
GitHub
Nuget

Padé Approximation / Interpolation

GitHub

- Derivation process of Padé approximations and interpolations

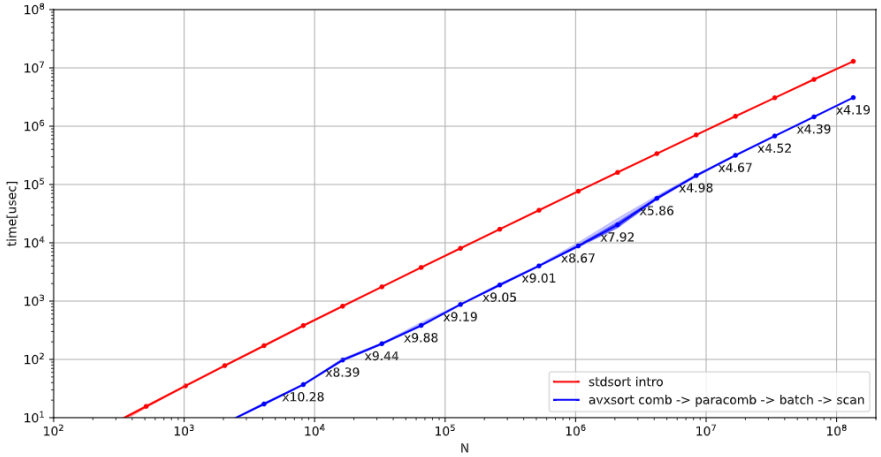
  One of my personal favorite algorithms
  It is an excellent one that can regress without causing the Runge phenomenon that occurs in polynomial interpolation.
  However, it may cause unintended poles, which is especially noticeable in cases where the series diverges rapidly.



SIMDSort

GitHub

- AVX2 sorting algorithm research
- How to pipeline processing and how to combine instructions efficiently
  After various trials, achieved 10 times faster than std::sort



Other Libraries

GitHub
Nuget

- Clustering
  - Kernel-SVM, K-means
- GameTreeSearch
  - alpha-beta, IDDFS
    Solve any game tree by simply defining states and evaluation values
    Software implementation in ReversiWPF
- PNGReadWrite
  - DeepColor (16x4bit) compatible PNG input/output library
    Passed test by PNG Suite (all standard PNG files)

Other Libraries

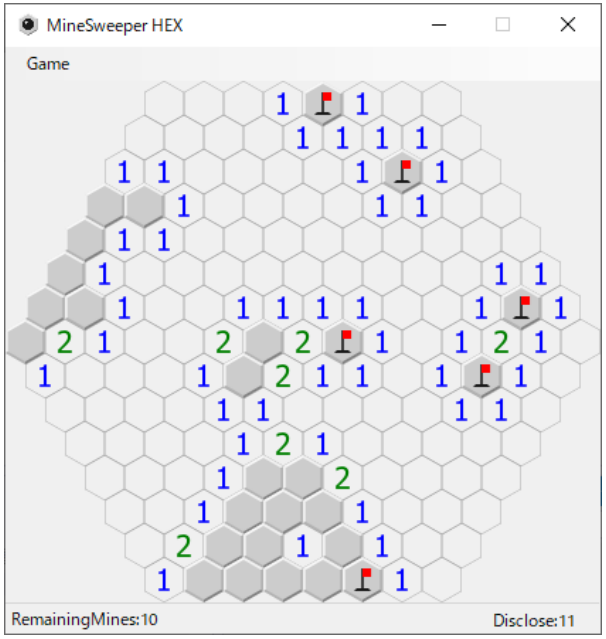
GitHub

Nuget

- ShapeFitting
  - Fitting to line, circle, and ellipse
  - (Lagrange undetermined multiplier method)
  - Robust curve fitting with M-estimation
- Spline
  - Catmull-Rom、 Akima
- Geometry
  - Calculate intersection, intersections line, and intersecting circle

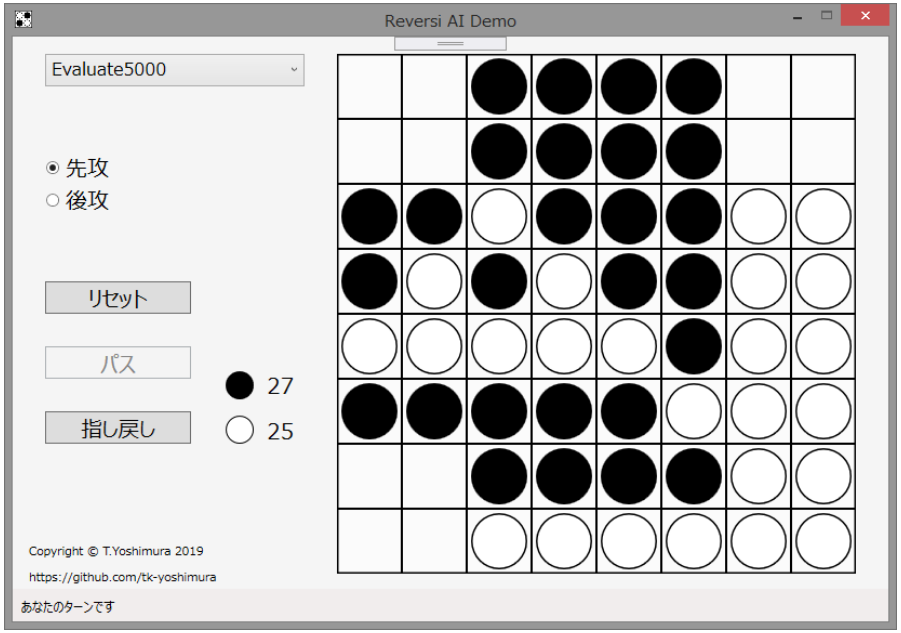
Mini Game

- MineSweeperHEX



- ReversiWPF

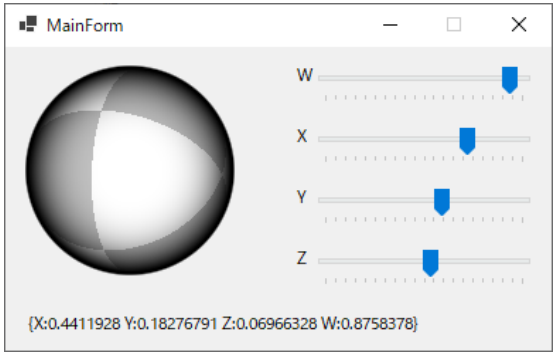
GitHub



GUI Control Parts (WinForms)

- TrackBall

  Quaternions are implemented as an internal representation of rotation in three dimensions.
  Unlike Euler angles, quaternions have the advantage that gimbal lock does not occur.



- ColorPicker

  UI to select specific colors
  from HSV, YCbCr color space

  Double buffer enables flicker-free rendering.

GitHub
Nuget