

LibAMM

0.1.4

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# Chapter 1

## Introduction

This project is for benchmarking common (approximate) matrix multiplication algorithms under various architectures in a streaming setting

### 1.1 Benchmark Tips

usage: ./benchmark [configfile]

#### Note

Require configs in configfile:

- aRow (U64) the rows of tensor A, required by RandomMatrixLoader, SparseMatrixLoader
- aCol (U64) the columns of tensor A, required by RandomMatrixLoader, SparseMatrixLoader
- bCol (U64) the columns of tensor B, required by RandomMatrixLoader, SparseMatrixLoader
- aDensity The density factor of matrix A, Double, 1.0, required by SparseMatrixLoader
- bDensity The density factor of matrix B, Double, 1.0, required by SparseMatrixLoader
- aReduce Reduce some rows of A to be linearly dependent, U64, 0, required by SparseMatrixLoader
- bReduce Reduce some rows of B to be linearly dependent, U64, 0, required by SparseMatrixLoader
- sketchDimension (U64) the dimension of sketch matrix, default 50
- coreBind (U64) the specific core to run this benchmark, default 0
- ptFile (String) the path for the \*.pt to be loaded, default torchscripts/FDAMM.pt
- matrixLoaderTag (String) the nameTag of matrix loader, see MatrixLoaderTable, default is random
- useCPP (U64) force the benchmark to use static and pure cpp implementation instead of pt, default 0
- cppAlgoTag (String) The algorithm tag to index a cpp algorithm, works only under useCPP=1, default "mm", see also CPPAlgoTable
- threads, U64, the number of worker threads, default 2
- osScheduling, U64, whether use default os scheduling instead of my own core bind, default 0
- firstCoreBind, U64, which core will the first thread be bound to, default 0, see also BlockPartitionRunner

Additional tags for energy measurement (please validate usingMeter first) see also [Energy Meter packs](#)

- usingMeter (U64) set to 1 if you want to use some energy meter, default disabled
- meterTag (String) the tag of meter, see also MeterTable, default is intelMsr
- staticPower (Double) set this to >0 if you want to manually config the static power of the device

- meterAddress (String) set this to the file system path of the meter, if it is different from the meter's default
- isStreaming (U64) whether or not use streaming, default 0

by default, we only make A matrix streaming, if also want yo streaming B, please also set streamingTwo↔  
Matrixes to 1

- streamingTwoMatrixes (U64) whether make B matrix also streaming, default 0, will only affect when isStreaming=1

#### Warning

For some platforms, the staticPower automatically measured by sleep is not accurate. Please do this mannully. See also the template config.csv

#### Note

Additional tags for hardware counters

- usePAPI (U64) whether or not use PAPI if papi exists, default 1
  - if PAPI is used, please refer to class ThreadPerfPAPI, otherwise, see class ThreadPerf
  - under PAPI, here is an unified way to custoimize perf events without recompile
    - \* create a configmap readable csv for perfList at perfLists folder, the key is tag you want to display, and the value is inline PAPI tag, type should be String
    - \* set perfUseExternalList (U64) in top configfile to 1
    - \* set perfListSrc (String) in top configfile to perfLists/<your file name>

## 1.2 How to extend a new algorithm (pt-based)

- go to the benchmark/torchscripts
- find any .python as an example
- copy and modify it and generate the \*.pt, please make it under hump style of naming
- the system will then support it by using the name of your pt.

## 1.3 How to extend a new algorithm (pure static c++ based)

- go to the src/CPPALgos and include/CPPALgos
- copy the example class, such as CRSCPPAlgo, rename it, and implement your own amm function
  - copy the cpp and h
  - rename the cpp and h
  - automatically conduct the IDE-full-replace over the CRSCPPAlgo by your own name in cpp and h
  - define your own function

#### Note

- Please use this copy-and-replace policy rather than creat your own, unless you know the doxygen comment style very well and can always keep it!!!

**Warning**

- This copy-and-replace policy will also prevent from wrong parameter types of interface functions, please DO KEEP THE INTERFACE PARAMETER UNDER THE SAME TYPE!!!!!!!!!!!!
- register your function with a tag to `src/CPPALgos/CPPALgoTable.cpp`
- edit the `CMakeList.txt` at `src/CPPALgos` to include your new algo and recompile
- remember to add a test bench, you can refer to `CRSTest.cpp` at `test/SystemTest` for example
- if your algorithms have specific parameters like `beta`, please additionally do the following in the `XXXCPPAlgo` class:
  - copy the virtual `void setConfig(INTELLI::ConfigMapPtr cfg)` claim to your `*.h`
  - implement that function in your `cpp`

## 1.4 How to add a single point test

- copy your config file to `test/scripts`, and your pt file to `test/torchscripts`
- follow and copy the `SketchTest.cpp` to create your own, say `A.cpp`
- register `A.cpp` to `test/CMakeLists.txt`, please follow how we deal with the `SketchTest.cpp`
- assuming you have made `A.cpp` into `a_test`, append `./a_test "--success"` to the last row of `.github/workflows/cmake.yml`



## Chapter 2

## Todo List

Member [INTELL::UtilityFunctions::bind2Core](#) (int id)

unsure about hyper-thread





## Chapter 3

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## Chapter 5

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<a href="#">LibAMM::CRSCPPAlgo</a>	The column row sampling (CRS) class of c++ algos . . . . .	132
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## Chapter 7

# Module Documentation

### 7.1 The matrix loaders

#### Classes

- class [LibAMM::AbstractMatrixLoader](#)  
*The abstract class of matrix loader, parent for all loaders.*
- class [LibAMM::BetaMatrixLoader](#)  
*The Beta class of matrix loader.*
- class [LibAMM::BinomialMatrixLoader](#)  
*The Binomial class of matrix loader.*
- class [LibAMM::CCAMatrixLoader](#)  
*For CCA downstream task.*
- class [LibAMM::ExponentialMatrixLoader](#)  
*The Exponential class of matrix loader.*
- class [LibAMM::GaussianMatrixLoader](#)  
*The Gaussian class of matrix loader.*
- class [LibAMM::MatrixLoaderTable](#)  
*The table class to index all matrix loaders.*
- class [LibAMM::MediaMillMatrixLoader](#)  
*Load MediaMill 2005-2006 data ( <https://rdr.io/github/fcharte/mldr.datasets/man/mediamill.html> ↩️ )*
- class [LibAMM::MNISTMatrixLoader](#)  
*The MNIST class of matrix loader <https://www.kaggle.com/datasets/hojjatk/mnist-dataset>.*
- class [LibAMM::MtxMatrixLoader](#)  
*The matrix loader to load matrixes stored in matrix market mtx format.*
- class [LibAMM::PoissonMatrixLoader](#)  
*The Poisson class of matrix loader.*
- class [LibAMM::RandomMatrixLoader](#)  
*The Random class of matrix loader.*
- class [LibAMM::SIFTMatrixLoader](#)  
*The SIFT class of matrix loader <http://corpus-texmex.irisa.fr/>.*
- class [LibAMM::SparseMatrixLoader](#)  
*The matrix loader to generate adjustable sparse matrix with adjust rank reduction.*
- class [LibAMM::ZeroMaskedMatrixLoader](#)

*The zero masked class of matrix loader, given generate a  $n \times m$  matrix, where only the left-top  $n1 \times m2$  contents are not zero.*

- class [LibAMM::ZipfMatrixLoader](#)

*The Zipf class of matrix loader.*

- `torch::Tensor LibAMM::loadMatrixFromMatrixMarket` (const string &filename)

*the stan-alone function to load a matrix from matrix market mitx file*

## 7.1.1 Detailed Description

### 7.1.1.1 MatrixLoader

This folder contains the loader to matrixes under different generation rules

We define the generation classes of matrixes. here

## 7.1.2 Function Documentation

### 7.1.2.1 loadMatrixFromMatrixMarket()

```
torch::Tensor LibAMM::loadMatrixFromMatrixMarket (
    const string & filename )
```

the stan-alone function to load a matrix from matrix market mitx file

#### Parameters

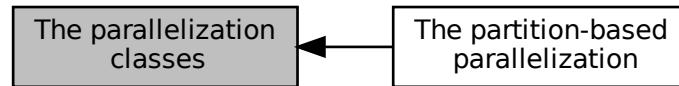
<i>filename</i>	the name of the mtz file
-----------------	--------------------------

#### Returns

the loaded tensor

## 7.2 The parallelization classes

Collaboration diagram for The parallelization classes:



### Modules

- [The partition-based parallelization](#)

### 7.2.1 Detailed Description

#### 7.2.1.1 Parallelization

This folder contains the parallelization approaches

We define the parallelization classes of AMM. here

## 7.3 The streaming classes

### Classes

- class [LibAMM::BlockPartitionStreamer](#)  
*The class to run streaming amm under block partition scheme, let rows of A coming in a streaming manner, all of which are partitioned with [BlockPartitionRunner](#).*
- class [LibAMM::SingleThreadStreamer](#)  
*The class to run streaming amm under single thread, let each row of A coming in a streaming manner.*
- class [LibAMM::AMMTimeStamp](#)  
*The class to define timestamp in streaming.*
- class [LibAMM::TimeStamper](#)  
*The basic class to generate time stamps.*

### 7.3.1 Detailed Description

#### 7.3.1.1 STREAMING

This folder contains the STREAMING approaches

We define the streaming classes of AMM. here

## 7.4 The c++ amm algorithms

### Classes

- class [LibAMM::AbstractCPPAlgo](#)  
*The abstract class of c++ algos.*
- class [LibAMM::BCRSCPPAlgo](#)  
*The Bernoulli column row sampling (BCRS) class of c++ algos.*
- class [LibAMM::BetaCoOFDCPPAlgo](#)  
*The Beta Co-Occurring FD AMM class of c++ algos.*
- class [LibAMM::CLMMCPPAlgo](#)  
*The MM class of c++ algos using opencl.*
- class [LibAMM::CoOccurringFDCPPAlgo](#)  
*The Co-Occurring FD AMM class of c++ algos.*
- class [LibAMM::CountSketchCPPAlgo](#)  
*The counter sketch class of c++ algos.*
- class [LibAMM::CPPAlgoTable](#)  
*The table to index cpp algos.*
- class [LibAMM::CRSCPPAlgo](#)  
*The column row sampling (CRS) class of c++ algos.*
- class [LibAMM::CRSV2CPPAlgo](#)  
*The column row sampling (CRS) class of c++ algos, a second implementation.*
- class [LibAMM::EWSCPPAlgo](#)  
*The Element Wise Sampling (EWS) class of c++ algos.*
- class [LibAMM::FastJLTCPPAlgo](#)  
*The tug of war class of c++ algoS.*
- class [LibAMM::INT8CPPAlgo](#)  
*The INT8 MM class of c++ algos.*
- class [LibAMM::ProductQuantizationHash](#)  
*The Product Quantization AMM class of c++ algos, using hash function to find matching prototypes.*
- class [LibAMM::ProductQuantizationRaw](#)  
*The Product Quantization AMM class of c++ algos, using Euclidean distance.*
- class [LibAMM::RIPCPPAlgo](#)  
*New and improved Johnson-Lindenstrauss embeddings via the Restricted Isometry Property.*
- class [LibAMM::SMPPCACPPAlgo](#)  
*sketch scaled JL class of c++ algos*
- class [LibAMM::TugOfWarCPPAlgo](#)  
*The tug of war class of c++ algoS.*
- class [LibAMM::VectorQuantization](#)  
*The Vector Quantization AMM class of c++ algos.*
- `#define newProductQuantizationHashAlgo std::make_shared<LibAMM::ProductQuantizationHash>`  
*(Macro) To creat a new ProductQuantizationHashAlgounder shared pointer.*
- `typedef std::shared_ptr< class LibAMM::ProductQuantizationHash > LibAMM::ProductQuantizationHashPtr`
- `#define newProductQuantizationRawAlgo std::make_shared<LibAMM::ProductQuantizationRaw>`  
*(Macro) To creat a new ProductQuantizationRawAlgounder shared pointer.*
- `typedef std::shared_ptr< class LibAMM::ProductQuantizationRaw > LibAMM::ProductQuantizationRawPtr`
- `#define newVectorQuantizationAlgo std::make_shared<LibAMM::VectorQuantization>`  
*(Macro) To creat a new VectorQuantizationAlgounder shared pointer.*
- `typedef std::shared_ptr< class LibAMM::VectorQuantization > LibAMM::VectorQuantizationPtr`



## 7.4.1 Detailed Description

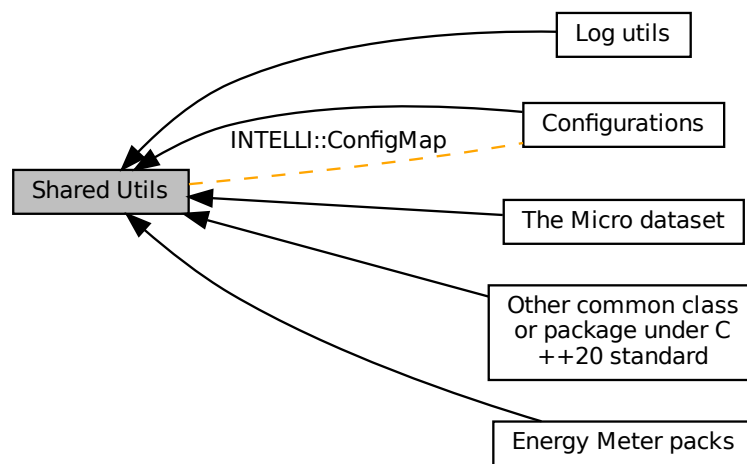
### 7.4.1.1 c++ algorithms

This folder contains the algorithms implemented under pure c++

We define the c++ algorithm classes of AMM. here

## 7.5 Shared Utils

Collaboration diagram for Shared Utils:



## Modules

- [Other common class or package under C++20 standard](#)
- [Configurations](#)
- [Log utils](#)
- [Energy Meter packs](#)
- [The Micro dataset](#)

## Classes

- class [INTELLI::ConfigMap](#)

*The unified map structure to store configurations in a key-value style.*

## Functions

- static void **INTELLI::ConfigMap::spilt** (const std::string s, const std::string &c, vector< std::string > &v)
- void **INTELLI::ConfigMap::smartParse** (std::string key, std::string value)
- void **INTELLI::ConfigMap::edit** (const std::string &key, uint64\_t value)  
*Edit the config map. If not exist the config, will create new, or will overwrite.*
- void **INTELLI::ConfigMap::edit** (const std::string &key, int64\_t value)  
*Edit the config map. If not exist the config, will create new, or will overwrite.*
- void **INTELLI::ConfigMap::edit** (const std::string &key, double value)  
*Edit the config map. If not exist the config, will create new, or will overwrite.*
- void **INTELLI::ConfigMap::edit** (const std::string &key, std::string value)  
*Edit the config map. If not exist the config, will create new, or will overwrite.*
- bool **INTELLI::ConfigMap::existU64** (const std::string &key)  
*To detect whether the key exists and related to a U64.*
- bool **INTELLI::ConfigMap::existI64** (const std::string &key)  
*To detect whether the key exists and related to a I64.*
- bool **INTELLI::ConfigMap::existDouble** (const std::string &key)  
*To detect whether the key exists and related to a double.*
- bool **INTELLI::ConfigMap::existString** (const std::string &key)  
*To detect whether the key exists and related to a std::string.*
- bool **INTELLI::ConfigMap::exist** (const std::string &key)  
*To detect whether the key exists.*
- uint64\_t **INTELLI::ConfigMap::getU64** (const std::string &key)  
*To get a U64 value by key.*
- int64\_t **INTELLI::ConfigMap::getI64** (const std::string &key)  
*To get a I64 value by key.*
- double **INTELLI::ConfigMap::getDouble** (const std::string &key)  
*To get a double value by key.*
- std::string **INTELLI::ConfigMap::getString** (const std::string &key)  
*To get a std::string value by key.*
- std::string **INTELLI::ConfigMap::toString** (const std::string &separator="\t", std::string newLine="\n")  
*convert the whole map to std::string and retuen*
- bool **INTELLI::ConfigMap::fromString** (const std::string src, const std::string &separator="\t", std::string newLine="\n")  
*load the map from some external string*
- void **INTELLI::ConfigMap::cloneInto** (ConfigMap &dest)  
*clone this config into destination*
- void **INTELLI::ConfigMap::loadFrom** (ConfigMap &src)  
*load some information an external one*
- bool **INTELLI::ConfigMap::toFile** (const std::string &fname, const std::string &separator=",", std::string newLine="\n")  
*convert the whole map to file*
- bool **INTELLI::ConfigMap::fromFile** (const std::string &fname, std::string separator=",", std::string newLine="\n")  
*update the whole map from file*
- bool **INTELLI::ConfigMap::fromCArg** (const int argc, char \*\*argv)  
*update the whole map from c/c++ program's args*
- int64\_t **INTELLI::ConfigMap::tryI64** (const string &key, int64\_t defaultValue=0, bool showWarning=false)  
*Try to get an I64 from config map, if not exist, use default value instead.*
- std::map< std::string, std::string > **INTELLI::ConfigMap::getStrMap** ()  
*return the map of string*

- `std::map< std::string, int64_t > INTELLI::ConfigMap::getI64Map ()`  
*return the map of I64*
- `std::map< std::string, uint64_t > INTELLI::ConfigMap::getU64Map ()`  
*return the map of U64*
- `std::map< std::string, double > INTELLI::ConfigMap::getDoubleMap ()`  
*return the map of I64*
- `uint64_t INTELLI::ConfigMap::tryU64 (const string &key, uint64_t defaultValue=0, bool showWarning=false)`  
*Try to get an U64 from config map, if not exist, use default value instead.*
- `double INTELLI::ConfigMap::tryDouble (const string &key, double defaultValue=0, bool showWarning=false)`  
*Try to get a double from config map, if not exist, use default value instead.*
- `string INTELLI::ConfigMap::tryString (const string &key, const string &defaultValue="", bool showWarning=false)`  
*Try to get an String from config map, if not exist, use default value instead.*
- `void INTELLI::ConfigMap::addPrefixToKeys (std::string prefix)`  
*Add prefix to the front of keys, it is useful in downstream task where we need to generate metric config file for each components in the downstream task e.g. instructions -> \${prefix}Instructions.*

## Variables

- `std::map< std::string, uint64_t > INTELLI::ConfigMap::u64Map`
- `std::map< std::string, int64_t > INTELLI::ConfigMap::i64Map`
- `std::map< std::string, double > INTELLI::ConfigMap::doubleMap`
- `std::map< std::string, std::string > INTELLI::ConfigMap::strMap`

### 7.5.1 Detailed Description

This group provides common functions to support the Intelli Stream programs.

### 7.5.2 Function Documentation

#### 7.5.2.1 addPrefixToKeys()

```
void INTELLI::ConfigMap::addPrefixToKeys (
    std::string prefix ) [inline]
```

Add prefix to the front of keys, it is useful in downstream task where we need to generate metric config file for each components in the downstream task e.g. instructions -> \${prefix}Instructions.

#### Parameters

<i>prefix</i>	The prefix you want to add to the front of keys
---------------	---

#### Returns

void

### 7.5.2.2 cloneInto()

```
void INTELLI::ConfigMap::cloneInto (
    ConfigMap & dest ) [inline]
```

clone this config into destination

#### Parameters

<i>dest</i>	The clone destination
-------------	-----------------------

### 7.5.2.3 edit() [1/4]

```
void INTELLI::ConfigMap::edit (
    const std::string & key,
    double value ) [inline]
```

Edit the config map. If not exist the config, will create new, or will overwrite.

#### Parameters

<i>key</i>	The look up key in std::string
<i>value</i>	The double value

### 7.5.2.4 edit() [2/4]

```
void INTELLI::ConfigMap::edit (
    const std::string & key,
    int64_t value ) [inline]
```

Edit the config map. If not exist the config, will create new, or will overwrite.

#### Parameters

<i>key</i>	The look up key in std::string
<i>value</i>	The i64 value

### 7.5.2.5 edit() [3/4]

```
void INTELLI::ConfigMap::edit (
```

```
const std::string & key,  
std::string value ) [inline]
```

Edit the config map. If not exit the config, will create new, or will overwrite.

#### Parameters

<i>key</i>	The look up key in std::string
<i>value</i>	The std::string value

#### 7.5.2.6 edit() [4/4]

```
void INTELLI::ConfigMap::edit (  
    const std::string & key,  
    uint64_t value ) [inline]
```

Edit the config map. If not exit the config, will create new, or will overwrite.

#### Parameters

<i>key</i>	The look up key in std::string
<i>value</i>	The u64 value

#### 7.5.2.7 exist()

```
bool INTELLI::ConfigMap::exist (  
    const std::string & key ) [inline]
```

To detect whether the key exists.

#### Parameters

<i>key</i>	
------------	--

#### Returns

bool for the result

#### 7.5.2.8 existDouble()

```
bool INTELLI::ConfigMap::existDouble (  
    const std::string & key ) [inline]
```

To detect whether the key exists and related to a double.

**Parameters**

<i>key</i>	
------------	--

**Returns**

bool for the result

**7.5.2.9 existI64()**

```
bool INTELLI::ConfigMap::existI64 (  
    const std::string & key ) [inline]
```

To detect whether the key exists and related to a I64.

**Parameters**

<i>key</i>	
------------	--

**Returns**

bool for the result

**7.5.2.10 existString()**

```
bool INTELLI::ConfigMap::existString (  
    const std::string & key ) [inline]
```

To detect whether the key exists and related to a std::string.

**Parameters**

<i>key</i>	
------------	--

**Returns**

bool for the result

**7.5.2.11 existU64()**

```
bool INTELLI::ConfigMap::existU64 (  
    const std::string & key ) [inline]
```

To detect whether the key exists and related to a U64.

**Parameters**

<i>key</i>	
------------	--

**Returns**

bool for the result

**7.5.2.12 fromCArg()**

```
bool INTELLI::ConfigMap::fromCArg (
    const int argc,
    char ** argv ) [inline]
```

update the whole map from c/c++ program's args

**Parameters**

<i>argc</i>	the count of input args
<i>argv</i>	the arg list in chars

**Note**

Will automatically detect int64, double, and string

**Returns**

bool, whether the file is loaded

**7.5.2.13 fromFile()**

```
bool INTELLI::ConfigMap::fromFile (
    const std::string & fname,
    std::string separator = ",",
    std::string newLine = "\n" ) [inline]
```

update the whole map from file

**Parameters**

<i>fname</i>	The file name
<i>separator</i>	The separator std::string, default ",", for csv style
<i>newLine</i>	The newline std::string, default "\n"



**Returns**

bool, whether the file is loaded

**7.5.2.14 fromString()**

```
bool INTELLI::ConfigMap::fromString (
    const std::string src,
    const std::string & separator = "\t",
    std::string newLine = "\n" ) [inline]
```

load the map from some external string

**Parameters**

<i>src, the</i>	string
<i>separator</i>	The separator std::string, default "\t"
<i>newLine</i>	The newline std::string, default "\n"

**Returns**

bool whether successful

**7.5.2.15 getDouble()**

```
double INTELLI::ConfigMap::getDouble (
    const std::string & key ) [inline]
```

To get a double value by key.

**Parameters**

<i>key</i>	
------------	--

**Returns**

value

**Warning**

the key must exist!!

### 7.5.2.16 getDoubleMap()

```
std::map<std::string, double> INTELLI::ConfigMap::getDoubleMap ( ) [inline]
```

return the map of I64

#### Returns

the doubleMap variable

### 7.5.2.17 getI64()

```
int64_t INTELLI::ConfigMap::getI64 (
    const std::string & key ) [inline]
```

To get a I64 value by key.

#### Parameters

key	
-----	--

#### Returns

value

#### Warning

the key must exist!!

### 7.5.2.18 getI64Map()

```
std::map<std::string, int64_t> INTELLI::ConfigMap::getI64Map ( ) [inline]
```

return the map of I64

#### Returns

the i64Map variable

### 7.5.2.19 getString()

```
std::string INTELLI::ConfigMap::getString (
    const std::string & key ) [inline]
```

To get a std::string value by key.

**Parameters**

<i>key</i>	
------------	--

**Returns**

value

**Warning**

the key must exist!!

**7.5.2.20 getStrMap()**

```
std::map<std::string, std::string> INTELLI::ConfigMap::getStrMap ( ) [inline]
```

return the map of string

**Returns**

the strMap variable

**7.5.2.21 getU64()**

```
uint64_t INTELLI::ConfigMap::getU64 (
    const std::string & key ) [inline]
```

To get a U64 value by key.

**Parameters**

<i>key</i>	
------------	--

**Returns**

value

**Warning**

the key must exist!!

### 7.5.2.22 getU64Map()

```
std::map<std::string, uint64_t> INTELLI::ConfigMap::getU64Map ( ) [inline]
```

return the map of U64

#### Returns

the u64Map variable

### 7.5.2.23 loadFrom()

```
void INTELLI::ConfigMap::loadFrom (
    ConfigMap & src ) [inline]
```

load some information an external one

#### Parameters

<i>src</i>	The clone destination
------------	-----------------------

### 7.5.2.24 toFile()

```
bool INTELLI::ConfigMap::toFile (
    const std::string & fname,
    const std::string & separator = ",",
    std::string newLine = "\n" ) [inline]
```

convert the whole map to file

#### Parameters

<i>fname</i>	The file name
<i>separator</i>	The separator std::string, default ",", for csv style
<i>newLine</i>	The newline std::string, default "\n"

#### Returns

bool, whether the file is created

### 7.5.2.25 toString()

```
std::string INTELLI::ConfigMap::toString (
```

```
const std::string & separator = "\t",
std::string newLine = "\n" ) [inline]
```

convert the whole map to std::string and return

#### Parameters

<i>separator</i>	The separator std::string, default "\t"
<i>newLine</i>	The newline std::string, default "\n"

#### Returns

the result

### 7.5.2.26 tryDouble()

```
double INTELLI::ConfigMap::tryDouble (
    const string & key,
    double defaultValue = 0,
    bool showWarning = false ) [inline]
```

Try to get a double from config map, if not exist, use default value instead.

#### Parameters

<i>key</i>	The key
<i>defaultValue</i>	The default
<i>showWarning</i>	Whether show warning logs if not found

#### Returns

The returned value

### 7.5.2.27 tryI64()

```
int64_t INTELLI::ConfigMap::tryI64 (
    const string & key,
    int64_t defaultValue = 0,
    bool showWarning = false ) [inline]
```

Try to get an I64 from config map, if not exist, use default value instead.

#### Parameters

<i>key</i>	The key
<i>defaultValue</i>	The default
<i>showWarning</i>	Whether show warning logs if not found

**Returns**

The returned value

**7.5.2.28 tryString()**

```
string INTELLI::ConfigMap::tryString (
    const string & key,
    const string & defaultValue = "",
    bool showWarning = false ) [inline]
```

Try to get an String from config map, if not exist, use default value instead.

**Parameters**

<i>key</i>	The key
<i>defaultValue</i>	The default
<i>showWarning</i>	Whether show warning logs if not found

**Returns**

The returned value

**7.5.2.29 tryU64()**

```
uint64_t INTELLI::ConfigMap::tryU64 (
    const string & key,
    uint64_t defaultValue = 0,
    bool showWarning = false ) [inline]
```

Try to get an U64 from config map, if not exist, use default value instead.

**Parameters**

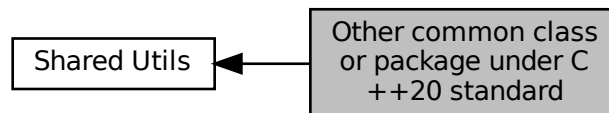
<i>key</i>	The key
<i>defaultValue</i>	The default
<i>showWarning</i>	Whether show warning logs if not found

## Returns

The returned value

## 7.6 Other common class or package under C++20 standard

Collaboration diagram for Other common class or package under C++20 standard:



### Classes

- class [INTELLI::AbstractC20Thread](#)  
The base class and abstraction of C++20 thread, and it can be derived into other threads.
- class [INTELLI::C20Buffer< dataType >](#)
- class [INTELLI::ThreadPerf](#)  
The top entity to provide perf traces, please use this class only UNLESS you know what you are doing.
- class [INTELLI::ThreadPerfPAPI](#)  
The top entity to provide perf traces by using PAPI lib.

### Macros

- `#define newAbstractC20Thread std::make_shared<INTELLI::AbstractC20Thread>`  
(Macro) To creat a new [newAbstractC20Thread](#) under shared pointer.
- `#define newThreadPerf std::make_shared<INTELLI::ThreadPerf>`  
(Macro) To creat a new [ThreadPerf](#) under shared pointer.
- `#define newThreadPerfPAPI std::make_shared<INTELLI::ThreadPerfPAPI>`  
(Macro) To creat a new [ThreadPerfPAPI](#) under shared pointer.

### Typedefs

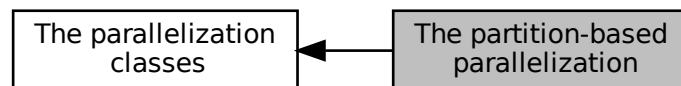
- `typedef std::shared_ptr< AbstractC20Thread > INTELLI::AbstractC20ThreadPtr`  
The class to describe a shared pointer to [AbstractC20Thread](#).
- `typedef std::shared_ptr< INTELLI::ThreadPerf > INTELLI::ThreadPerfPtr`  
The class to describe a shared pointer to [ThreadPerf](#).
- `typedef std::shared_ptr< INTELLI::ThreadPerfPAPI > INTELLI::ThreadPerfPAPIPtr`  
The class to describe a shared pointer to [ThreadPerfPAPI](#).

### 7.6.1 Detailed Description

This package covers some common C++20 new features, such as `std::thread` to ease the programming

## 7.7 The partition-based parallelization

Collaboration diagram for The partition-based parallelization:



### Classes

- class [LibAMM::BlockPartitionWorker](#)  
*The basic partition worker.*
- class [LibAMM::BlockPartitionRunner](#)  
*The top entity to control all workers, see also [BlockPartitionWorker](#). This one works under a simple row partition parallelization.*
- `#define newBlockPartitionWorker std::make_shared<LibAMM::BlockPartitionWorker>`  
*(Macro) To creat a new BlockPartitionWorker under shared pointer.*
- `typedef std::shared_ptr< LibAMM::BlockPartitionWorker > LibAMM::BlockPartitionWorkerPtr`

### 7.7.1 Detailed Description

## 7.8 Configurations

Collaboration diagram for Configurations:





## Classes

- class [INTELLI::ConfigMap](#)  
*The unified map structure to store configurations in a key-value style.*

## Macros

- `#define newConfigMap make_shared<INTELLI::ConfigMap>`  
*(Macro) To creat a new ConfigMap under shared pointer.*

## Typedefs

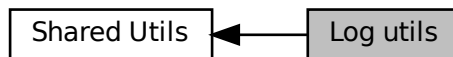
- `typedef std::shared_ptr< ConfigMap > INTELLI::ConfigMapPtr`  
*The class to describe a shared pointer to [ConfigMap](#).*

### 7.8.1 Detailed Description

This package is used to store configuration information in an unified map and get away from too many stand-alone functtions

## 7.9 Log utils

Collaboration diagram for Log utils:



## Classes

- class [INTELLI::IntelliLog](#)  
*The log functions packed in class.*
- class [INTELLI::IntelliLog\\_FileProtector](#)  
*The protector for concurrent log on a file.*

## Macros

- `#define INTELLI_INFO(n) INTELLI::IntelliLog::log("INFO",n)`  
*(Macro) To log something as information*
- `#define INTELLI_ERROR(n) INTELLI::IntelliLog::log("ERROR",n)`  
*(Macro) To log something as error*
- `#define INTELLI_WARNING(n) INTELLI::IntelliLog::log("WARNING",n)`
- `#define INTELLI_DEBUG(n) IntelliLog::log("DEBUG",n)`  
*(Macro) To log something as debug*

## Functions

- static void `INTELLI::IntelliLog::log` (std::string level, std::string\_view message, std::source\_location const source=std::source\_location::current())  
*Produce a log.*
- static void `INTELLI::IntelliLog::setupLoggingFile` (string fname)  
*set up the logging file by its name*
- void `INTELLI::IntelliLog_FileProtector::lock` ()  
*lock this protector*
- void `INTELLI::IntelliLog_FileProtector::unlock` ()  
*unlock this protector*
- void `INTELLI::IntelliLog_FileProtector::openLogFile` (const string &fname)  
*try to open a file*
- void `INTELLI::IntelliLog_FileProtector::appendLogFile` (const string &msg)  
*try to appened something to the file, if it's opened*

### 7.9.1 Detailed Description

This package is used for logging

### 7.9.2 Function Documentation

#### 7.9.2.1 appendLogFile()

```
void INTELLI::IntelliLog_FileProtector::appendLogFile (
    const string & msg ) [inline]
```

try to appened something to the file, if it's opened

##### Parameters

<i>msg</i>	The message to appened
------------	------------------------

#### 7.9.2.2 log()

```
void INTELLI::IntelliLog::log (
    std::string level,
    std::string_view message,
    std::source_location const source = std::source_location::current() ) [static]
```

Produce a log.

**Parameters**

<i>level</i>	The log level you want to indicate
<i>message</i>	The log message you want to indicate
<i>source</i>	reserved

**Note**

message is automatically appended with a "\n"

**7.9.2.3 openLogFile()**

```
void INTELLI::IntelliLog_FileProtector::openLogFile (
    const string & fname ) [inline]
```

try to open a file

**Parameters**

<i>fname</i>	The name of file
--------------	------------------

**7.9.2.4 setupLoggingFile()**

```
void INTELLI::IntelliLog::setupLoggingFile (
    string fname ) [static]
```

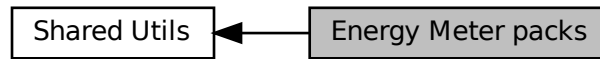
set up the logging file by its name

**Parameters**

<i>fname</i>	the name of file
--------------	------------------

## 7.10 Energy Meter packs

Collaboration diagram for Energy Meter packs:



### Classes

- class [DIVERSE\\_METER::AbstractMeter](#)  
*The abstract class for all meters.*
- class [DIVERSE\\_METER::EspMeterUart](#)  
*the entity of an esp32s2-based power meter, connected by uart 115200*
- class [DIVERSE\\_METER::IntelMeter](#)  
*the entity of intel msr-based power meter, may be not support for some newer architectures*
- class [DIVERSE\\_METER::MeterTable](#)  
*The table class to index all meters.*

### Macros

- `#define newMeterTable std::make_shared<DIVERSE\_METER::MeterTable>`  
*(Macro) To creat a new MeterTable under shared pointer.*

### Typedefs

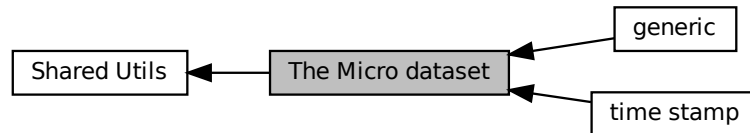
- `typedef std::shared_ptr< class DIVERSE\_METER::MeterTable > DIVERSE\_METER::MeterTable::MeterTablePtr`  
*The class to describe a shared pointer to [MeterTable](#).*
- `typedef std::shared_ptr< DIVERSE\_METER::AbstractMeter > DIVERSE\_METER::AbstractMeterPtr`

#### 7.10.1 Detailed Description

This package is used for energy meter

## 7.11 The Micro dataset

Collaboration diagram for The Micro dataset:



### Modules

- [generic](#)
- [time stamp](#)

### Classes

- class [INTELLI::MicroDataSet](#)  
*The all-in-one class for the Micro dataset.*

### Functions

- [INTELLI::MicroDataSet::MicroDataSet](#) ()=default  
*default construction, with auto random generator*
- [INTELLI::MicroDataSet::MicroDataSet](#) (uint64\_t \_seed)  
*construction with seed*
- void [INTELLI::MicroDataSet::setSeed](#) (uint64\_t \_seed)  
*construction with seed*

#### 7.11.1 Detailed Description

##### Note

The STL and static headers will be named as \*.hpp, while \*.h means there are real, fixed classes

##### Warning

Please use this file ONLY as STL, it may not work if you turn it into \*.cpp!!!!

This is the synthetic dataset Micro, firstly introduced in our SIGMOD 2021 paper

```

@article{IntraWJoin21,
  author = {Zhang, Shuhao and Mao, Yancan and He, Jiong and Grulich, Philipp M and Zeuch, Steffen and He, Bing},
  title = {Parallelizing Intra-Window Join on Multicores: An Experimental Study},
  booktitle = {Proceedings of the 2021 International Conference on Management of Data (SIGMOD '21), June 18--22, 2021, Denver, Colorado, USA},
  series = {SIGMOD '21},
  year={2021},
  isbn = {978-1-4503-8343-1/21/06},
  url = {https://doi.org/10.1145/3448016.3452793},
  doi = {10.1145/3448016.3452793},
}
  
```

## 7.11.2 Function Documentation

### 7.11.2.1 MicroDataSet()

```
INTELLI::MicroDataSet::MicroDataSet (
    uint64_t _seed ) [inline], [explicit]
```

construction with seed

#### Parameters

<i>seed</i>	The seed for random generator
-------------	-------------------------------

### 7.11.2.2 setSeed()

```
void INTELLI::MicroDataSet::setSeed (
    uint64_t _seed ) [inline]
```

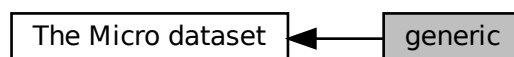
construction with seed

#### Parameters

<i>seed</i>	The seed for random generator
-------------	-------------------------------

## 7.12 generic

Collaboration diagram for generic:



## Functions

- `template<class dType = uint32_t>`  
`vector< dType > INTELLI::MicroDataSet::genIncrementalAlphabet (size_t len)`

*To generate incremental alphabet, starting from 0 and end at len.*

- `template<class tsType = size_t>`  
`vector< tsType > INTELLI::MicroDataSet::genZipflnt (size_t len, tsType maxV, double fac)`

*The function to generate a vector of integers which has zipf distribution.*

- `template<class tsType = uint32_t, class genType = std::mt19937>`  
`vector< tsType > INTELLI::MicroDataSet::genRandInt (size_t len, tsType maxV, tsType minV=0)`

*generate the vector of random integer*

- `template<class dType = double>`  
`vector< dType > INTELLI::MicroDataSet::genZipfLut (size_t len, dType fac)`

*To generate the zipf Lut.*

### 7.12.1 Detailed Description

The functions for general generation of Micro

### 7.12.2 Function Documentation

#### 7.12.2.1 genIncrementalAlphabet()

```
template<class dType = uint32_t>
vector<dType> INTELLI::MicroDataSet::genIncrementalAlphabet (
    size_t len ) [inline]
```

To generate incremental alphabet, starting from 0 and end at len.

##### Template Parameters

<i>dType</i>	The data type in the alphabet, default uint32_t
--------------	---

##### Parameters

<i>len</i>	The length of alphabet
------------	------------------------

##### Returns

The output vector alphabet

#### 7.12.2.2 genRandInt()

```
template<class tsType = uint32_t, class genType = std::mt19937>
vector<tsType> INTELLI::MicroDataSet::genRandInt (
```

```
size_t len,
tsType maxV,
tsType minV = 0 ) [inline]
```

generate the vector of random integer

#### Template Parameters

<i>tsType</i>	The data type, default uint32_t
<i>genType</i>	The generator type, default mt19937 (32 bit rand)

#### Parameters

<i>len</i>	The length of output vector
<i>maxV</i>	The maximum value of output
<i>minV</i>	The minimum value of output

#### Returns

The output vector

#### Note

Both signed and unsigned int are support, just make sure you have right tsType

Other options for genType:

- mt19937\_64: 64 bit rand
- ranlux24: 24 bit
- ranlux48: 48 bit

### 7.12.2.3 genZipfInt()

```
template<class tsType = size_t>
vector<tsType> INTELLI::MicroDataSet::genZipfInt (
    size_t len,
    tsType maxV,
    double fac ) [inline]
```

The function to generate a vector of integers which has zipf distribution.

#### Parameters

<i>tsType</i>	The data type of int, default is size_t
<i>len</i>	The length of output vector
<i>maxV</i>	The maximum value of integer
<i>fac</i>	The zipf factor, in [0,1]



**Returns**

the output vector

**7.12.2.4 genZipfLut()**

```
template<class dType = double>
vector<dType> INTELLI::MicroDataSet::genZipfLut (
    size_t len,
    dType fac ) [inline]
```

To generate the zipf Lut.

**Template Parameters**

<i>dType</i>	The data type in the alphabet, default double
--------------	---

**Parameters**

<i>len</i>	The length of alphabet
<i>fac</i>	The zipf factor, in [0,1]

**Returns**

The output vector lut

Compute scaling factor such that

$\text{sum}(\text{lut}[i], i=1..\text{alphabet\_size}) = 1.0$

Generate the lookup table

**7.13 time stamp**

Collaboration diagram for time stamp:



## Functions

- `template<class tsType = size_t>`  
`vector< tsType > INTELLI::MicroDataSet::genSmoothTimeStamp (size_t len, size_t step, size_t interval)`  
*The function to generate a vector of timestamp which grows smoothly.*
- `template<class tsType = size_t>`  
`vector< tsType > INTELLI::MicroDataSet::genSmoothTimeStamp (size_t len, size_t maxTime)`
- `template<class tsType = size_t>`  
`vector< tsType > INTELLI::MicroDataSet::genZipfTimeStamp (size_t len, tsType maxTime, double fac)`  
*The function to generate a vector of timestamp which has zipf distribution.*

### 7.13.1 Detailed Description

This group is specialized for time stamps, as they should follow an incremental order

### 7.13.2 Function Documentation

#### 7.13.2.1 genSmoothTimeStamp()

```
template<class tsType = size_t>
vector<tsType> INTELLI::MicroDataSet::genSmoothTimeStamp (
    size_t len,
    size_t step,
    size_t interval ) [inline]
```

The function to generate a vector of timestamp which grows smoothly.

#### Template Parameters

<i>tsType</i>	The data type of time stamp, default is <code>size_t</code>
---------------	---

#### Parameters

<i>len</i>	The length of output vector
<i>step</i>	Within the step, timestamp will remain the same
<i>interval</i>	The incremental value between two steps

#### Returns

The vector of time stamp

### 7.13.2.2 genZipfTimeStamp()

```
template<class tsType = size_t>
vector<tsType> INTELLI::MicroDataSet::genZipfTimeStamp (
    size_t len,
    tsType maxTime,
    double fac ) [inline]
```

The function to generate a vector of timestamp which has zipf distribution.

#### Parameters

<i>tsType</i>	The data type of time stamp, default is <code>size_t</code>
<i>len</i>	The length of output vector
<i>maxTime</i>	The maximum value of time stamp
<i>fac</i>	The zipf factor, in [0,1]

#### Returns

the output vector

#### See also

[genZipfInt](#)

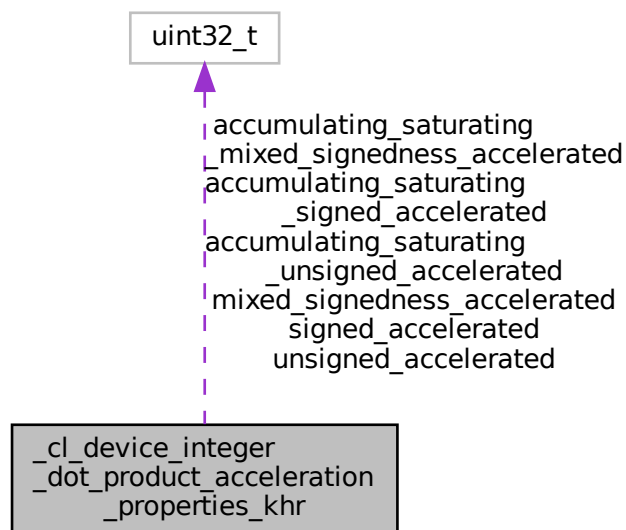


## Chapter 8

# Class Documentation

### 8.1 `_cl_device_integer_dot_product_acceleration_properties_khr` Struct Reference

Collaboration diagram for `_cl_device_integer_dot_product_acceleration_properties_khr`:



#### Public Attributes

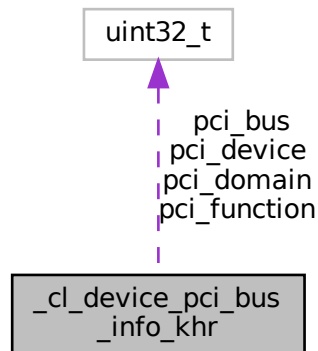
- `cl_bool` **signed\_accelerated**
- `cl_bool` **unsigned\_accelerated**
- `cl_bool` **mixed\_signedness\_accelerated**
- `cl_bool` **accumulating\_saturating\_signed\_accelerated**
- `cl_bool` **accumulating\_saturating\_unsigned\_accelerated**
- `cl_bool` **accumulating\_saturating\_mixed\_signedness\_accelerated**

The documentation for this struct was generated from the following file:

- `include/CL/cl_ext.h`

## 8.2 \_cl\_device\_pci\_bus\_info\_khr Struct Reference

Collaboration diagram for \_cl\_device\_pci\_bus\_info\_khr:



### Public Attributes

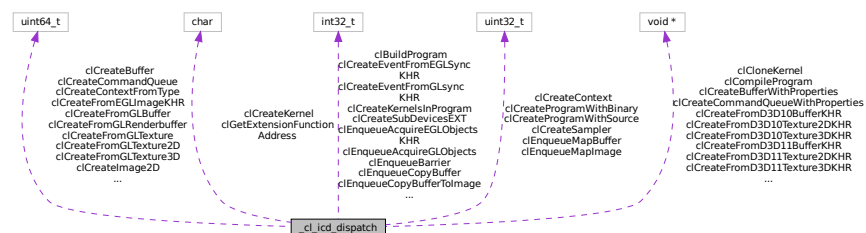
- `cl_uint pci_domain`
- `cl_uint pci_bus`
- `cl_uint pci_device`
- `cl_uint pci_function`

The documentation for this struct was generated from the following file:

- `include/CL/cl_ext.h`

## 8.3 \_cl\_icd\_dispatch Struct Reference

Collaboration diagram for \_cl\_icd\_dispatch:



## Public Attributes

- cl\_api\_clGetPlatformIDs **clGetPlatformIDs**
- cl\_api\_clGetPlatformInfo **clGetPlatformInfo**
- cl\_api\_clGetDeviceIDs **clGetDeviceIDs**
- cl\_api\_clGetDeviceInfo **clGetDeviceInfo**
- cl\_api\_clCreateContext **clCreateContext**
- cl\_api\_clCreateContextFromType **clCreateContextFromType**
- cl\_api\_clRetainContext **clRetainContext**
- cl\_api\_clReleaseContext **clReleaseContext**
- cl\_api\_clGetContextInfo **clGetContextInfo**
- cl\_api\_clCreateCommandQueue **clCreateCommandQueue**
- cl\_api\_clRetainCommandQueue **clRetainCommandQueue**
- cl\_api\_clReleaseCommandQueue **clReleaseCommandQueue**
- cl\_api\_clGetCommandQueueInfo **clGetCommandQueueInfo**
- cl\_api\_clSetCommandQueueProperty **clSetCommandQueueProperty**
- cl\_api\_clCreateBuffer **clCreateBuffer**
- cl\_api\_clCreateImage2D **clCreateImage2D**
- cl\_api\_clCreateImage3D **clCreateImage3D**
- cl\_api\_clRetainMemObject **clRetainMemObject**
- cl\_api\_clReleaseMemObject **clReleaseMemObject**
- cl\_api\_clGetSupportedImageFormats **clGetSupportedImageFormats**
- cl\_api\_clGetMemObjectInfo **clGetMemObjectInfo**
- cl\_api\_clGetImageInfo **clGetImageInfo**
- cl\_api\_clCreateSampler **clCreateSampler**
- cl\_api\_clRetainSampler **clRetainSampler**
- cl\_api\_clReleaseSampler **clReleaseSampler**
- cl\_api\_clGetSamplerInfo **clGetSamplerInfo**
- cl\_api\_clCreateProgramWithSource **clCreateProgramWithSource**
- cl\_api\_clCreateProgramWithBinary **clCreateProgramWithBinary**
- cl\_api\_clRetainProgram **clRetainProgram**
- cl\_api\_clReleaseProgram **clReleaseProgram**
- cl\_api\_clBuildProgram **clBuildProgram**
- cl\_api\_clUnloadCompiler **clUnloadCompiler**
- cl\_api\_clGetProgramInfo **clGetProgramInfo**
- cl\_api\_clGetProgramBuildInfo **clGetProgramBuildInfo**
- cl\_api\_clCreateKernel **clCreateKernel**
- cl\_api\_clCreateKernelsInProgram **clCreateKernelsInProgram**
- cl\_api\_clRetainKernel **clRetainKernel**
- cl\_api\_clReleaseKernel **clReleaseKernel**
- cl\_api\_clSetKernelArg **clSetKernelArg**
- cl\_api\_clGetKernelInfo **clGetKernelInfo**
- cl\_api\_clGetKernelWorkGroupInfo **clGetKernelWorkGroupInfo**
- cl\_api\_clWaitForEvents **clWaitForEvents**
- cl\_api\_clGetEventInfo **clGetEventInfo**
- cl\_api\_clRetainEvent **clRetainEvent**
- cl\_api\_clReleaseEvent **clReleaseEvent**
- cl\_api\_clGetEventProfilingInfo **clGetEventProfilingInfo**
- cl\_api\_clFlush **clFlush**
- cl\_api\_clFinish **clFinish**
- cl\_api\_clEnqueueReadBuffer **clEnqueueReadBuffer**
- cl\_api\_clEnqueueWriteBuffer **clEnqueueWriteBuffer**
- cl\_api\_clEnqueueCopyBuffer **clEnqueueCopyBuffer**
- cl\_api\_clEnqueueReadImage **clEnqueueReadImage**
- cl\_api\_clEnqueueWriteImage **clEnqueueWriteImage**

- `cl_api_clEnqueueCopyImage` **clEnqueueCopyImage**
- `cl_api_clEnqueueCopyImageToBuffer` **clEnqueueCopyImageToBuffer**
- `cl_api_clEnqueueCopyBufferToImage` **clEnqueueCopyBufferToImage**
- `cl_api_clEnqueueMapBuffer` **clEnqueueMapBuffer**
- `cl_api_clEnqueueMapImage` **clEnqueueMapImage**
- `cl_api_clEnqueueUnmapMemObject` **clEnqueueUnmapMemObject**
- `cl_api_clEnqueueNDRangeKernel` **clEnqueueNDRangeKernel**
- `cl_api_clEnqueueTask` **clEnqueueTask**
- `cl_api_clEnqueueNativeKernel` **clEnqueueNativeKernel**
- `cl_api_clEnqueueMarker` **clEnqueueMarker**
- `cl_api_clEnqueueWaitForEvents` **clEnqueueWaitForEvents**
- `cl_api_clEnqueueBarrier` **clEnqueueBarrier**
- `cl_api_clGetExtensionFunctionAddress` **clGetExtensionFunctionAddress**
- `cl_api_clCreateFromGLBuffer` **clCreateFromGLBuffer**
- `cl_api_clCreateFromGLTexture2D` **clCreateFromGLTexture2D**
- `cl_api_clCreateFromGLTexture3D` **clCreateFromGLTexture3D**
- `cl_api_clCreateFromGLRenderbuffer` **clCreateFromGLRenderbuffer**
- `cl_api_clGetGLObjectInfo` **clGetGLObjectInfo**
- `cl_api_clGetGLTextureInfo` **clGetGLTextureInfo**
- `cl_api_clEnqueueAcquireGLObjects` **clEnqueueAcquireGLObjects**
- `cl_api_clEnqueueReleaseGLObjects` **clEnqueueReleaseGLObjects**
- `cl_api_clGetGLContextInfoKHR` **clGetGLContextInfoKHR**
- `cl_api_clGetDeviceIDsFromD3D10KHR` **clGetDeviceIDsFromD3D10KHR**
- `cl_api_clCreateFromD3D10BufferKHR` **clCreateFromD3D10BufferKHR**
- `cl_api_clCreateFromD3D10Texture2DKHR` **clCreateFromD3D10Texture2DKHR**
- `cl_api_clCreateFromD3D10Texture3DKHR` **clCreateFromD3D10Texture3DKHR**
- `cl_api_clEnqueueAcquireD3D10ObjectsKHR` **clEnqueueAcquireD3D10ObjectsKHR**
- `cl_api_clEnqueueReleaseD3D10ObjectsKHR` **clEnqueueReleaseD3D10ObjectsKHR**
- `cl_api_clSetEventCallback` **clSetEventCallback**
- `cl_api_clCreateSubBuffer` **clCreateSubBuffer**
- `cl_api_clSetMemObjectDestructorCallback` **clSetMemObjectDestructorCallback**
- `cl_api_clCreateUserEvent` **clCreateUserEvent**
- `cl_api_clSetUserEventStatus` **clSetUserEventStatus**
- `cl_api_clEnqueueReadBufferRect` **clEnqueueReadBufferRect**
- `cl_api_clEnqueueWriteBufferRect` **clEnqueueWriteBufferRect**
- `cl_api_clEnqueueCopyBufferRect` **clEnqueueCopyBufferRect**
- `cl_api_clCreateSubDevicesEXT` **clCreateSubDevicesEXT**
- `cl_api_clRetainDeviceEXT` **clRetainDeviceEXT**
- `cl_api_clReleaseDeviceEXT` **clReleaseDeviceEXT**
- `cl_api_clCreateEventFromGLsyncKHR` **clCreateEventFromGLsyncKHR**
- `cl_api_clCreateSubDevices` **clCreateSubDevices**
- `cl_api_clRetainDevice` **clRetainDevice**
- `cl_api_clReleaseDevice` **clReleaseDevice**
- `cl_api_clCreateImage` **clCreateImage**
- `cl_api_clCreateProgramWithBuiltInKernels` **clCreateProgramWithBuiltInKernels**
- `cl_api_clCompileProgram` **clCompileProgram**
- `cl_api_clLinkProgram` **clLinkProgram**
- `cl_api_clUnloadPlatformCompiler` **clUnloadPlatformCompiler**
- `cl_api_clGetKernelArgInfo` **clGetKernelArgInfo**
- `cl_api_clEnqueueFillBuffer` **clEnqueueFillBuffer**
- `cl_api_clEnqueueFillImage` **clEnqueueFillImage**
- `cl_api_clEnqueueMigrateMemObjects` **clEnqueueMigrateMemObjects**
- `cl_api_clEnqueueMarkerWithWaitList` **clEnqueueMarkerWithWaitList**
- `cl_api_clEnqueueBarrierWithWaitList` **clEnqueueBarrierWithWaitList**
- `cl_api_clGetExtensionFunctionAddressForPlatform` **clGetExtensionFunctionAddressForPlatform**



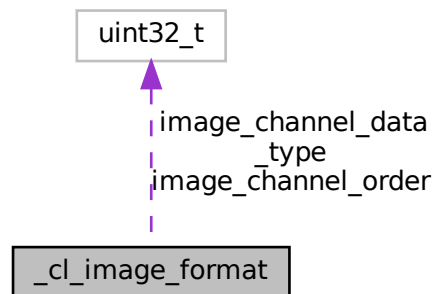
- `cl_api_clCreateFromGLTexture` **clCreateFromGLTexture**
- `cl_api_clGetDeviceIDsFromD3D11KHR` **clGetDeviceIDsFromD3D11KHR**
- `cl_api_clCreateFromD3D11BufferKHR` **clCreateFromD3D11BufferKHR**
- `cl_api_clCreateFromD3D11Texture2DKHR` **clCreateFromD3D11Texture2DKHR**
- `cl_api_clCreateFromD3D11Texture3DKHR` **clCreateFromD3D11Texture3DKHR**
- `cl_api_clCreateFromDX9MediaSurfaceKHR` **clCreateFromDX9MediaSurfaceKHR**
- `cl_api_clEnqueueAcquireD3D11ObjectsKHR` **clEnqueueAcquireD3D11ObjectsKHR**
- `cl_api_clEnqueueReleaseD3D11ObjectsKHR` **clEnqueueReleaseD3D11ObjectsKHR**
- `cl_api_clGetDeviceIDsFromDX9MediaAdapterKHR` **clGetDeviceIDsFromDX9MediaAdapterKHR**
- `cl_api_clEnqueueAcquireDX9MediaSurfacesKHR` **clEnqueueAcquireDX9MediaSurfacesKHR**
- `cl_api_clEnqueueReleaseDX9MediaSurfacesKHR` **clEnqueueReleaseDX9MediaSurfacesKHR**
- `cl_api_clCreateFromEGLImageKHR` **clCreateFromEGLImageKHR**
- `cl_api_clEnqueueAcquireEGLObjectsKHR` **clEnqueueAcquireEGLObjectsKHR**
- `cl_api_clEnqueueReleaseEGLObjectsKHR` **clEnqueueReleaseEGLObjectsKHR**
- `cl_api_clCreateEventFromEGLSyncKHR` **clCreateEventFromEGLSyncKHR**
- `cl_api_clCreateCommandQueueWithProperties` **clCreateCommandQueueWithProperties**
- `cl_api_clCreatePipe` **clCreatePipe**
- `cl_api_clGetPipeInfo` **clGetPipeInfo**
- `cl_api_clSVMAlloc` **clSVMAlloc**
- `cl_api_clSVMFree` **clSVMFree**
- `cl_api_clEnqueueSVMFree` **clEnqueueSVMFree**
- `cl_api_clEnqueueSVMMemcpy` **clEnqueueSVMMemcpy**
- `cl_api_clEnqueueSVMMemFill` **clEnqueueSVMMemFill**
- `cl_api_clEnqueueSVMMap` **clEnqueueSVMMap**
- `cl_api_clEnqueueSVMUnmap` **clEnqueueSVMUnmap**
- `cl_api_clCreateSamplerWithProperties` **clCreateSamplerWithProperties**
- `cl_api_clSetKernelArgSVMPointer` **clSetKernelArgSVMPointer**
- `cl_api_clSetKernelExecInfo` **clSetKernelExecInfo**
- `cl_api_clGetKernelSubGroupInfoKHR` **clGetKernelSubGroupInfoKHR**
- `cl_api_clCloneKernel` **clCloneKernel**
- `cl_api_clCreateProgramWithIL` **clCreateProgramWithIL**
- `cl_api_clEnqueueSVMigrateMem` **clEnqueueSVMigrateMem**
- `cl_api_clGetDeviceAndHostTimer` **clGetDeviceAndHostTimer**
- `cl_api_clGetHostTimer` **clGetHostTimer**
- `cl_api_clGetKernelSubGroupInfo` **clGetKernelSubGroupInfo**
- `cl_api_clSetDefaultDeviceCommandQueue` **clSetDefaultDeviceCommandQueue**
- `cl_api_clSetProgramReleaseCallback` **clSetProgramReleaseCallback**
- `cl_api_clSetProgramSpecializationConstant` **clSetProgramSpecializationConstant**
- `cl_api_clCreateBufferWithProperties` **clCreateBufferWithProperties**
- `cl_api_clCreateImageWithProperties` **clCreateImageWithProperties**
- `cl_api_clSetContextDestructorCallback` **clSetContextDestructorCallback**

The documentation for this struct was generated from the following file:

- `include/CL/cl_icd.h`

## 8.4 `_cl_image_format` Struct Reference

Collaboration diagram for `_cl_image_format`:



### Public Attributes

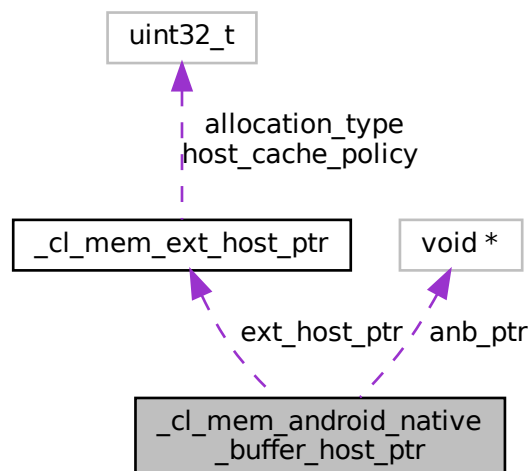
- `cl_channel_order` **`image_channel_order`**
- `cl_channel_type` **`image_channel_data_type`**

The documentation for this struct was generated from the following file:

- `include/CL/cl.h`

## 8.5 `_cl_mem_android_native_buffer_host_ptr` Struct Reference

Collaboration diagram for `_cl_mem_android_native_buffer_host_ptr`:



## Public Attributes

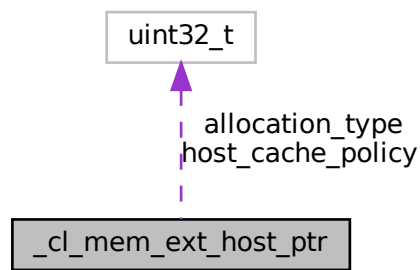
- [cl\\_mem\\_ext\\_host\\_ptr](#) **ext\_host\_ptr**
- void \* **anb\_ptr**

The documentation for this struct was generated from the following file:

- include/CL/cl\_ext.h

## 8.6 \_cl\_mem\_ext\_host\_ptr Struct Reference

Collaboration diagram for \_cl\_mem\_ext\_host\_ptr:



## Public Attributes

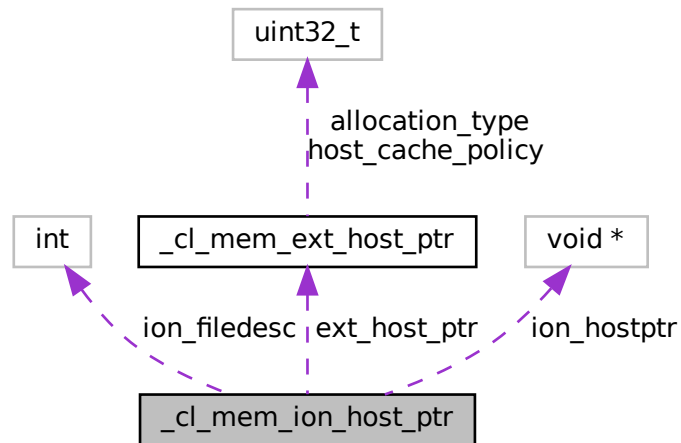
- cl\_uint **allocation\_type**
- cl\_uint **host\_cache\_policy**

The documentation for this struct was generated from the following file:

- include/CL/cl\_ext.h

## 8.7 \_cl\_mem\_ion\_host\_ptr Struct Reference

Collaboration diagram for \_cl\_mem\_ion\_host\_ptr:



### Public Attributes

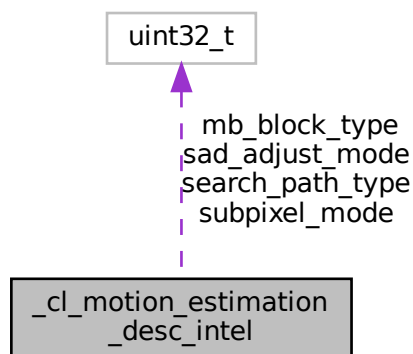
- `cl_mem_ext_host_ptr` `ext_host_ptr`
- `int` `ion_filedesc`
- `void *` `ion_hostptr`

The documentation for this struct was generated from the following file:

- `include/CL/cl_ext.h`

## 8.8 \_cl\_motion\_estimation\_desc\_intel Struct Reference

Collaboration diagram for \_cl\_motion\_estimation\_desc\_intel:



### Public Attributes

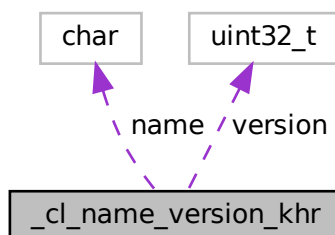
- `cl_uint` **mb\_block\_type**
- `cl_uint` **subpixel\_mode**
- `cl_uint` **sad\_adjust\_mode**
- `cl_uint` **search\_path\_type**

The documentation for this struct was generated from the following file:

- `include/CL/cl_ext.h`

## 8.9 \_cl\_name\_version\_khr Struct Reference

Collaboration diagram for \_cl\_name\_version\_khr:



## Public Attributes

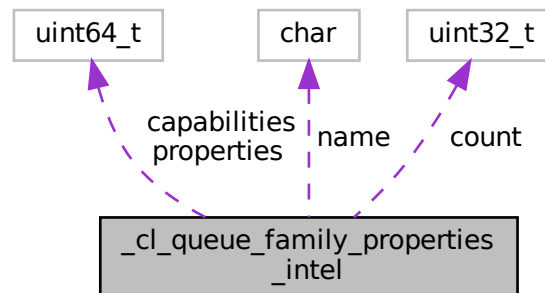
- `cl_version_khr` **version**
- `char` **name** [CL\_NAME\_VERSION\_MAX\_NAME\_SIZE\_KHR]

The documentation for this struct was generated from the following file:

- `include/CL/cl_ext.h`

## 8.10 `_cl_queue_family_properties_intel` Struct Reference

Collaboration diagram for `_cl_queue_family_properties_intel`:



## Public Attributes

- `cl_command_queue_properties` **properties**
- `cl_command_queue_capabilities_intel` **capabilities**
- `cl_uint` **count**
- `char` **name** [CL\_QUEUE\_FAMILY\_MAX\_NAME\_SIZE\_INTEL]

The documentation for this struct was generated from the following file:

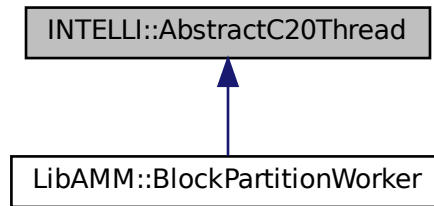
- `include/CL/cl_ext.h`

## 8.11 INTELLI::AbstractC20Thread Class Reference

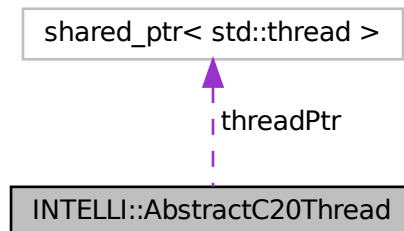
The base class and abstraction of C++20 thread, and it can be derived into other threads.

```
#include <Utils/AbstractC20Thread.hpp>
```

Inheritance diagram for INTELLI::AbstractC20Thread:



Collaboration diagram for INTELLI::AbstractC20Thread:



### Public Member Functions

- void `startThread` ()  
to start this thread
- void `joinThread` ()  
the thread join function

### Protected Member Functions

- virtual void `inlineMain` ()  
The inline 'main' function of thread, as an interface.

## Protected Attributes

- `std::shared_ptr< std::thread > threadPtr`

### 8.11.1 Detailed Description

The base class and abstraction of C++20 thread, and it can be derived into other threads.

### 8.11.2 Member Function Documentation

#### 8.11.2.1 inlineMain()

```
virtual void INTELLI::AbstractC20Thread::inlineMain ( ) [inline], [protected], [virtual]
```

The inline "main" function of thread, as an interface.

#### Note

Normally re-write this in derived classes

Reimplemented in [LibAMM::BlockPartitionWorker](#).

The documentation for this class was generated from the following file:

- `include/Utils/AbstractC20Thread.hpp`

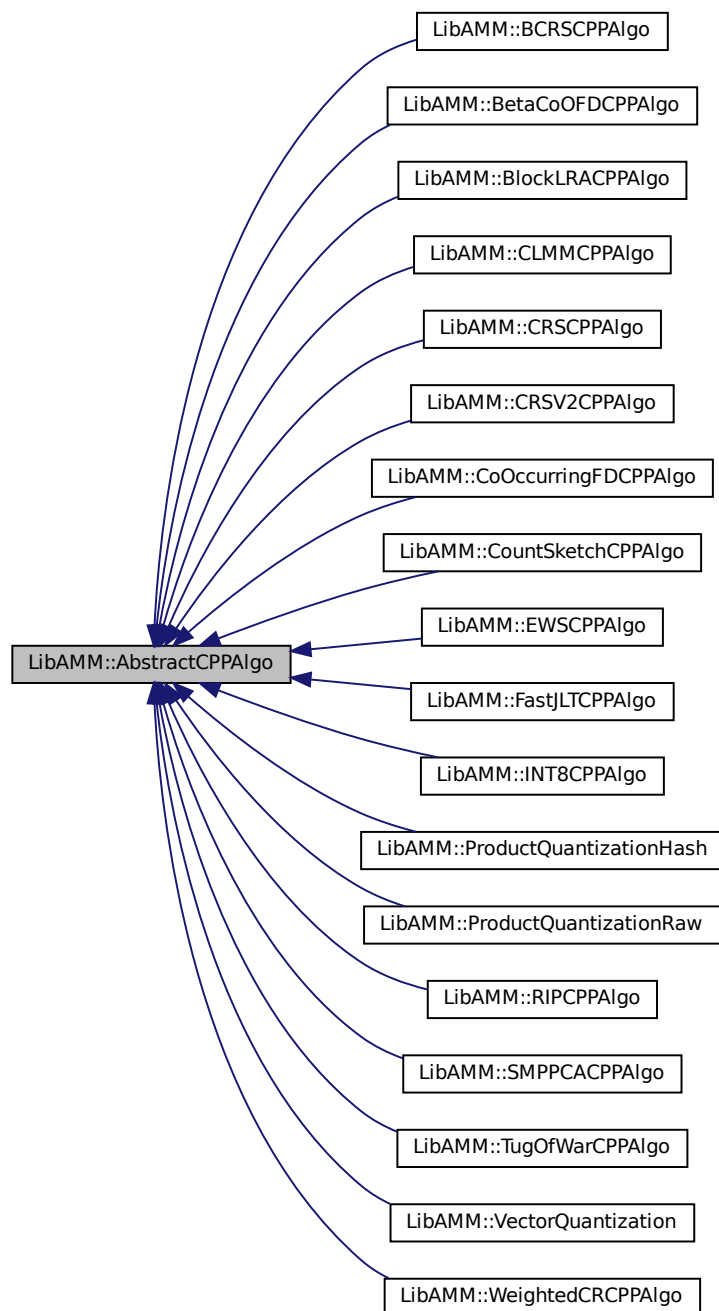
## 8.12 LibAMM::AbstractCPPAlgo Class Reference

The abstract class of c++ algos.

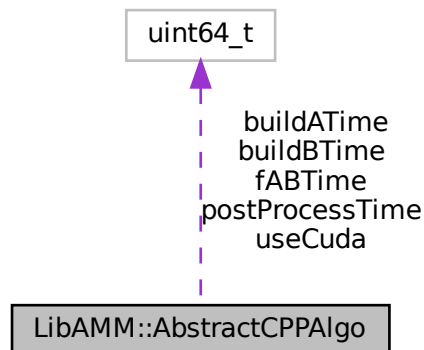
```
#include <CPPAlgos/AbstractCPPAlgo.h>
```



Inheritance diagram for LibAMM::AbstractCPPAlgo:



Collaboration diagram for LibAMM::AbstractCPPAlgo:



## Public Member Functions

- virtual void `setConfig` (`INTELLI::ConfigMapPtr` cfg)  
*set the algo-specific config related to one algorithm*
- virtual `torch::Tensor amm` (`torch::Tensor` A, `torch::Tensor` B, `uint64_t` sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*
- virtual `INTELLI::ConfigMapPtr getBreakDown` ()  
*to get the breakdown of this algorithm, returned as a config map*

## Protected Attributes

- `uint64_t buildATime` = 0  
*the default time break down variables*
- `uint64_t buildBTime` = 0
- `uint64_t fABTime` = 0
- `uint64_t postProcessTime` = 0
- `uint64_t useCuda` = 0

### 8.12.1 Detailed Description

The abstract class of c++ algos.

++

### 8.12.2 Member Function Documentation

### 8.12.2.1 amm()

```
torch::Tensor LibAMM::AbstractCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

#### Returns

the output c matrix

Reimplemented in [LibAMM::WeightedCRCPPAlgo](#), [LibAMM::VectorQuantization](#), [LibAMM::TugOfWarCPPAlgo](#), [LibAMM::SMPPCACPPAlgo](#), [LibAMM::RIPCPPAlgo](#), [LibAMM::ProductQuantizationRaw](#), [LibAMM::ProductQuantizationHash](#), [LibAMM::INT8CPPAlgo](#), [LibAMM::FastJLTCPPAlgo](#), [LibAMM::EWSCPPAlgo](#), [LibAMM::CRSV2CPPAlgo](#), [LibAMM::CRSCPPAlgo](#), [LibAMM::CountSketchCPPAlgo](#), [LibAMM::CoOccurringFDCPPAlgo](#), [LibAMM::CLMMCPPAlgo](#), [LibAMM::BetaCoOFDCPPAlgo](#), [LibAMM::BCRSCPPAlgo](#), and [LibAMM::BlockLRACPPAlgo](#).

### 8.12.2.2 getBreakDown()

```
INTELLI::ConfigMapPtr LibAMM::AbstractCPPAlgo::getBreakDown ( ) [virtual]
```

to get the breakdown of this algorithm, returned as a config map

#### Returns

the key-value table breakdown in ConfigMapPtr;

## 8.12.3 Member Data Documentation

### 8.12.3.1 buildATime

```
uint64_t LibAMM::AbstractCPPAlgo::buildATime = 0 [protected]
```

the default time break down variables

## Note

By default, we decompose each AMM as

- buildA, to translate A matrix
- buildB, to translate B matrix
- fABTime, to conduct mm or table look-up over the reduced A,B
- postProcessTime, if f(A,B) is not the final result, measure the time spend for post process
- useCuda, whether or not use cuda to conduct computation, default 0

The documentation for this class was generated from the following files:

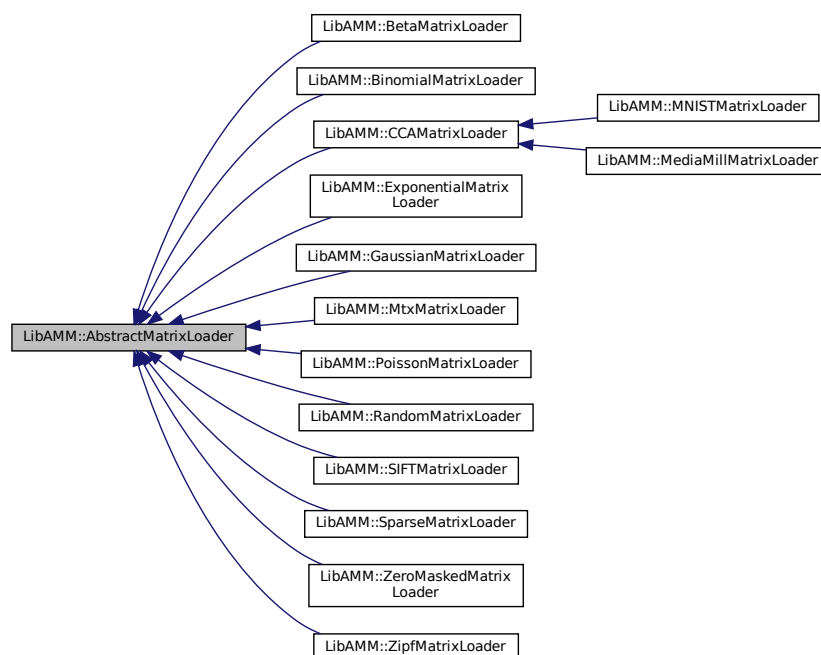
- include/CPPALgos/[AbstractCPPALgo.h](#)
- src/CPPALgos/AbstractCPPALgo.cpp

## 8.13 LibAMM::AbstractMatrixLoader Class Reference

The abstract class of matrix loader, parent for all loaders.

```
#include <MatrixLoader/AbstractMatrixLoader.h>
```

Inheritance diagram for LibAMM::AbstractMatrixLoader:



### Public Member Functions

- virtual bool [setConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
Set the GLOBAL config map related to this loader.
- virtual torch::Tensor [getA](#) ()  
get the A matrix
- virtual torch::Tensor [getB](#) ()  
get the B matrix

### 8.13.1 Detailed Description

The abstract class of matrix loader, parent for all loaders.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

### 8.13.2 Member Function Documentation

#### 8.13.2.1 getA()

```
torch::Tensor LibAMM::AbstractMatrixLoader::getA ( ) [virtual]
```

get the A matrix

Returns

the generated A matrix

Reimplemented in [LibAMM::ZipfMatrixLoader](#), [LibAMM::ZeroMaskedMatrixLoader](#), [LibAMM::SparseMatrixLoader](#), [LibAMM::SIFTMatrixLoader](#), [LibAMM::RandomMatrixLoader](#), [LibAMM::PoissonMatrixLoader](#), [LibAMM::MtxMatrixLoader](#), [LibAMM::MNISTMatrixLoader](#), [LibAMM::MediaMillMatrixLoader](#), [LibAMM::GaussianMatrixLoader](#), [LibAMM::ExponentialMatrixLoader](#), [LibAMM::CCAMatrixLoader](#), [LibAMM::BinomialMatrixLoader](#), and [LibAMM::BetaMatrixLoader](#).

#### 8.13.2.2 getB()

```
torch::Tensor LibAMM::AbstractMatrixLoader::getB ( ) [virtual]
```

get the B matrix

Returns

the generated B matrix

Reimplemented in [LibAMM::ZipfMatrixLoader](#), [LibAMM::ZeroMaskedMatrixLoader](#), [LibAMM::SparseMatrixLoader](#), [LibAMM::SIFTMatrixLoader](#), [LibAMM::RandomMatrixLoader](#), [LibAMM::PoissonMatrixLoader](#), [LibAMM::MtxMatrixLoader](#), [LibAMM::MNISTMatrixLoader](#), [LibAMM::MediaMillMatrixLoader](#), [LibAMM::GaussianMatrixLoader](#), [LibAMM::ExponentialMatrixLoader](#), [LibAMM::CCAMatrixLoader](#), [LibAMM::BinomialMatrixLoader](#), and [LibAMM::BetaMatrixLoader](#).

#### 8.13.2.3 setConfig()

```
bool LibAMM::AbstractMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

**Parameters**

<code>cfg</code>	The config map
------------------	----------------

**Returns**

bool whether the config is successfully set

**Note**

Reimplemented in [LibAMM::ZipfMatrixLoader](#), [LibAMM::ZeroMaskedMatrixLoader](#), [LibAMM::SparseMatrixLoader](#), [LibAMM::SIFTMatrixLoader](#), [LibAMM::RandomMatrixLoader](#), [LibAMM::PoissonMatrixLoader](#), [LibAMM::MtxMatrixLoader](#), [LibAMM::MNISTMatrixLoader](#), [LibAMM::MediaMillMatrixLoader](#), [LibAMM::GaussianMatrixLoader](#), [LibAMM::ExponentialMatrixLoader](#), [LibAMM::CCAMatrixLoader](#), [LibAMM::BinomialMatrixLoader](#), and [LibAMM::BetaMatrixLoader](#).

The documentation for this class was generated from the following files:

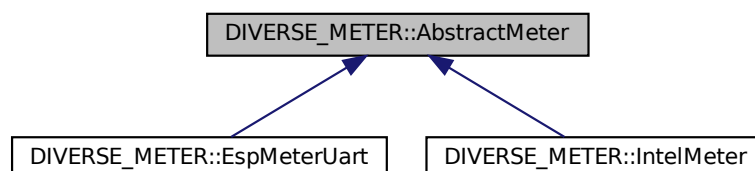
- include/MatrixLoader/[AbstractMatrixLoader.h](#)
- src/MatrixLoader/AbstractMatrixLoader.cpp

## 8.14 DIVERSE\_METER::AbstractMeter Class Reference

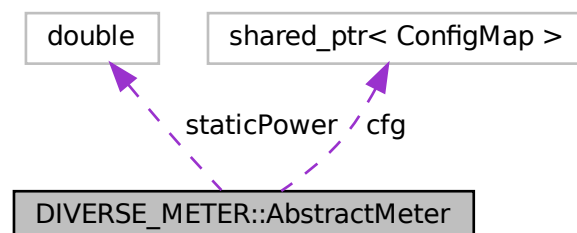
The abstract class for all meters.

```
#include <Utils/Meters/AbstractMeter.hpp>
```

Inheritance diagram for DIVERSE\_METER::AbstractMeter:



Collaboration diagram for DIVERSE\_METER::AbstractMeter:



## Public Member Functions

- virtual void [setConfig](#) (INTELLI::ConfigMapPtr \_cfg)  
*to set the configmap*
- void [setStaticPower](#) (double \_sp)  
*to manually set the static power*
- void [testStaticPower](#) (uint64\_t sleepingSecond)  
*to test the static power of a system by sleeping*
- virtual void [startMeter](#) ()  
*to start the meter into some measuring tasks*
- virtual void [stopMeter](#) ()  
*to stop the meter into some measuring tasks*
- virtual double [getE](#) ()  
*to get the energy in J, including static energy consumption of system*
- virtual double [getPeak](#) ()  
*to get the peak power in W, including static power of system*
- virtual bool [isValid](#) ()
- double [getStaticPower](#) ()  
*to return the tested static power return the [staticPower](#)*
- double [getStaicEnergyConsumption](#) (uint64\_t runningUs)  
*to return the static energy consumption of a system under several us*

## Protected Attributes

- double [staticPower](#) = 0  
*static power of a system in W*
- INTELLI::ConfigMapPtr [cfg](#) = nullptr

### 8.14.1 Detailed Description

The abstract class for all meters.

#### Note

default behaviors:

- create
- call [setConfig\(\)](#) to config this meter
- (optional) call [testStaticPower\(\)](#) to automatically test the static power of a device or [setStaticPower](#) to manually set the static power, if you want to exclude it
- call [startMeter\(\)](#) to start measurement
- (run your program)
- call [stopMeter\(\)](#) to stop measurement
- call [getE\(\)](#), [getPeak\(\)](#), etc to get the measurement results

### 8.14.2 Member Function Documentation

#### 8.14.2.1 [getStaicEnergyConsumption\(\)](#)

```
double DIVERSE_METER::AbstractMeter::getStaicEnergyConsumption (
    uint64_t runningUs )
```

to return the static energy consumption of a system under several us

## Parameters

<i>runningUs</i>	The time in us of a running return the <a href="#">staticPower</a>
------------------	--

**8.14.2.2 setConfig()**

```
virtual void DIVERSE_METER::AbstractMeter::setConfig (
    INTELLI::ConfigMapPtr _cfg ) [inline], [virtual]
```

to set the configmap

## Parameters

<i>cfg</i>	the config map
------------	----------------

Reimplemented in [DIVERSE\\_METER::IntelMeter](#), and [DIVERSE\\_METER::EspMeterUart](#).

**8.14.2.3 setStaticPower()**

```
void DIVERSE_METER::AbstractMeter::setStaticPower (
    double _sp ) [inline]
```

to manually set the static power

## Parameters

<i>_sp</i>	
------------	--

**8.14.2.4 testStaticPower()**

```
void DIVERSE_METER::AbstractMeter::testStaticPower (
    uint64_t sleepingSecond )
```

to test the static power of a system by sleeping

## Parameters

<i>sleepingSecond</i>	The seconds for sleep
-----------------------	-----------------------

The documentation for this class was generated from the following files:



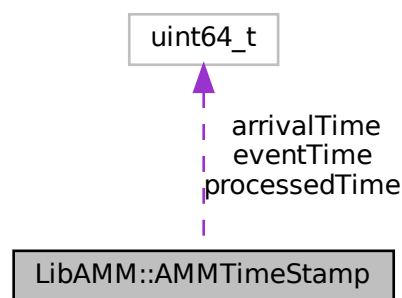
- include/Utils/Meters/[AbstractMeter.hpp](#)
- src/Utils/Meters/AbstractMeter.cpp

## 8.15 LibAMM::AMMTimeStamp Class Reference

The class to define timestamp in streaming.

```
#include <Streaming/TimeStamper.h>
```

Collaboration diagram for LibAMM::AMMTimeStamp:



### Public Member Functions

- **AMMTimeStamp** (uint64\_t te, uint64\_t ta, uint64\_t tp)

### Public Attributes

- uint64\_t `eventTime` = 0  
*The time when the related event (to a row or a column) happen.*
- uint64\_t `arrivalTime` = 0  
*The time when the related event (to a row or a column) arrive to the system.*
- uint64\_t `processedTime` = 0  
*the time when the related event is fully processed*

#### 8.15.1 Detailed Description

The class to define timestamp in streaming.

The documentation for this class was generated from the following file:

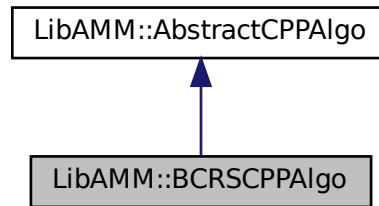
- include/Streaming/TimeStamper.h

## 8.16 LibAMM::BCRSCPPAlgo Class Reference

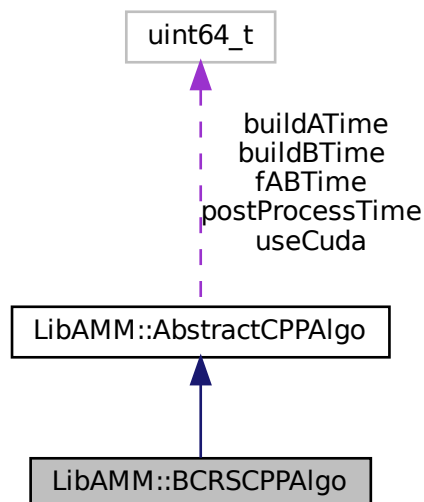
The Bernoulli column row sampling (BCRS) class of c++ algos.

```
#include <CPPAlgos/BCRSCPPAlgo.h>
```

Inheritance diagram for LibAMM::BCRSCPPAlgo:



Collaboration diagram for LibAMM::BCRSCPPAlgo:



### Public Member Functions

- virtual torch::Tensor [amm](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.16.1 Detailed Description

The Bernoulli column row sampling (BCRS) class of c++ algos.

++

### 8.16.2 Member Function Documentation

#### 8.16.2.1 amm()

```
torch::Tensor LibAMM::BCRSCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

#### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

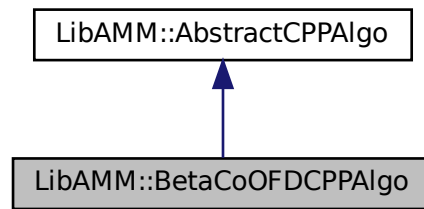
- include/CPPAlgos/[BCRSCPPAlgo.h](#)
- src/CPPAlgos/BCRSCPPAlgo.cpp

## 8.17 LibAMM::BetaCoOFDCPPAlgo Class Reference

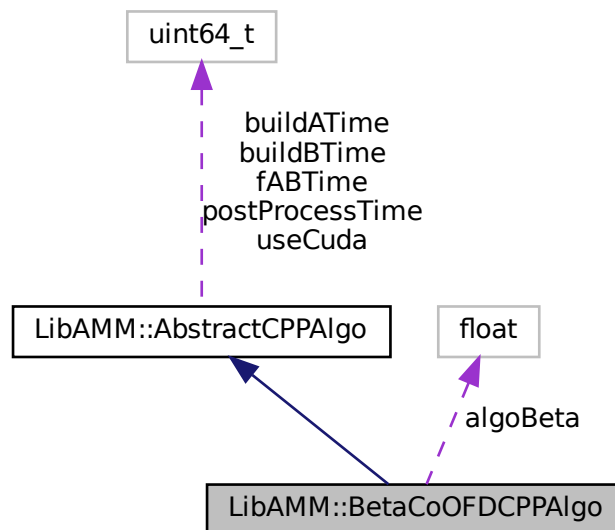
The Beta Co-Occurring FD AMM class of c++ algos.

```
#include <CPPAlgos/BetaCoOFDCPPAlgo.h>
```

Inheritance diagram for LibAMM::BetaCoOFDCPPAlgo:



Collaboration diagram for LibAMM::BetaCoOFDCPPAlgo:



## Public Member Functions

- virtual void [setConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*set the algo-specific config related to one algorithm*
- virtual [torch::Tensor amm](#) ([torch::Tensor](#) A, [torch::Tensor](#) B, [uint64\\_t](#) sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Protected Attributes

- float **algoBeta** = 1.0

### 8.17.1 Detailed Description

The Beta Co-Occurring FD AMM class of c++ algos.

++

Note

parameters

- algoBeta Double, the beta parameters in this algo, default 1.0

### 8.17.2 Member Function Documentation

#### 8.17.2.1 amm()

```
torch::Tensor LibAMM::BetaCoOFDCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

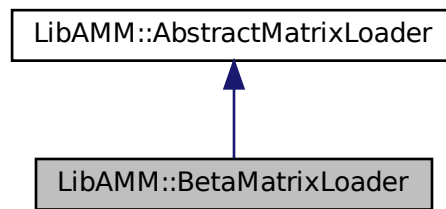
- include/CPPalgos/[BetaCoOFDCPPAlgo.h](#)
- src/CPPalgos/BetaCoOFDCPPAlgo.cpp

## 8.18 LibAMM::BetaMatrixLoader Class Reference

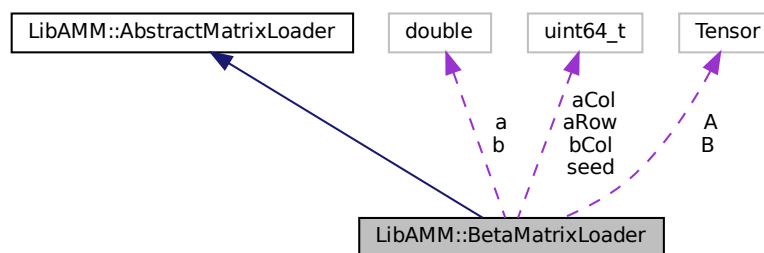
The Beta class of matrix loader.

```
#include <MatrixLoader/BetaMatrixLoader.h>
```

Inheritance diagram for LibAMM::BetaMatrixLoader:



Collaboration diagram for LibAMM::BetaMatrixLoader:



## Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*

## Protected Member Functions

- void [parseConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- uint64\_t **aRow**
- uint64\_t **aCol**
- uint64\_t **bCol**
- uint64\_t **seed**
- double **a**
- double **b**

### 8.18.1 Detailed Description

The Beta class of matrix loader.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: require config parameters and default values

- "aRow" The rows in matrix A, U64, 100
- "aCol" The cols in matrix B, U64, 1000
- "bCol" The rows in matrix B, U64, 500
- "seed" The seed of inline random generator,U64,114514
- "a" parameters of beta distribution, Double, 2.0
- "b" parameters of beta distribution, Double, 2.0

: default name tags "random": [BetaMatrixLoader](#)

### 8.18.2 Member Function Documentation

#### 8.18.2.1 getA()

```
torch::Tensor LibAMM::BetaMatrixLoader::getA ( ) [virtual]
```

get the A matrix

Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.18.2.2 getB()

```
torch::Tensor LibAMM::BetaMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.18.2.3 paraseConfig()

```
void LibAMM::BetaMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

#### Parameters

<i>cfg</i>	the config
------------	------------

### 8.18.2.4 setConfig()

```
bool LibAMM::BetaMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

#### Parameters

<i>cfg</i>	The config map
------------	----------------

#### Returns

bool whether the config is successfully set

#### Note

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

- include/MatrixLoader/BetaMatrixLoader.h
- src/MatrixLoader/BetaMatrixLoader.cpp

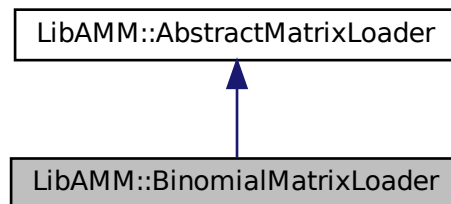


## 8.19 LibAMM::BinomialMatrixLoader Class Reference

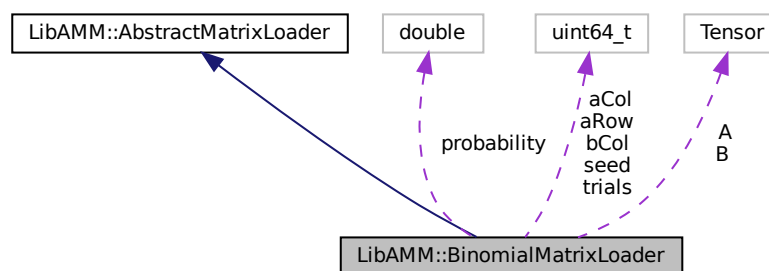
The Binomial class of matrix loader.

```
#include <MatrixLoader/BinomialMatrixLoader.h>
```

Inheritance diagram for LibAMM::BinomialMatrixLoader:



Collaboration diagram for LibAMM::BinomialMatrixLoader:



### Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*

### Protected Member Functions

- void [parseConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- uint64\_t **aRow**
- uint64\_t **aCol**
- uint64\_t **bCol**
- uint64\_t **seed**
- uint64\_t **trials**
- double **probability**

### 8.19.1 Detailed Description

The Binomial class of matrix loader.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: require config parameters and default values

- "aRow" The rows in matrix A, U64, 100
- "aCol" The cols in matrix B, U64, 1000
- "bCol" The rows in matrix B, U64, 500
- "seed" The seed of inline random generator, U64, 114514
- "trials" parameters of binomial distribution, U64, 10
- "probability" parameters of binomial distribution, Double, 0.5

: default name tags "random": [BinomialMatrixLoader](#)

### 8.19.2 Member Function Documentation

#### 8.19.2.1 getA()

```
torch::Tensor LibAMM::BinomialMatrixLoader::getA ( ) [virtual]
```

get the A matrix

Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.19.2.2 getB()

```
torch::Tensor LibAMM::BinomialMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.19.2.3 paraseConfig()

```
void LibAMM::BinomialMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

#### Parameters

<i>cfg</i>	the config
------------	------------

### 8.19.2.4 setConfig()

```
bool LibAMM::BinomialMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

#### Parameters

<i>cfg</i>	The config map
------------	----------------

#### Returns

bool whether the config is successfully set

#### Note

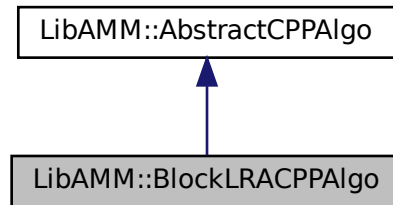
Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

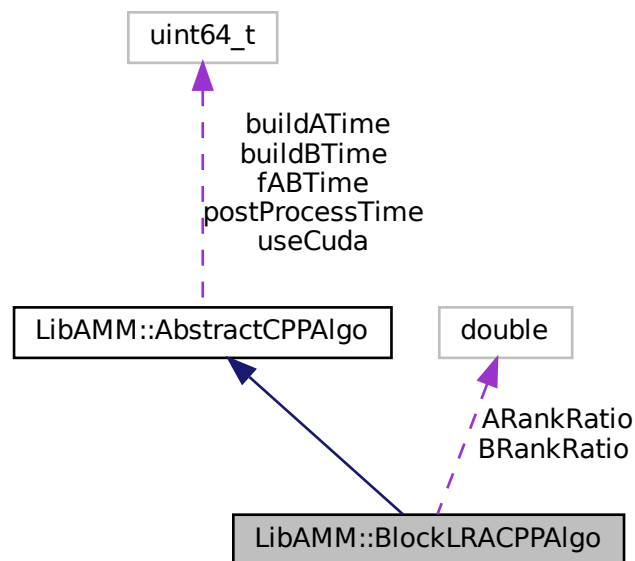
- include/MatrixLoader/BinomialMatrixLoader.h
- src/MatrixLoader/BinomialMatrixLoader.cpp

## 8.20 LibAMM::BlockLRACPPAlgo Class Reference

Inheritance diagram for LibAMM::BlockLRACPPAlgo:



Collaboration diagram for LibAMM::BlockLRACPPAlgo:



### Public Member Functions

- virtual void [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*set the algo-specific config related to one algorithm*
- virtual torch::Tensor [amm](#) (torch::Tensor A, torch::Tensor B, uint64\_t blockSize)  
*Implementation of paper [IEEE-HPCS 2017] Accelerating Matrix Multiplication in Deep Learning by Using Low-Rank Approximation <https://ieeexplore.ieee.org/abstract/document/8035076>.*

## Protected Attributes

- double **ARankRatio** = 0.5
- double **BRankRatio** = 0.5

### 8.20.1 Member Function Documentation

#### 8.20.1.1 amm()

```
torch::Tensor LibAMM::BlockLRACPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t blockSize ) [virtual]
```

Implementation of paper [IEEE-HPCS 2017] Accelerating Matrix Multiplication in Deep Learning by Using Low-Rank Approximation <https://ieeexplore.ieee.org/abstract/document/8035076>.

##### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>blockSize</i>	the size of block to do SVD

##### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

#### 8.20.1.2 setConfig()

```
void LibAMM::BlockLRACPPAlgo::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

set the alo-specific config related to one algorithm

##### Parameters

<i>ARankRatio</i>	LRA rank ratio over A complete SVD rank
<i>BRankRatio</i>	LRA rank ratio over B complete SVD rank

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

- [include/CPPALgos/BlockLRACPPAlgo.h](#)
- [src/CPPALgos/BlockLRACPPAlgo.cpp](#)

## 8.21 BlockLRACPPAlgo Class Reference

The block SVD LRA class of c++ algos.

```
#include <CPPALgos/BlockLRACPPAlgo.h>
```

### 8.21.1 Detailed Description

The block SVD LRA class of c++ algos.

++

The documentation for this class was generated from the following file:

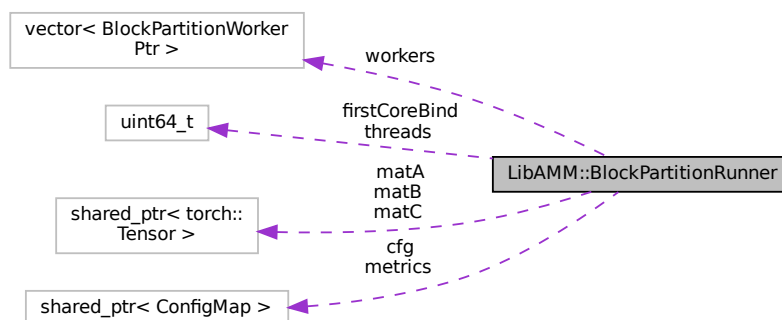
- [include/CPPALgos/BlockLRACPPAlgo.h](#)

## 8.22 LibAMM::BlockPartitionRunner Class Reference

The top entity to control all workers, see also [BlockPartitionWorker](#). This one works under a simple row partition parallelization.

```
#include <Parallelization/BlockPartitionRunner.h>
```

Collaboration diagram for LibAMM::BlockPartitionRunner:



## Public Member Functions

- void [setConfig](#) (INTELLI::ConfigMapPtr \_cfg)  
*set the config map*
- void [createABC](#) (torch::Tensor A, torch::Tensor B)  
*create the A,B,C matrix and pass it to all workers*
- torch::Tensor [parallelForward](#) ()  
*run a parallel forward of A,B, and return C*
- torch::Tensor [runAMM](#) (torch::Tensor A, torch::Tensor B)  
*conduce the multithread AMM and return*
- uint64\_t [getElapsedTime](#) ()  
*get the elapsed time of multithread running*
- void [appendThreadInfo](#) (INTELLI::ConfigMapPtr ru)  
*append the running information of each thread to the result csv*
- void [calculateMetrics](#) ()  
*calculate metrics including the pef result for all threads used in the runner, and elapsed time, throughput..*
- INTELLI::ConfigMapPtr [getMetrics](#) ()  
*get metrics*
- virtual INTELLI::ConfigMapPtr [getBreakDown](#) ()  
*to export the algorithm breakdown*

## Protected Attributes

- INTELLI::ConfigMapPtr **cfg**
- uint64\_t **threads** = 0
- TensorPtr **matA** = nullptr  
*Input matrix A.*
- TensorPtr **matB** = nullptr  
*Input matrix B.*
- TensorPtr **matC** = nullptr  
*OUTput matrix C.*
- std::vector< BlockPartitionWorkerPtr > **workers**
- uint64\_t **firstCoreBind** = 0  
*special bind of first core, if need*
- INTELLI::ConfigMapPtr **metrics** = [newConfigMap](#)()

### 8.22.1 Detailed Description

The top entity to control all workers, see also [BlockPartitionWorker](#). This one works under a simple row partition parallelization.

#### Note

parameters

- threads, U64, the number of worker threads, default 2
- osScheduling, U64, whether use default os scheduling instead of my own core bind, default 0
- firstCoreBind, U64, which core will the first thread be bound to, default 0

default behaviors

- create
- call [setConfig](#)
- call [runAMM](#) and return result
- call [getElapsedTime](#)
- call [getMetrics](#)

## 8.22.2 Member Function Documentation

### 8.22.2.1 appendThreadInfo()

```
void LibAMM::BlockPartitionRunner::appendThreadInfo (
    INTELLI::ConfigMapPtr ru )
```

append the running information of each thread to the result csv

#### Parameters

<i>ru</i>	The result csv to be appended
-----------	-------------------------------

### 8.22.2.2 createABC()

```
void LibAMM::BlockPartitionRunner::createABC (
    torch::Tensor A,
    torch::Tensor B )
```

create the A,B,C matrix and pass it to all workers

#### Parameters

<i>A</i>	The A matrix
<i>B</i>	The B matrix @warning call after <a href="#">setConfig</a>

### 8.22.2.3 getBreakDown()

```
INTELLI::ConfigMapPtr LibAMM::BlockPartitionRunner::getBreakDown ( ) [virtual]
```

to export the algorithm breakdown

#### Note

only valid for c++ algo

#### Returns

the key-value table breakdown in ConfigMapPtr;



#### 8.22.2.4 getElapsedTime()

```
uint64_t LibAMM::BlockPartitionRunner::getElapsedTime ( )
```

get the elapsed time of multithread running

##### Returns

the elapsed time

##### Note

Exclude the overhead of cleaning thread states such as loaded module

#### 8.22.2.5 getMetrics()

```
INTELLI::ConfigMapPtr LibAMM::BlockPartitionRunner::getMetrics ( )
```

get metrics

##### Returns

metrics ConfigMapPtr

#### 8.22.2.6 parallelForward()

```
torch::Tensor LibAMM::BlockPartitionRunner::parallelForward ( )
```

run a parallel forward of A,B, and return C

##### Returns

C=matA\*matB @warning call after [createABC](#)

#### 8.22.2.7 runAMM()

```
torch::Tensor LibAMM::BlockPartitionRunner::runAMM (
    torch::Tensor A,
    torch::Tensor B )
```

conducte the multithread AMM and return

## Parameters

<i>A</i>	The A matrix
<i>B</i>	The B matrix

## Returns

The AMM(A,B) @warning call after [setConfig](#)

## 8.22.2.8 setConfig()

```
void LibAMM::BlockPartitionRunner::setConfig (
    INTELLI::ConfigMapPtr _cfg )
```

set the config map

## Parameters

<i>_cfg</i>	
-------------	--

The documentation for this class was generated from the following files:

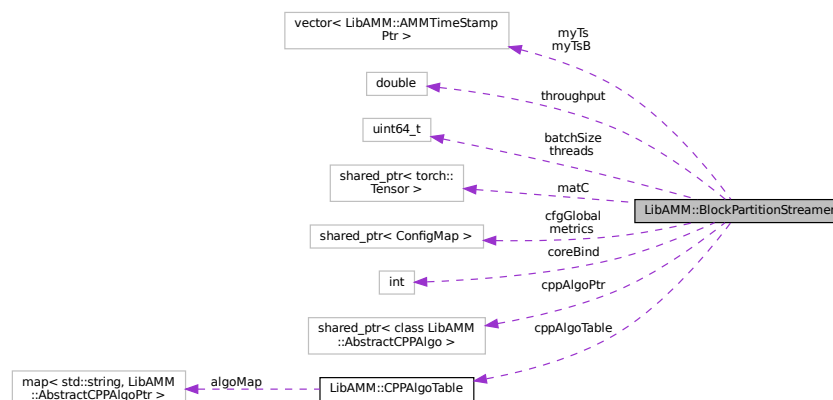
- include/Parallelization/[BlockPartitionRunner.h](#)
- src/Parallelization/BlockPartitionRunner.cpp

## 8.23 LibAMM::BlockPartitionStreamer Class Reference

The class to run streaming amm under block partition scheme, let rows of A coming in a streaming manner, all of which are partitioned with [BlockPartitionRunner](#).

```
#include <Streaming/BlockPartitionStreamer.h>
```

Collaboration diagram for LibAMM::BlockPartitionStreamer:



## Public Member Functions

- virtual bool [setConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Set the GLOBAL config map related to this TimerStamper.*
- virtual torch::Tensor [streamingAmm](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize=1)  
*To run a streaming Amm, assuming the rows of A coming in a streaming manner and B is fixed.*
- virtual torch::Tensor [streamingAmm2S](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize=1)  
*To run a streaming Amm, assuming the rows of A coming in a streaming manner and the cols of B coming in a streaming manner.*
- double [getThroughput](#) ()  
*to get the throughput of last streaming process, the unit is rows/second*
- double [getLatencyPercentage](#) (double fraction)  
*to get the latency within some fraction, such as 0.95*
- [INTELLI::ConfigMapPtr](#) [getMetrics](#) ()  
*get metrics (including the pef result for all threads used in the runner, and elapsed time, throughput..)*

## Public Attributes

- std::vector< [LibAMM::AMMTimeStampPtr](#) > [myTs](#)  
*the timestamps to trace the streaming process*
- std::vector< [LibAMM::AMMTimeStampPtr](#) > [myTsB](#)  
*the additional timestamps to trace the streaming process, if B is also stream*

## Protected Attributes

- [INTELLI::ConfigMapPtr](#) [cfgGlobal](#)
- [LibAMM::CPPAlgoTable](#) [cppAlgoTable](#)
- uint64\_t [batchSize](#) = 1
- [LibAMM::AbstractCPPAlgoPtr](#) [cppAlgoPtr](#) = nullptr
- [LibAMM::TensorPtr](#) [matC](#) = nullptr
- double [throughput](#) = 0.0
- uint64\_t [threads](#) = 1
- int [coreBind](#)
- [INTELLI::ConfigMapPtr](#) [metrics](#) = [newConfigMap](#)()

### 8.23.1 Detailed Description

The class to run streaming amm under block partition scheme, let rows of A coming in a streaming manner, all of which are partitioned with [BlockPartitionRunner](#).

#### Note

Default behavior

- create
- call [setConfig](#), this will also determine how to generate time stamp and config will be passed to [TimeStamper](#)
- run streaming amm:
  - call [streamingAmm](#), if only A matrix will be streamed
  - call [streamingAmm2S](#), if both A and B will be streamed
- call [getThroughput](#), and [getLatencyPercentage](#) to get the streaming performance

## 8.23.2 Member Function Documentation

### 8.23.2.1 getLatencyPercentage()

```
double LibAMM::BlockPartitionStreamer::getLatencyPercentage (
    double fraction )
```

to get the latency within some fraction, such as 0.95

#### Parameters

<i>fraction</i>	the 0~1 fraction
-----------------	------------------

#### Returns

the latency in us

### 8.23.2.2 getMetrics()

```
INTELLI::ConfigMapPtr LibAMM::BlockPartitionStreamer::getMetrics ( ) [inline]
```

get metrics (including the pef result for all threads used in the runner, and elapsed time, throughput..)

#### Returns

metrics ConfigMapPtr

### 8.23.2.3 getThroughput()

```
double LibAMM::BlockPartitionStreamer::getThroughput ( ) [inline]
```

to get the throughput of last streaming process, the unit is rows/second

#### Returns

the throughput

### 8.23.2.4 setConfig()

```
bool LibAMM::BlockPartitionStreamer::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this TimerStamper.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

1.set the algo

1. set the batch size

## 8.23.2.5 streamingAmm()

```
torch::Tensor LibAMM::BlockPartitionStreamer::streamingAmm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize = 1 ) [virtual]
```

To run a streaming Amm, assuming the rows of A coming in a streaming manner and B is fixed.

## Parameters

<i>A</i>	The A matrix
<i>B</i>	The B matrix

## Returns

bool whether the config is successfully set

update the indexes

## 8.23.2.6 streamingAmm2S()

```
torch::Tensor LibAMM::BlockPartitionStreamer::streamingAmm2S (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize = 1 ) [virtual]
```

To run a streaming Amm, assuming the rows of A coming in a streaming manner and the cols of B coming in a streaming manner.

## Parameters

<i>A</i>	The A matrix
<i>B</i>	The B matrix

**Returns**

bool whether the config is successfully set

now, the whole batch has arrived, compute

do the incomingA\*newArrivedB part

do the oldArrivedA\*incomingB part

update the indexes

The latency calculation is different from one stream case here, as older A will still be probed by newer B

The documentation for this class was generated from the following files:

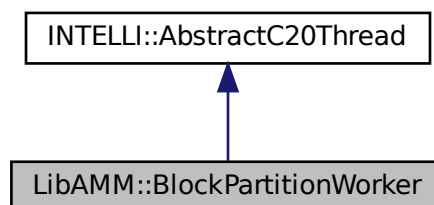
- include/Streaming/BlockPartitionStreamer.h
- src/Streaming/BlockPartitionStreamer.cpp

## 8.24 LibAMM::BlockPartitionWorker Class Reference

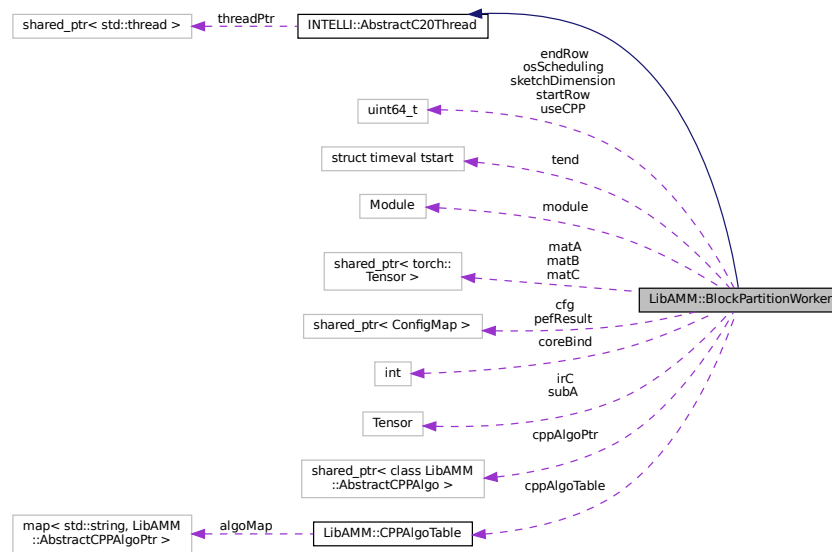
The basic partition worker.

```
#include <Parallelization/BlockPartitionRunner.h>
```

Inheritance diagram for LibAMM::BlockPartitionWorker:



Collaboration diagram for LibAMM::BlockPartitionWorker:



## Public Member Functions

- void **setConfig** (INTELLI::ConfigMapPtr \_cfg)  
*set the config map*
- void **setABC** (TensorPtr A, TensorPtr B, TensorPtr C)  
*set the pointer to A,B,C matrix*
- void **setWorkParameters** (uint64\_t aStart, uint64\_t aEnd, int mycore)  
*set work parameters*
- void **setCoreBlnd** (int cno)
- uint64\_t **getElapsedTime** ()
- INTELLI::ConfigMapPtr **getPefResult** ()
- virtual INTELLI::ConfigMapPtr **getBreakDown** ()  
*to export the algorithm breakdown*

## Public Attributes

- torch::Tensor **irC**
- torch::Tensor **subA**
- uint64\_t **startRow** = 0
- uint64\_t **endRow** = 0

## Protected Member Functions

- virtual void **inlineMain** ()  
*The inline 'main' function of thread, as an interface.*

## Protected Attributes

- [LibAMM::CPPAlgoTable](#) **cppAlgoTable**
- struct timeval tstart **tend**
- uint64\_t **useCPP** = 0
- uint64\_t **osScheduling** = 0
- LibAMM::AbstractCPPAlgoPtr **cppAlgoPtr** = nullptr
- TensorPtr **matA** = nullptr  
*Input matrix A.*
- TensorPtr **matB** = nullptr  
*Input matrix B.*
- TensorPtr **matC** = nullptr  
*OUTput matrix C.*
- [INTELLI::ConfigMapPtr](#) **cfg**
- torch::jit::script::Module **module**
- uint64\_t **sketchDimension** = 0
- int **coreBind**
- [INTELLI::ConfigMapPtr](#) **pefResult**

### 8.24.1 Detailed Description

The basic partition worker.

### 8.24.2 Member Function Documentation

#### 8.24.2.1 getBreakDown()

```
INTELLI::ConfigMapPtr LibAMM::BlockPartitionWorker::getBreakDown ( ) [virtual]
```

to export the algorithm breakdown

#### Note

only valid for c++ algo

#### Returns

the key-value table breakdown in ConfigMapPtr;



### 8.24.2.2 inlineMain()

```
void LibAMM::BlockPartitionWorker::inlineMain ( ) [protected], [virtual]
```

The inline 'main' function of thread, as an interface.

#### Note

Normally re-write this in derived classes

1. bind core and torch setting
2. multiply sub-matrix of A

Reimplemented from [INTELLI::AbstractC20Thread](#).

### 8.24.2.3 setConfig()

```
void LibAMM::BlockPartitionWorker::setConfig (
    INTELLI::ConfigMapPtr _cfg )
```

set the config map

#### Parameters

<i>_cfg</i>	
-------------	--

### 8.24.2.4 setWorkParameters()

```
void LibAMM::BlockPartitionWorker::setWorkParameters (
    uint64_t aStart,
    uint64_t aEnd,
    int mycore )
```

set work parameters

#### Parameters

<i>aStart</i>	The start row in A
<i>aEnd</i>	The end row in A
<i>mycore</i>	the core to be binded

The documentation for this class was generated from the following files:

- include/Parallelization/[BlockPartitionRunner.h](#)
- src/Parallelization/[BlockPartitionRunner.cpp](#)

## 8.25 BS::blocks< T1, T2, T > Class Template Reference

A helper class to divide a range into blocks. Used by `parallelize_loop()` and `push_loop()`.

```
#include <BS_thread_pool.hpp>
```

### Public Member Functions

- `blocks` (const T1 first\_index\_, const T2 index\_after\_last\_, const size\_t num\_blocks\_)  
*Construct a blocks object with the given specifications.*
- `T start` (const size\_t i) const  
*Get the first index of a block.*
- `T end` (const size\_t i) const  
*Get the index after the last index of a block.*
- `size_t get_num_blocks` () const  
*Get the number of blocks. Note that this may be different than the desired number of blocks that was passed to the constructor.*
- `size_t get_total_size` () const  
*Get the total number of indices in the range.*

### 8.25.1 Detailed Description

```
template<typename T1, typename T2, typename T = std::common_type_t<T1, T2>>
class BS::blocks< T1, T2, T >
```

A helper class to divide a range into blocks. Used by `parallelize_loop()` and `push_loop()`.

#### Template Parameters

<i>T1</i>	The type of the first index in the range. Should be a signed or unsigned integer.
<i>T2</i>	The type of the index after the last index in the range. Should be a signed or unsigned integer. If T1 is not the same as T2, a common type will be automatically inferred.
<i>T</i>	The common type of T1 and T2.

### 8.25.2 Constructor & Destructor Documentation

#### 8.25.2.1 blocks()

```
template<typename T1 , typename T2 , typename T = std::common_type_t<T1, T2>>
BS::blocks< T1, T2, T >::blocks (
    const T1 first_index_,
    const T2 index_after_last_,
    const size_t num_blocks_ ) [inline]
```

Construct a blocks object with the given specifications.

## Parameters

<i>first_index_</i>	The first index in the range.
<i>index_after_↵ last_</i>	The index after the last index in the range.
<i>num_blocks_</i>	The desired number of blocks to divide the range into.

## 8.25.3 Member Function Documentation

### 8.25.3.1 end()

```
template<typename T1 , typename T2 , typename T = std::common_type_t<T1, T2>>
T BS::blocks< T1, T2, T >::end (
    const size_t i ) const [inline]
```

Get the index after the last index of a block.

## Parameters

<i>i</i>	The block number.
----------	-------------------

## Returns

The index after the last index.

### 8.25.3.2 get\_num\_blocks()

```
template<typename T1 , typename T2 , typename T = std::common_type_t<T1, T2>>
size_t BS::blocks< T1, T2, T >::get_num_blocks ( ) const [inline]
```

Get the number of blocks. Note that this may be different than the desired number of blocks that was passed to the constructor.

## Returns

The number of blocks.

### 8.25.3.3 get\_total\_size()

```
template<typename T1 , typename T2 , typename T = std::common_type_t<T1, T2>>
size_t BS::blocks< T1, T2, T >::get_total_size ( ) const [inline]
```

Get the total number of indices in the range.

#### Returns

The total number of indices.

### 8.25.3.4 start()

```
template<typename T1 , typename T2 , typename T = std::common_type_t<T1, T2>>
T BS::blocks< T1, T2, T >::start (
    const size_t i ) const [inline]
```

Get the first index of a block.

#### Parameters

<i>i</i>	The block number.
----------	-------------------

#### Returns

The first index.

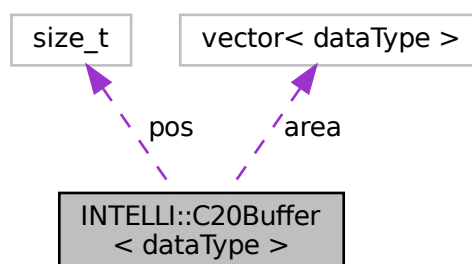
The documentation for this class was generated from the following file:

- [include/Utils/BS\\_thread\\_pool.hpp](#)

## 8.26 INTELLI::C20Buffer< dataType > Class Template Reference

```
#include <Utils/C20Buffers.hpp>
```

Collaboration diagram for INTELLI::C20Buffer< dataType >:



## Public Member Functions

- void [reset](#) ()  
*reset this buffer, set pos back to 0*
- [C20Buffer](#) (size\_t len)  
*Init with original length of buffer.*
- size\_t [bufferSize](#) ()  
*To get how many elements are allowed in the buffer.*
- size\_t [size](#) ()  
*To get how many VALID elements are existed in the buffer.*
- dataType \* [data](#) ()  
*To get the original memory area pointer of data.*
- dataType \* [data](#) (size\_t offset)  
*To get the original memory area pointer of data, with offset.*
- size\_t [append](#) (dataType da)  
*Append the data to the buffer.*
- size\_t [append](#) (dataType \*da, size\_t len)  
*Append the data to the buffer.*

## Public Attributes

- std::vector< dataType > **area**

## Protected Attributes

- size\_t **pos** = 0

### 8.26.1 Detailed Description

```
template<typename dataType>
class INTELLI::C20Buffer< dataType >
```

Template Parameters

<i>dataType</i>	The type of your buffering element
-----------------	------------------------------------

### 8.26.2 Constructor & Destructor Documentation

#### 8.26.2.1 C20Buffer()

```
template<typename dataType >
INTELLI::C20Buffer< dataType >::C20Buffer (
    size_t len ) [inline]
```

Init with original length of buffer.

## Parameters

<i>len</i>	The original length of buffer
------------	-------------------------------

## 8.26.3 Member Function Documentation

### 8.26.3.1 `append()` [1/2]

```
template<typename dataType >
size_t INTELLI::C20Buffer< dataType >::append (
    dataType * da,
    size_t len ) [inline]
```

Append the data to the buffer.

## Parameters

<i>da</i>	Data to be appended, a buffer
<i>len</i>	the length of data

## Note

Exceed length will lead to a `push_back` in vector

## Returns

The valid size after this `append`

### 8.26.3.2 `append()` [2/2]

```
template<typename dataType >
size_t INTELLI::C20Buffer< dataType >::append (
    dataType da ) [inline]
```

Append the data to the buffer.

## Parameters

<i>da</i>	Data to be appended
-----------	---------------------

**Note**

Exceed length will lead to a push\_back in vector

**Returns**

The valid size after this append

**8.26.3.3 bufferSize()**

```
template<typename dataType >
size_t INTELLI::C20Buffer< dataType >::bufferSize ( ) [inline]
```

To get how many elements are allowed in the buffer.

**Returns**

The size of buffer area, i.e., area.size()

**Note**

: This is NOT the size of valid data

**See also**

[size](#)

**8.26.3.4 data() [1/2]**

```
template<typename dataType >
dataType* INTELLI::C20Buffer< dataType >::data ( ) [inline]
```

To get the original memory area pointer of data.

**Returns**

The memory area address (pointer) that stores the data

**8.26.3.5 data() [2/2]**

```
template<typename dataType >
dataType* INTELLI::C20Buffer< dataType >::data (
    size_t offset ) [inline]
```

To get the original memory area pointer of data, with offset.

**Parameters**

<i>offset</i>	Offset of data
---------------	----------------

**Returns**

The memory area address (pointer) that stores the data

**Warning**

Please ensure the offset is NOT larger than the `area.size()-1`

**8.26.3.6 size()**

```
template<typename dataType >
size_t INTELLI::C20Buffer< dataType >::size ( ) [inline]
```

To get how many VALID elements are existed in the buffer.

**Returns**

The size of VALID elements

**Note**

: This is NOT the size of total buffer

**See also**

[bufferSize](#)

The documentation for this class was generated from the following file:

- [include/Utils/C20Buffers.hpp](#)

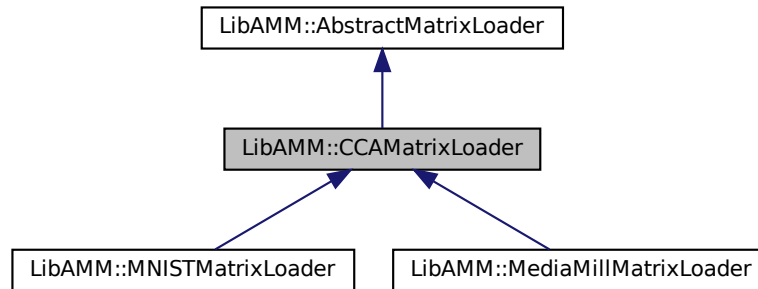


## 8.27 LibAMM::CCAMatrixLoader Class Reference

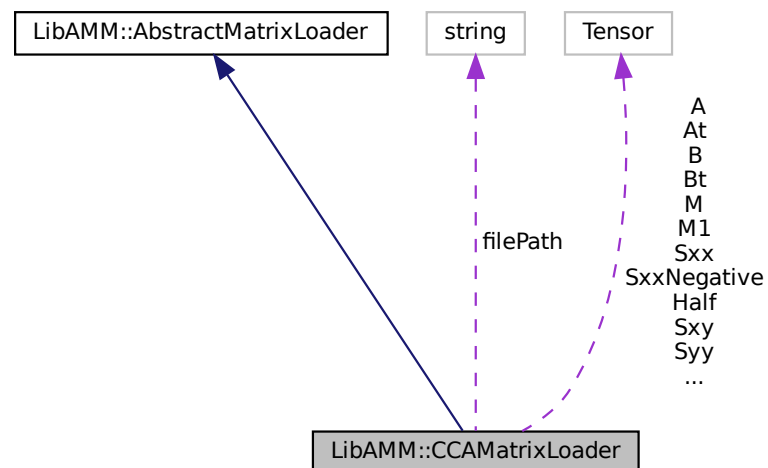
For CCA downstream task.

```
#include <MatrixLoader/CCAMatrixLoader.h>
```

Inheritance diagram for LibAMM::CCAMatrixLoader:



Collaboration diagram for LibAMM::CCAMatrixLoader:



### Public Member Functions

- virtual bool [setConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
Set the GLOBAL config map related to this loader.
- virtual void [calculate\\_correlation](#) ()  
Calculate the correlation by mm, and generate tensor `Sxx`, `Sxy`, `Syy`, `M`, correlation.

- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*
- virtual torch::Tensor [getAt](#) ()  
*get the transpose of A matrix*
- virtual torch::Tensor [getBt](#) ()  
*get the transpose of B matrix*
- virtual torch::Tensor [getSxx](#) ()  
*get the Sxx matrix*
- virtual torch::Tensor [getSyy](#) ()  
*get the Sxyymatrix*
- virtual torch::Tensor [getSxy](#) ()  
*get the Sxy matrix*
- virtual torch::Tensor [getSxxNegativeHalf](#) ()  
*get the SxxNegativeHalf matrix*
- virtual torch::Tensor [getSyyNegativeHalf](#) ()  
*get the SyyNegativeHalf matrix*
- virtual torch::Tensor [getM](#) ()  
 $M = mm(mm(SxxNegativeHalf.t(), Sxy), SyyNegativeHalf)$
- virtual torch::Tensor [getM1](#) ()  
 $M1 = mm(SxxNegativeHalf.t(), Sxy)$
- virtual torch::Tensor [getCorrelation](#) ()  
*get the correlation value*

## Protected Member Functions

- void [paraseConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- std::string **filePath**
- torch::Tensor **A**
- torch::Tensor **B**
- torch::Tensor **At**
- torch::Tensor **Bt**
- torch::Tensor **Sxx**
- torch::Tensor **Syy**
- torch::Tensor **Sxy**
- torch::Tensor **SxxNegativeHalf**
- torch::Tensor **SyyNegativeHalf**
- torch::Tensor **M**
- torch::Tensor **M1**
- torch::Tensor **correlation**

### 8.27.1 Detailed Description

For CCA downstream task.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking `torch.mm(A,B)`)

: does not need config

: default name tags "CCA": [CCAMatrixLoader](#)

### 8.27.2 Member Function Documentation

#### 8.27.2.1 `getA()`

```
torch::Tensor LibAMM::CCAMatrixLoader::getA ( ) [virtual]
```

get the A matrix

Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

#### 8.27.2.2 `getAt()`

```
torch::Tensor LibAMM::CCAMatrixLoader::getAt ( ) [virtual]
```

get the transpose of A matrix

Returns

the `A.t().contiguous()` matrix, which is not a view but has its own memory space

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.3 getB()

```
torch::Tensor LibAMM::CCAMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.4 getBt()

```
torch::Tensor LibAMM::CCAMatrixLoader::getBt ( ) [virtual]
```

get the transpose of B matrix

#### Returns

the B.t().contiguous() matrix, which is not a view but has its own memory space

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.5 getCorrelation()

```
torch::Tensor LibAMM::CCAMatrixLoader::getCorrelation ( ) [virtual]
```

get the correlation value

#### Returns

the generated correlation by calling [calculate\\_correlation\(\)](#)

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.6 getM()

```
torch::Tensor LibAMM::CCAMatrixLoader::getM ( ) [virtual]
```

$M = \text{mm}(\text{mm}(\text{SxxNegativeHalf.t}(), \text{Sxy}), \text{SyyNegativeHalf})$

#### Returns

the generated M matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.7 getM1()

```
torch::Tensor LibAMM::CCAMatrixLoader::getM1 ( ) [virtual]
```

$M1 = \text{mm}(\text{SxxNegativeHalf.t}(), \text{Sxy})$

#### Returns

the generated M1 matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.8 getSxx()

```
torch::Tensor LibAMM::CCAMatrixLoader::getSxx ( ) [virtual]
```

get the Sxx matrix

#### Returns

the generated Sxx matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.9 getSxxNegativeHalf()

```
torch::Tensor LibAMM::CCAMatrixLoader::getSxxNegativeHalf ( ) [virtual]
```

get the SxxNegativeHalf matrix

#### Returns

the generated SxxNegativeHalf matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.10 getSxy()

```
torch::Tensor LibAMM::CCAMatrixLoader::getSxy ( ) [virtual]
```

get the Sxy matrix

#### Returns

the generated Sxy matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.11 getSyy()

```
torch::Tensor LibAMM::CCAMatrixLoader::getSyy ( ) [virtual]
```

get the Syy matrix

#### Returns

the generated Syy matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.12 getSyyNegativeHalf()

```
torch::Tensor LibAMM::CCAMatrixLoader::getSyyNegativeHalf ( ) [virtual]
```

get the SyyNegativeHalf matrix

#### Returns

the generated SyyNegativeHalf matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

### 8.27.2.13 paraseConfig()

```
void LibAMM::CCAMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

## Parameters

<i>cfg</i>	the config
------------	------------

**8.27.2.14 setConfig()**

```
bool LibAMM::CCAMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

## Note

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

Reimplemented in [LibAMM::MNISTMatrixLoader](#), and [LibAMM::MediaMillMatrixLoader](#).

The documentation for this class was generated from the following files:

- include/MatrixLoader/CCAMatrixLoader.h
- src/MatrixLoader/CCAMatrixLoader.cpp

**8.28 cl\_char16 Union Reference****Public Member Functions**

- cl\_char **CL\_ALIGNED** (16) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.29 cl\_char2 Union Reference

### Public Member Functions

- cl\_char **CL\_ALIGNED** (2) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.30 cl\_char4 Union Reference

### Public Member Functions

- cl\_char **CL\_ALIGNED** (4) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.31 cl\_char8 Union Reference

### Public Member Functions

- cl\_char **CL\_ALIGNED** (8) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.32 cl\_double16 Union Reference

### Public Member Functions

- cl\_double **CL\_ALIGNED** (128) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h



## 8.33 cl\_double2 Union Reference

### Public Member Functions

- cl\_double **CL\_ALIGNED** (16) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.34 cl\_double4 Union Reference

### Public Member Functions

- cl\_double **CL\_ALIGNED** (32) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.35 cl\_double8 Union Reference

### Public Member Functions

- cl\_double **CL\_ALIGNED** (64) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.36 cl\_float16 Union Reference

### Public Member Functions

- cl\_float **CL\_ALIGNED** (64) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.37 cl\_float2 Union Reference

### Public Member Functions

- cl\_float **CL\_ALIGNED** (8) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.38 cl\_float4 Union Reference

### Public Member Functions

- cl\_float **CL\_ALIGNED** (16) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.39 cl\_float8 Union Reference

### Public Member Functions

- cl\_float **CL\_ALIGNED** (32) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.40 cl\_half16 Union Reference

### Public Member Functions

- cl\_half **CL\_ALIGNED** (32) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.41 cl\_half2 Union Reference

### Public Member Functions

- cl\_half **CL\_ALIGNED** (4) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.42 cl\_half4 Union Reference

### Public Member Functions

- cl\_half **CL\_ALIGNED** (8) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.43 cl\_half8 Union Reference

### Public Member Functions

- cl\_half **CL\_ALIGNED** (16) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.44 cl\_int16 Union Reference

### Public Member Functions

- cl\_int **CL\_ALIGNED** (64) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.45 cl\_int2 Union Reference

### Public Member Functions

- cl\_int **CL\_ALIGNED** (8) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.46 cl\_int4 Union Reference

### Public Member Functions

- cl\_int **CL\_ALIGNED** (16) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.47 cl\_int8 Union Reference

### Public Member Functions

- cl\_int **CL\_ALIGNED** (32) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.48 cl\_long16 Union Reference

### Public Member Functions

- cl\_long **CL\_ALIGNED** (128) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.49 cl\_long2 Union Reference

### Public Member Functions

- cl\_long **CL\_ALIGNED** (16) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.50 cl\_long4 Union Reference

### Public Member Functions

- cl\_long **CL\_ALIGNED** (32) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.51 cl\_long8 Union Reference

### Public Member Functions

- cl\_long **CL\_ALIGNED** (64) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.52 cl\_short16 Union Reference

### Public Member Functions

- cl\_short **CL\_ALIGNED** (32) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.53 cl\_short2 Union Reference

### Public Member Functions

- cl\_short **CL\_ALIGNED** (4) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.54 cl\_short4 Union Reference

### Public Member Functions

- cl\_short **CL\_ALIGNED** (8) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.55 cl\_short8 Union Reference

### Public Member Functions

- cl\_short **CL\_ALIGNED** (16) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.56 cl\_uchar16 Union Reference

### Public Member Functions

- cl\_uchar **CL\_ALIGNED** (16) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.57 cl\_uchar2 Union Reference

### Public Member Functions

- cl\_uchar **CL\_ALIGNED** (2) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.58 cl\_uchar4 Union Reference

### Public Member Functions

- cl\_uchar **CL\_ALIGNED** (4) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.59 cl\_uchar8 Union Reference

### Public Member Functions

- cl\_uchar **CL\_ALIGNED** (8) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.60 cl\_uint16 Union Reference

### Public Member Functions

- cl\_uint **CL\_ALIGNED** (64) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.61 cl\_uint2 Union Reference

### Public Member Functions

- cl\_uint **CL\_ALIGNED** (8) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.62 cl\_uint4 Union Reference

### Public Member Functions

- cl\_uint **CL\_ALIGNED** (16) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.63 cl\_uint8 Union Reference

### Public Member Functions

- cl\_uint **CL\_ALIGNED** (32) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.64 cl\_ulong16 Union Reference

### Public Member Functions

- cl\_ulong **CL\_ALIGNED** (128) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h



## 8.65 cl\_ulong2 Union Reference

### Public Member Functions

- cl\_ulong **CL\_ALIGNED** (16) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.66 cl\_ulong4 Union Reference

### Public Member Functions

- cl\_ulong **CL\_ALIGNED** (32) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.67 cl\_ulong8 Union Reference

### Public Member Functions

- cl\_ulong **CL\_ALIGNED** (64) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.68 cl\_ushort16 Union Reference

### Public Member Functions

- cl\_ushort **CL\_ALIGNED** (32) s[16]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.69 cl\_ushort2 Union Reference

### Public Member Functions

- cl\_ushort **CL\_ALIGNED** (4) s[2]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.70 cl\_ushort4 Union Reference

### Public Member Functions

- cl\_ushort **CL\_ALIGNED** (8) s[4]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.71 cl\_ushort8 Union Reference

### Public Member Functions

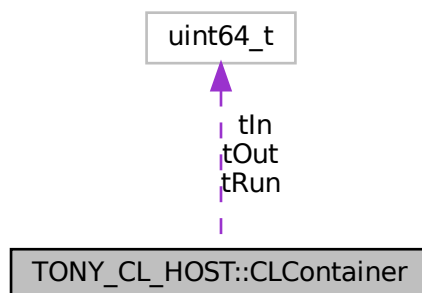
- cl\_ushort **CL\_ALIGNED** (16) s[8]

The documentation for this union was generated from the following file:

- include/CL/cl\_platform.h

## 8.72 TONY\_CL\_HOST::CLContainer Class Reference

Collaboration diagram for TONY\_CL\_HOST::CLContainer:



## Public Member Functions

- **CLContainer** (cl\_uint id, cl\_device\_type type, string kernelName)
- **CLContainer** (cl\_uint id, cl\_device\_type type, string kernelName, string clName)
- **CLContainer** (cl\_uint id, cl\_device\_type type, string kernelName, char \*filenameFull)
- void **setWorkDimension** (int nd)
- void **saveProgram** (char \*outName)
- void **addHostOutPara** ([HostPara](#) par)
- void **addHostInPara** ([HostPara](#) par)
- void **resetHostIn** (size\_t idx, [HostPara](#) par)
- void **resetHostOut** (size\_t idx, [HostPara](#) par)
- void **clearPar** ()
- void **addBoundaryValue** (uint64\_t bnd)
- void **resetBoundary** (size\_t idx, uint64\_t bnd)
- void **execute** (size\_t globalSize, size\_t localSize)
- void **execute** (std::vector< size\_t > gs, std::vector< size\_t > ls)

## Public Attributes

- uint64\_t **tIn**
- uint64\_t **tRun**
- uint64\_t **tOut**

The documentation for this class was generated from the following files:

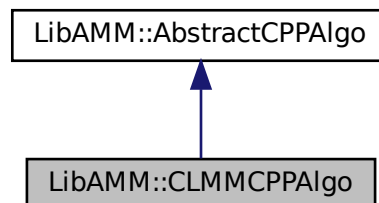
- include/CL/CLContainer.hpp
- src/CLContainer.cpp

## 8.73 LibAMM::CLMMCPPAlgo Class Reference

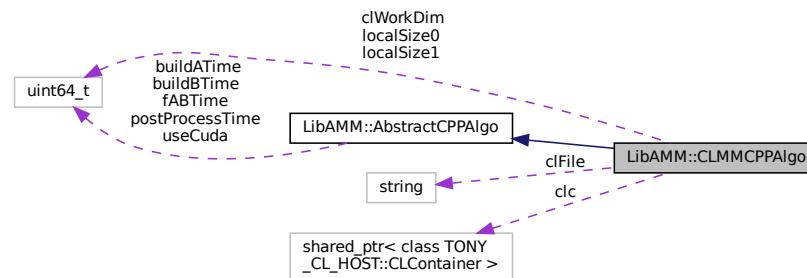
The MM class of c++ algos using opencl.

```
#include <CPPAlgos/CLMMCPPAlgo.h>
```

Inheritance diagram for LibAMM::CLMMCPPAlgo:



Collaboration diagram for LibAMM::CLMMCPPAlgo:



## Public Member Functions

- virtual torch::Tensor **amm** (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*
- virtual void **setConfig** (INTELLI::ConfigMapPtr cfg)  
*set the alo-specific config related to one algorithm*

## Protected Member Functions

- torch::Tensor **clmm** (torch::Tensor A, torch::Tensor B)
- torch::Tensor **clint8** (torch::Tensor A, torch::Tensor B)

## Protected Attributes

- std::string **clFile** = "CL/CLMM"
- uint64\_t **clWorkDim** = 2
- TONY\_CL\_HOST::CLContainerPtr **clc** = nullptr
- uint64\_t **localSize0** = 1
- uint64\_t **localSize1** = 1

### 8.73.1 Detailed Description

The MM class of c++ algos using opencl.

++

Note

additionally parameters

- clFile, String, default "CL/CLMM"

### 8.73.2 Member Function Documentation

### 8.73.2.1 amm()

```
torch::Tensor LibAMM::CLMMCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

#### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

### 8.73.2.2 clint8()

```
torch::Tensor LibAMM::CLMMCPPAlgo::clint8 (
    torch::Tensor A,
    torch::Tensor B ) [protected]
```

build A into std vector

run fAB

fix the time measure related to cl

### 8.73.2.3 clmm()

```
torch::Tensor LibAMM::CLMMCPPAlgo::clmm (
    torch::Tensor A,
    torch::Tensor B ) [protected]
```

build A into std vector

fix the time measure related to cl

The documentation for this class was generated from the following files:

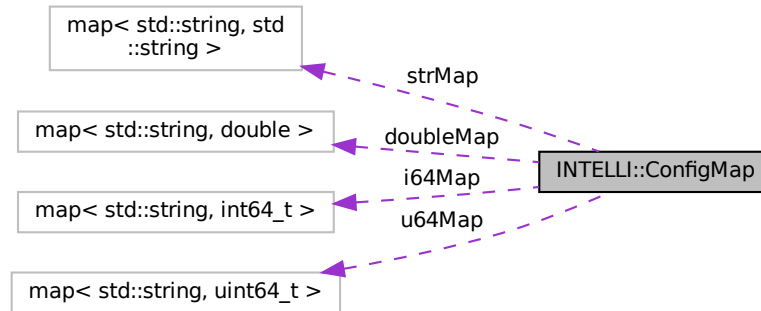
- [include/CPPAIgos/CLMMCPPAlgo.h](#)
- [src/CPPAIgos/CLMMCPPAlgo.cpp](#)

## 8.74 INTELLI::ConfigMap Class Reference

The unified map structure to store configurations in a key-value style.

```
#include <Utils/ConfigMap.hpp>
```

Collaboration diagram for INTELLI::ConfigMap:



### Public Member Functions

- void [edit](#) (const std::string &key, uint64\_t value)  
*Edit the config map. If not exit the config, will create new, or will overwrite.*
- void [edit](#) (const std::string &key, int64\_t value)  
*Edit the config map. If not exit the config, will create new, or will overwrite.*
- void [edit](#) (const std::string &key, double value)  
*Edit the config map. If not exit the config, will create new, or will overwrite.*
- void [edit](#) (const std::string &key, std::string value)  
*Edit the config map. If not exit the config, will create new, or will overwrite.*
- bool [existU64](#) (const std::string &key)  
*To detect whether the key exists and related to a U64.*
- bool [existI64](#) (const std::string &key)  
*To detect whether the key exists and related to a I64.*
- bool [existDouble](#) (const std::string &key)  
*To detect whether the key exists and related to a double.*
- bool [existString](#) (const std::string &key)  
*To detect whether the key exists and related to a std::string.*
- bool [exist](#) (const std::string &key)  
*To detect whether the key exists.*
- uint64\_t [getU64](#) (const std::string &key)  
*To get a U64 value by key.*
- int64\_t [getI64](#) (const std::string &key)  
*To get a I64 value by key.*
- double [getDouble](#) (const std::string &key)  
*To get a double value by key.*
- std::string [getString](#) (const std::string &key)

*To get a std::string value by key.*

- std::string **toString** (const std::string &separator="\t", std::string newLine="\n")  
*convert the whole map to std::string and return*
- bool **fromString** (const std::string src, const std::string &separator="\t", std::string newLine="\n")  
*load the map from some external string*
- void **cloneInto** (ConfigMap &dest)  
*clone this config into destination*
- void **loadFrom** (ConfigMap &src)  
*load some information an external one*
- bool **toFile** (const std::string &fname, const std::string &separator=",", std::string newLine="\n")  
*convert the whole map to file*
- bool **fromFile** (const std::string &fname, std::string separator=",", std::string newLine="\n")  
*update the whole map from file*
- bool **fromCArg** (const int argc, char \*\*argv)  
*update the whole map from c/c++ program's args*
- int64\_t **tryI64** (const string &key, int64\_t defaultValue=0, bool showWarning=false)  
*Try to get an I64 from config map, if not exist, use default value instead.*
- std::map< std::string, std::string > **getStrMap** ()  
*return the map of string*
- std::map< std::string, int64\_t > **getI64Map** ()  
*return the map of I64*
- std::map< std::string, uint64\_t > **getU64Map** ()  
*return the map of U64*
- std::map< std::string, double > **getDoubleMap** ()  
*return the map of I64*
- uint64\_t **tryU64** (const string &key, uint64\_t defaultValue=0, bool showWarning=false)  
*Try to get an U64 from config map, if not exist, use default value instead.*
- double **tryDouble** (const string &key, double defaultValue=0, bool showWarning=false)  
*Try to get a double from config map, if not exist, use default value instead.*
- string **tryString** (const string &key, const string &defaultValue="", bool showWarning=false)  
*Try to get an String from config map, if not exist, use default value instead.*
- void **addPrefixToKeys** (std::string prefix)  
*Add prefix to the front of keys, it is useful in downstream task where we need to generate metric config file for each components in the downstream task e.g. instructions -> \${prefix}Instructions.*

## Protected Member Functions

- void **smartParse** (std::string key, std::string value)

## Static Protected Member Functions

- static void **spilt** (const std::string s, const std::string &c, vector< std::string > &v)

## Protected Attributes

- std::map< std::string, uint64\_t > **u64Map**
- std::map< std::string, int64\_t > **i64Map**
- std::map< std::string, double > **doubleMap**
- std::map< std::string, std::string > **strMap**

### 8.74.1 Detailed Description

The unified map structure to store configurations in a key-value style.

#### Note

Require [IntelliLog](#) Util package

The documentation for this class was generated from the following file:

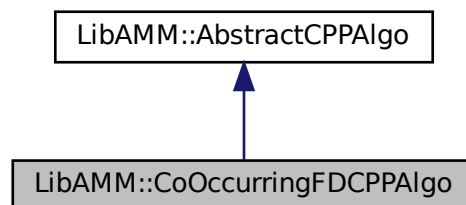
- [include/Utils/ConfigMap.hpp](#)

## 8.75 LibAMM::CoOccurringFDCPPAlgo Class Reference

The Co-Occurring FD AMM class of c++ algos.

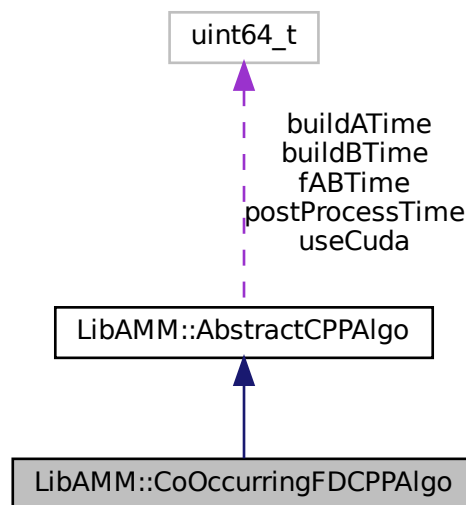
```
#include <CPPAlgos/CoOccurringFDCPPAlgo.h>
```

Inheritance diagram for LibAMM::CoOccurringFDCPPAlgo:





Collaboration diagram for LibAMM::CoOccurringFDCPPAlgo:



## Public Member Functions

- virtual torch::Tensor **amm** (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.75.1 Detailed Description

The Co-Occurring FD AMM class of c++ algos.

++

### 8.75.2 Member Function Documentation

#### 8.75.2.1 amm()

```

torch::Tensor LibAMM::CoOccurringFDCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
  
```

the virtual function provided for outside callers, rewrite in children classes

**Parameters**

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

**Returns**

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

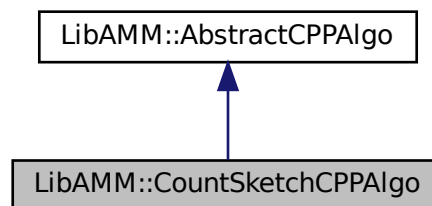
- include/CPPAlgos/CoOccurringFDCPPAlgo.h
- src/CPPAlgos/CoOccurringFDCPPAlgo.cpp

## 8.76 LibAMM::CountSketchCPPAlgo Class Reference

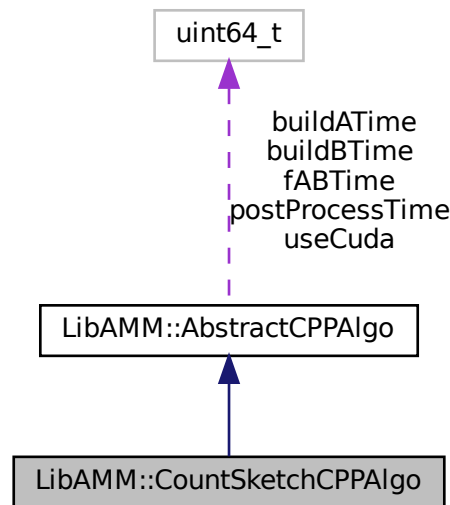
The counter sketch class of c++ algos.

```
#include <CPPAlgos/CountSketchCPPAlgo.h>
```

Inheritance diagram for LibAMM::CountSketchCPPAlgo:



Collaboration diagram for LibAMM::CountSketchCPPAlgo:



## Public Member Functions

- `torch::Tensor amm (torch::Tensor A, torch::Tensor B, uint64_t sketchSize)`  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.76.1 Detailed Description

The counter sketch class of c++ algos.

++

### 8.76.2 Member Function Documentation

#### 8.76.2.1 amm()

```

torch::Tensor LibAMM::CountSketchCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
  
```

the virtual function provided for outside callers, rewrite in children classes

## Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

## Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

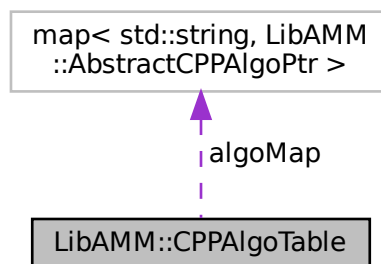
- include/CPPAlgos/[CountSketchCPPAlgo.h](#)
- src/CPPAlgos/CountSketchCPPAlgo.cpp

## 8.77 LibAMM::CPPAlgoTable Class Reference

The table to index cpp algos.

```
#include <CPPAlgos/CPPAlgoTable.h>
```

Collaboration diagram for LibAMM::CPPAlgoTable:



### Public Member Functions

- void [registerNewCppAlgo](#) (LibAMM::AbstractCPPAlgoPtr anew, std::string tag)  
*To register a new ALGO.*
- LibAMM::AbstractCPPAlgoPtr [findCppAlgo](#) (std::string name)  
*find a dataloader in the table according to its name*

## Protected Attributes

- `std::map< std::string, LibAMM::AbstractCPPAlgoPtr >` **algoMap**

### 8.77.1 Detailed Description

The table to index cpp algos.

++

#### Note

Default behavior

- create
- (optional) call [registerNewCppAlgo](#) for new algo
- find a loader by [findCppAlgo](#) using its tag

default tags

- mm [AbstractCPPAlgo](#) (default matmul)
- crs [CRSCPPAlgo](#) (the column-row-sampling, crs)

### 8.77.2 Member Function Documentation

#### 8.77.2.1 findCppAlgo()

```
LibAMM::AbstractCPPAlgoPtr LibAMM::CPPAlgoTable::findCppAlgo (
    std::string name ) [inline]
```

find a dataloader in the table according to its name

#### Parameters

<i>name</i>	The nameTag of loader
-------------	-----------------------

#### Returns

The AbstractCppAlgoPtr, nullptr if not found

#### 8.77.2.2 registerNewCppAlgo()

```
void LibAMM::CPPAlgoTable::registerNewCppAlgo (
    LibAMM::AbstractCPPAlgoPtr anew,
    std::string tag ) [inline]
```

To register a new ALGO.

## Parameters

<i>anew</i>	The new algo
<i>tag</i>	The name tag

The documentation for this class was generated from the following files:

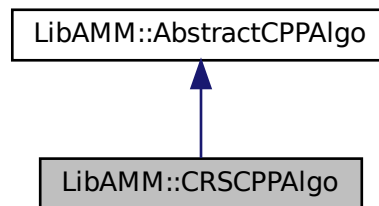
- include/CPPALgos/[CPPAlgoTable.h](#)
- src/CPPALgos/CPPALgoTable.cpp

## 8.78 LibAMM::CRSCPPAlgo Class Reference

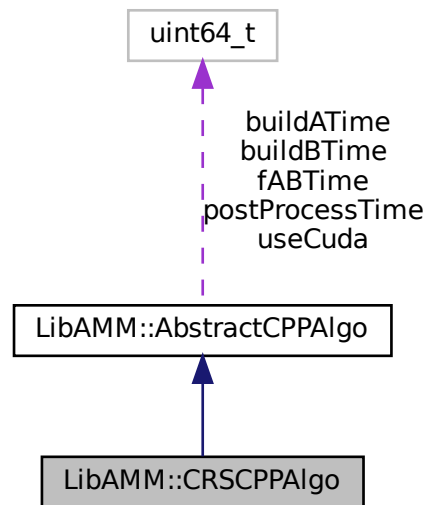
The column row sampling (CRS) class of c++ algos.

```
#include <CPPALgos/CRSCPPAlgo.h>
```

Inheritance diagram for LibAMM::CRSCPPAlgo:



Collaboration diagram for LibAMM::CRSCPPAlgo:



## Public Member Functions

- virtual torch::Tensor [amm](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.78.1 Detailed Description

The column row sampling (CRS) class of c++ algos.

++

### 8.78.2 Member Function Documentation

#### 8.78.2.1 amm()

```

torch::Tensor LibAMM::CRSCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
  
```

the virtual function provided for outside callers, rewrite in children classes

**Parameters**

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

**Returns**

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

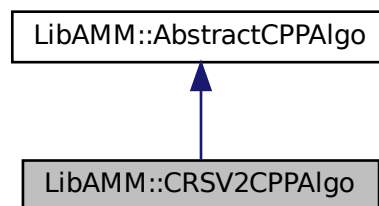
- include/CPPAlgos/[CRSCPPAlgo.h](#)
- src/CPPAlgos/CRSCPPAlgo.cpp

## 8.79 LibAMM::CRSV2CPPAlgo Class Reference

The column row sampling (CRS) class of c++ algos, a second implementation.

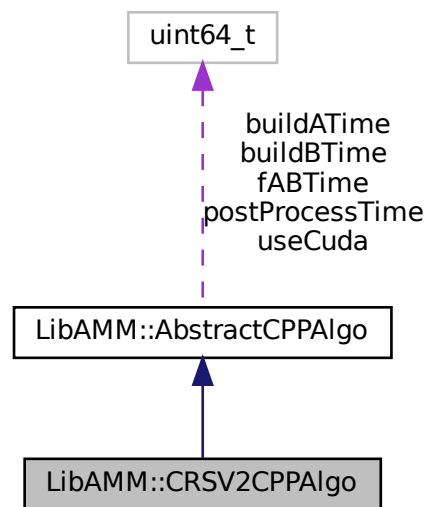
```
#include <CPPAlgos/CRSV2CPPAlgo.h>
```

Inheritance diagram for LibAMM::CRSV2CPPAlgo:





Collaboration diagram for LibAMM::CRSV2CPPAlgo:



## Public Member Functions

- virtual torch::Tensor [amm](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.79.1 Detailed Description

The column row sampling (CRS) class of c++ algos, a second implementation.

++

### 8.79.2 Member Function Documentation

#### 8.79.2.1 amm()

```

torch::Tensor LibAMM::CRSV2CPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
  
```

the virtual function provided for outside callers, rewrite in children classes

## Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

## Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

- include/CPPAlgos/[CRSV2CPPAlgo.h](#)
- src/CPPAlgos/CRSV2CPPAlgo.cpp

## 8.80 default\_attrs Struct Reference

The low-level perf descriptions passed to OS.

```
#include <ThreadPerf.hpp>
```

### 8.80.1 Detailed Description

The low-level perf descriptions passed to OS.

The low-level perf events send to OS call, don't touch me.

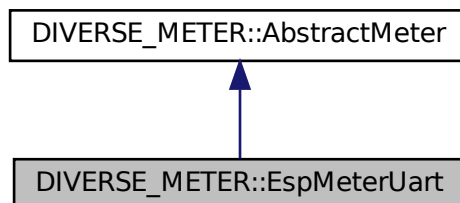
The documentation for this struct was generated from the following file:

- include/Utils/[ThreadPerf.hpp](#)

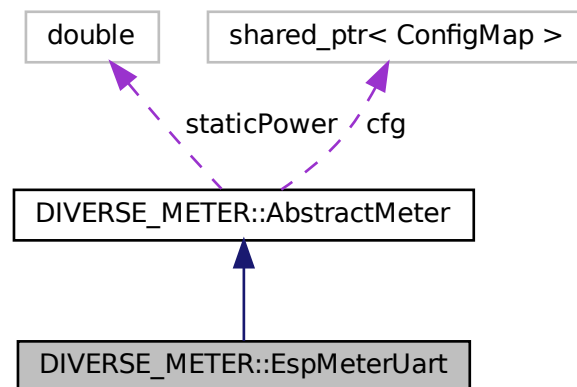
## 8.81 DIVERSE\_METER::EspMeterUart Class Reference

the entity of an esp32s2-based power meter, connected by uart 115200

Inheritance diagram for DIVERSE\_METER::EspMeterUart:



Collaboration diagram for DIVERSE\_METER::EspMeterUart:



## Public Member Functions

- virtual void [setConfig](#) (INTELLI::ConfigMapPtr \_cfg)  
to set the configmap
- void [startMeter](#) ()  
to start the meter into some measuring tasks
- void [stopMeter](#) ()  
to stop the meter into some measuring tasks
- double [getE](#) ()  
to get the energy in J, including static energy consumption of system
- double [getPeak](#) ()  
to get the peak power in W, including static power of system
- bool [isValid](#) ()

## Additional Inherited Members

### 8.81.1 Detailed Description

the entity of an esp32s2-based power meter, connected by uart 115200

#### Note

default behaviors:

- create
- call [setConfig\(\)](#) to config this meter
- (optional) call [testStaticPower\(\)](#) to test the static power of a device, if you want to exclude it
- call [startMeter\(\)](#) to start measurement
- (run your program)

- call [stopMeter\(\)](#) to stop measurement
- call [getE\(\)](#), [getPeak\(\)](#), etc to get the measurement results

config parameters:

- meterAddress, String, The file system path of meter, default "/dev/ttyUSB0";

tag is "espUart"

## 8.81.2 Member Function Documentation

### 8.81.2.1 setConfig()

```
void EspMeterUart::setConfig (
    INTELLI::ConfigMapPtr _cfg ) [virtual]
```

to set the configmap

Parameters

<i>cfg</i>	the config map
------------	----------------

Reimplemented from [DIVERSE\\_METER::AbstractMeter](#).

The documentation for this class was generated from the following files:

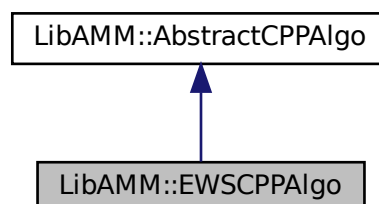
- include/Utils/Meters/EspMeterUart/[EspMeterUart.hpp](#)
- src/Utils/Meters/EspMeterUart/[EspMeterUart.cpp](#)

## 8.82 LibAMM::EWSCPPAlgo Class Reference

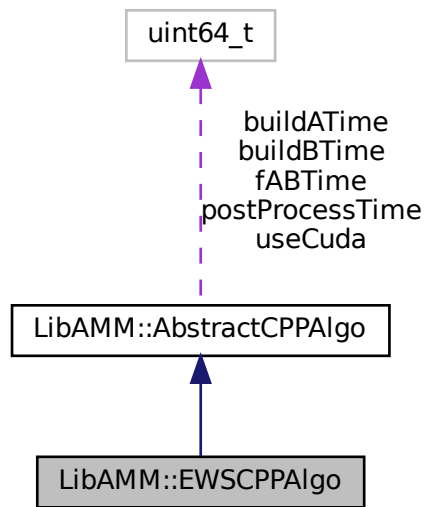
The Element Wise Sampling (EWS) class of c++ algos.

```
#include <CPPAlgos/EWSCPPAlgo.h>
```

Inheritance diagram for LibAMM::EWSCPPAlgo:



Collaboration diagram for LibAMM::EWSCPPAlgo:



## Public Member Functions

- virtual torch::Tensor [amm](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.82.1 Detailed Description

The Element Wise Sampling (EWS) class of c++ algos.

++

### 8.82.2 Member Function Documentation

#### 8.82.2.1 amm()

```

torch::Tensor LibAMM::EWSCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
  
```

the virtual function provided for outside callers, rewrite in children classes

## Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

## Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

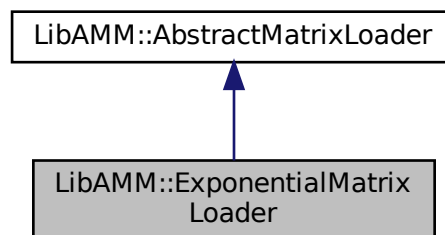
- [include/CPPAlgos/EWSCPPAlgo.h](#)
- [src/CPPAlgos/EWSCPPAlgo.cpp](#)

## 8.83 LibAMM::ExponentialMatrixLoader Class Reference

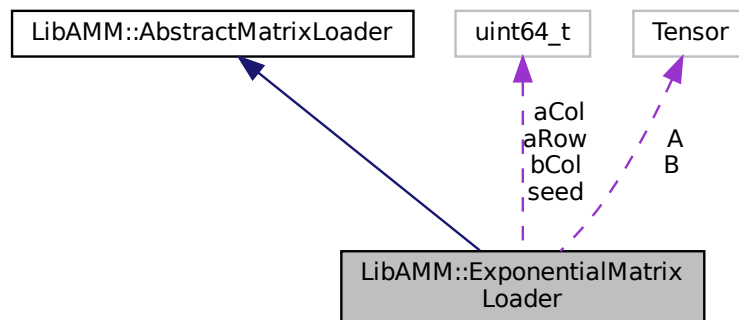
The Exponential class of matrix loader.

```
#include <MatrixLoader/ExponentialMatrixLoader.h>
```

Inheritance diagram for LibAMM::ExponentialMatrixLoader:



Collaboration diagram for LibAMM::ExponentialMatrixLoader:



## Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*

## Protected Member Functions

- void [paraseConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- uint64\_t **aRow**
- uint64\_t **aCol**
- uint64\_t **bCol**
- uint64\_t **seed**

### 8.83.1 Detailed Description

The Exponential class of matrix loader.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking `torch.mm(A,B)`)

: require config parameters and default values

- "aRow" The rows in matrix A, U64, 100
- "aCol" The cols in matrix B, U64, 1000
- "bCol" The rows in matrix B, U64, 500
- "seed" The seed of inline random generator, U64, 114514

: default name tags "random": [ExponentialMatrixLoader](#)

### 8.83.2 Member Function Documentation

#### 8.83.2.1 `getA()`

```
torch::Tensor LibAMM::ExponentialMatrixLoader::getA ( ) [virtual]
```

get the A matrix

Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

#### 8.83.2.2 `getB()`

```
torch::Tensor LibAMM::ExponentialMatrixLoader::getB ( ) [virtual]
```

get the B matrix

Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

#### 8.83.2.3 `paraseConfig()`

```
void LibAMM::ExponentialMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.



## Parameters

<i>cfg</i>	the config
------------	------------

### 8.83.2.4 setConfig()

```
bool LibAMM::ExponentialMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

## Note

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

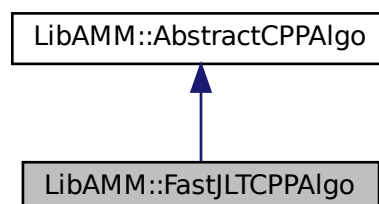
- include/MatrixLoader/ExponentialMatrixLoader.h
- src/MatrixLoader/ExponentialMatrixLoader.cpp

## 8.84 LibAMM::FastJLTCPAlgo Class Reference

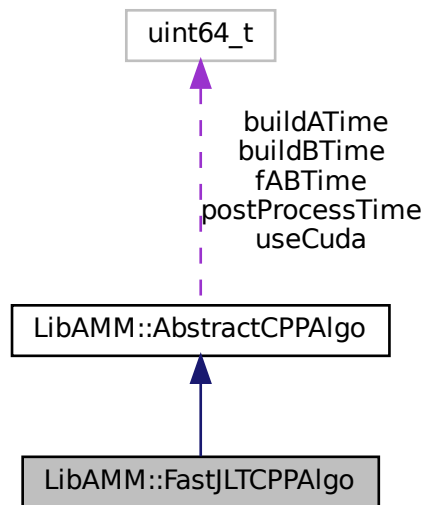
The tug of war class of c++ algoS.

```
#include <CPPAlgos/FastJLTCPAlgo.h>
```

Inheritance diagram for LibAMM::FastJLTCPAlgo:



Collaboration diagram for LibAMM::FastJLTCPAlgo:



## Public Member Functions

- virtual `torch::Tensor amm` (`torch::Tensor A`, `torch::Tensor B`, `uint64_t sketchSize`)  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.84.1 Detailed Description

The tug of war class of c++ algoS.

++

### 8.84.2 Member Function Documentation

#### 8.84.2.1 amm()

```

torch::Tensor LibAMM::FastJLTCPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
  
```

the virtual function provided for outside callers, rewrite in children classes

## Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

## Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

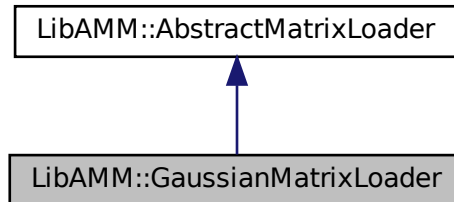
- include/CPPAlgos/[FastJLTCPPAlgo.h](#)
- src/CPPAlgos/[FastJLTCPPAlgo.cpp](#)

## 8.85 LibAMM::GaussianMatrixLoader Class Reference

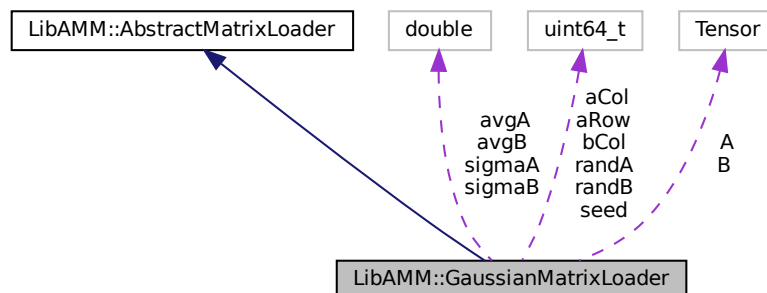
The Gaussian class of matrix loader.

```
#include <MatrixLoader/GaussianMatrixLoader.h>
```

Inheritance diagram for LibAMM::GaussianMatrixLoader:



Collaboration diagram for LibAMM::GaussianMatrixLoader:



## Public Member Functions

- virtual bool [setConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*

## Protected Member Functions

- void [paraseConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- uint64\_t **aRow**
- uint64\_t **aCol**
- uint64\_t **bCol**
- uint64\_t **seed**
- uint64\_t **randA**
- uint64\_t **randB**
- double **sigmaA**
- double **avgA**
- double **sigmaB**
- double **avgB**

### 8.85.1 Detailed Description

The Gaussian class of matrix loader.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: require config parameters and default values

- "aRow" The rows in matrix A, U64, 100
- "aCol" The cols in matrix B, U64, 1000
- "bCol" The rows in matrix B, U64, 500

- "seed" The seed of inline random generator, U64, 114514
- "randA" To generate matrix A under random distribution instead (will disable all gaussian-related settings), U64, 0
- "randB" To generate matrix B under random distribution instead (will disable all gaussian-related settings), U64, 0
- "sigmaA" The standard divation of A, Double, 1
- "avgA" The average value of A, Double, 0
- "sigmaB" The standard divation of B, Double, 1
- "avgB" The average value of A, Double, 0

: default name tags "random": [GaussianMatrixLoader](#)

## 8.85.2 Member Function Documentation

### 8.85.2.1 getA()

```
torch::Tensor LibAMM::GaussianMatrixLoader::getA ( ) [virtual]
```

get the A matrix

#### Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.85.2.2 getB()

```
torch::Tensor LibAMM::GaussianMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.85.2.3 paraseConfig()

```
void LibAMM::GaussianMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

## Parameters

<i>cfg</i>	the config
------------	------------

#### 8.85.2.4 setConfig()

```
bool LibAMM::GaussianMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

## Note

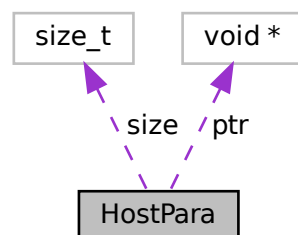
Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

- include/MatrixLoader/GaussianMatrixLoader.h
- src/MatrixLoader/GaussianMatrixLoader.cpp

## 8.86 HostPara Class Reference

Collaboration diagram for HostPara:



## Public Member Functions

- **HostPara** (void \*tptr, size\_t tsize)

## Public Attributes

- void \* **ptr**
- size\_t **size**

The documentation for this class was generated from the following file:

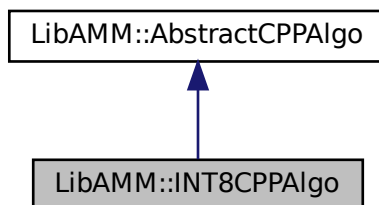
- include/CL/CLContainer.hpp

## 8.87 LibAMM::INT8CPPAlgo Class Reference

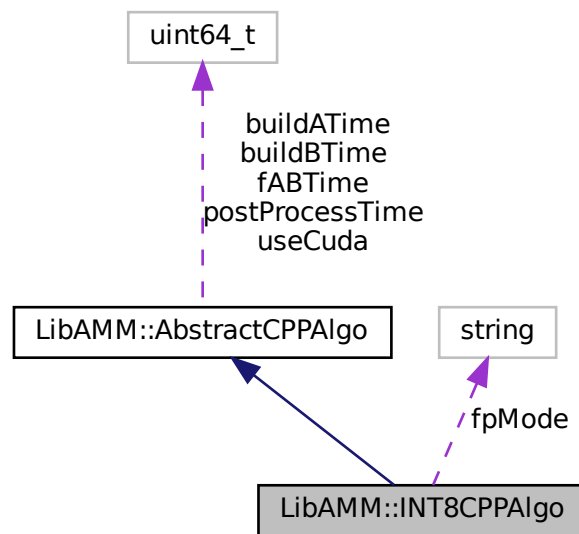
The INT8 MM class of c++ algos.

```
#include <CPPAlgos/INT8CPPAlgo.h>
```

Inheritance diagram for LibAMM::INT8CPPAlgo:



Collaboration diagram for LibAMM::INT8CPPAlgo:



## Public Member Functions

- virtual `torch::Tensor amm` (`torch::Tensor A`, `torch::Tensor B`, `uint64_t sketchSize`)  
*the virtual function provided for outside callers, rewrite in children classes*
- virtual void `setConfig` (`INTELLI::ConfigMapPtr cfg`)  
*set the alo-specific config related to one algorithm*

## Protected Member Functions

- `torch::Tensor fp32amm` (`torch::Tensor A`, `torch::Tensor B`)  
*the inline amm under nested loop fp32*
- `torch::Tensor fp64amm` (`torch::Tensor A`, `torch::Tensor B`)  
*the inline amm under nested loop fp64*
- `torch::Tensor int8amm` (`torch::Tensor A`, `torch::Tensor B`)  
*the inline amm under nested loop int8*
- `torch::Tensor int4amm` (`torch::Tensor A`, `torch::Tensor B`)  
*the inline amm under nested loop int4*
- `torch::Tensor int16amm` (`torch::Tensor A`, `torch::Tensor B`)  
*the inline amm under nested loop int16*

## Protected Attributes

- `std::string fpMode` = "FP32"



### 8.87.1 Detailed Description

The INT8 MM class of c++ algos.

++

#### Warning

This function disables all additional optimization by libtorch, as it has different, and not fair SIMD/cache optimization over FP32/INT16/INT8 on cpu, which is hard to compare

#### Note

additionally parameters

- fpMode, String, default FP32, can also use INT8 or INT16

### 8.87.2 Member Function Documentation

#### 8.87.2.1 amm()

```
torch::Tensor LibAMM::INT8CPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

#### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

#### 8.87.2.2 fp32amm()

```
torch::Tensor LibAMM::INT8CPPAlgo::fp32amm (
    torch::Tensor A,
    torch::Tensor B ) [protected]
```

the inline amm under nested loop fp32

**Parameters**

$A$	the A matrix
$B$	the B matrix

**Returns**

the output c matrix

build A into std vector

**8.87.2.3 fp64amm()**

```
torch::Tensor LibAMM::INT8CPPAlgo::fp64amm (  
    torch::Tensor A,  
    torch::Tensor B ) [protected]
```

the inline amm under nested loop fp64

**Parameters**

$A$	the A matrix
$B$	the B matrix

**Returns**

the output c matrix

build A into std vector

**8.87.2.4 int16amm()**

```
torch::Tensor LibAMM::INT8CPPAlgo::int16amm (  
    torch::Tensor A,  
    torch::Tensor B ) [protected]
```

the inline amm under nested loop int16

**Parameters**

$A$	the A matrix
$B$	the B matrix

**Returns**

the output c matrix

build A

build B

run fAB

$32/16=2$ , so we simulate a 2-way SHARED-NOTHING speed up in one loop

post process

#### 8.87.2.5 int4amm()

```
torch::Tensor LibAMM::INT8CPPAlgo::int4amm (  
    torch::Tensor A,  
    torch::Tensor B ) [protected]
```

the inline amm under nested loop int4

##### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix

##### Returns

the output c matrix

build A

build B

run fAB

$32/4=8$ , so we simulate a 8-way SHARED-NOTHING speed up in one loop

post process

#### 8.87.2.6 int8amm()

```
torch::Tensor LibAMM::INT8CPPAlgo::int8amm (  
    torch::Tensor A,  
    torch::Tensor B ) [protected]
```

the inline amm under nested loop int8

##### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix

**Returns**

the output c matrix

build A

build B

run fAB

32/8=4, so we simulate a 4-way SHARED-NOTHING speed up in one loop

post process

The documentation for this class was generated from the following files:

- [include/CPPALgos/INT8CPPALgo.h](#)
- [src/CPPALgos/INT8CPPALgo.cpp](#)

## 8.88 INTELLI::IntelliLog Class Reference

The log functions packed in class.

### Static Public Member Functions

- static void [log](#) (std::string level, std::string\_view message, std::source\_location const source=std::source\_↔ location::current())  
*Produce a log.*
- static void [setupLoggingFile](#) (string fname)  
*set up the logging file by its name*

### 8.88.1 Detailed Description

The log functions packed in class.

The documentation for this class was generated from the following files:

- [include/Utils/IntelliLog.h](#)
- [src/Utils/IntelliLog.cpp](#)

## 8.89 INTELLI::IntelliLog\_FileProtector Class Reference

The protector for concurrent log on a file.

## Public Member Functions

- void [lock](#) ()  
*lock this protector*
- void [unlock](#) ()  
*unlock this protector*
- void [openLogFile](#) (const string &fname)  
*try to open a file*
- void [appendLogFile](#) (const string &msg)  
*try to appened something to the file, if it's opened*

### 8.89.1 Detailed Description

The protector for concurrent log on a file.

#### Warning

This class is preserved for internal use only!

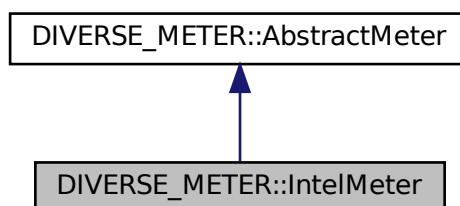
The documentation for this class was generated from the following file:

- include/Utils/IntelliLog.h

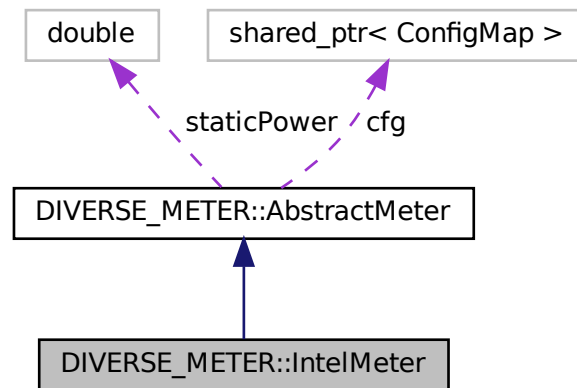
## 8.90 DIVERSE\_METER::IntelMeter Class Reference

the entity of intel msr-based power meter, may be not support for some newer architectures

Inheritance diagram for DIVERSE\_METER::IntelMeter:



Collaboration diagram for DIVERSE\_METER::IntelMeter:



## Public Member Functions

- virtual void [setConfig](#) ([INTELLI::ConfigMapPtr](#) \_cfg)  
*to set the configmap*
- void [startMeter](#) ()  
*to start the meter into some measuring tasks*
- void [stopMeter](#) ()  
*to stop the meter into some measuring tasks*
- double [getE](#) ()  
*to get the energy in J, including static energy consumption of system*
- bool [isValid](#) ()

## Additional Inherited Members

### 8.90.1 Detailed Description

the entity of intel msr-based power meter, may be not support for some newer architectures

- create
- call [setConfig\(\)](#) to config this meter
- (optional) call [testStaticPower\(\)](#) to test the static power of a device, if you want to exclude it
- call [startMeter\(\)](#) to start measurement
- (run your program)
- call [stopMeter\(\)](#) to stop measurement
- call [getE\(\)](#), [getPeak\(\)](#), etc to get the measurement results

**Warning**

: only works for some x64 machines

**Note**

: no peak power support, tag is "intelMsr"

**8.90.2 Member Function Documentation****8.90.2.1 setConfig()**

```
void IntelMeter::setConfig (
    INTELLI::ConfigMapPtr _cfg ) [virtual]
```

to set the configmap

**Parameters**

<i>cfg</i>	the config map
------------	----------------

Reimplemented from [DIVERSE\\_METER::AbstractMeter](#).

The documentation for this class was generated from the following files:

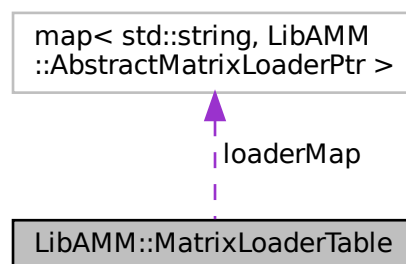
- include/Utils/Meters/IntelMeter/IntelMeter.hpp
- src/Utils/Meters/IntelMeter/IntelMeter.cpp

**8.91 LibAMM::MatrixLoaderTable Class Reference**

The table class to index all matrix loaders.

```
#include <MatrixLoader/MatrixLoaderTable.h>
```

Collaboration diagram for LibAMM::MatrixLoaderTable:



## Public Types

- typedef std::shared\_ptr< class [LibAMM::MatrixLoaderTable](#) > [MatrixLoaderTablePtr](#)  
*The class to describe a shared pointer to [MatrixLoaderTable](#).*

## Public Member Functions

- [MatrixLoaderTable](#) ()  
*The constructing function.*
- void [registerNewDataLoader](#) ([LibAMM::AbstractMatrixLoaderPtr](#) dnew, std::string tag)  
*To register a new loader.*
- [LibAMM::AbstractMatrixLoaderPtr](#) [findMatrixLoader](#) (std::string name)  
*find a dataloader in the table according to its name*

## Protected Attributes

- std::map< std::string, [LibAMM::AbstractMatrixLoaderPtr](#) > **loaderMap**

### 8.91.1 Detailed Description

The table class to index all matrix loaders.

#### Note

Default behavior

- create
- (optional) call [registerNewDataLoader](#) for new loader
- find a loader by [findMatrixLoader](#) using its tag

default tags

- random [RandomMatrixLoader](#)
- sparse [SparseMatrixLoader](#)

### 8.91.2 Constructor & Destructor Documentation

#### 8.91.2.1 MatrixLoaderTable()

```
LibAMM::MatrixLoaderTable::MatrixLoaderTable ( )
```

The constructing function.

#### Note

If new MatrixLoader wants to be included by default, please revise the following in \*.cpp  
 revise me if you need new loader



### 8.91.3 Member Function Documentation

#### 8.91.3.1 findMatrixLoader()

```
LibAMM::AbstractMatrixLoaderPtr LibAMM::MatrixLoaderTable::findMatrixLoader (
    std::string name ) [inline]
```

find a dataloader in the table according to its name

##### Parameters

<i>name</i>	The nameTag of loader
-------------	-----------------------

##### Returns

The MatrixLoader, nullptr if not found

#### 8.91.3.2 registerNewDataLoader()

```
void LibAMM::MatrixLoaderTable::registerNewDataLoader (
    LibAMM::AbstractMatrixLoaderPtr dnew,
    std::string tag ) [inline]
```

To register a new loader.

##### Parameters

<i>onew</i>	The new operator
<i>tag</i>	The name tag

The documentation for this class was generated from the following files:

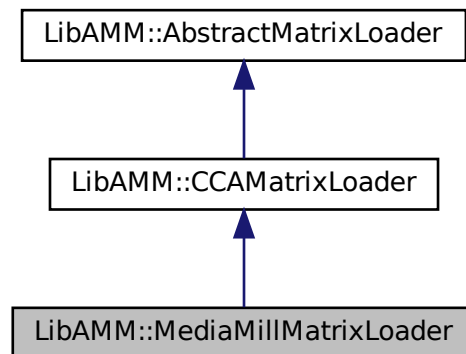
- include/MatrixLoader/MatrixLoaderTable.h
- src/MatrixLoader/MatrixLoaderTable.cpp

## 8.92 LibAMM::MediaMillMatrixLoader Class Reference

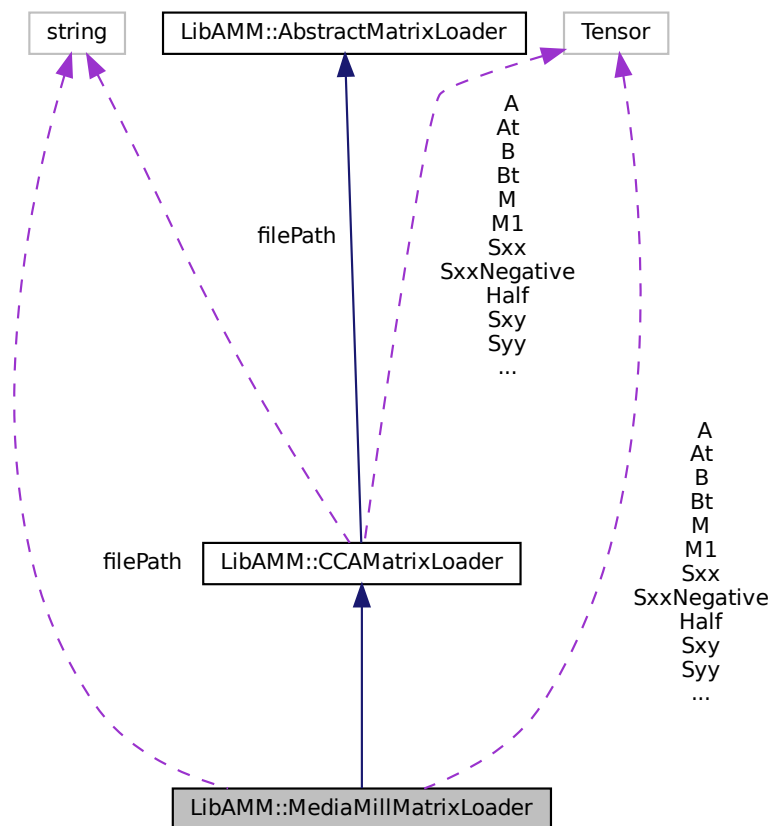
Load MediaMill 2005-2006 data ( <https://rdr.io/github/fcharte/mldr.datasets/man/mediamill.html> )

```
#include <MatrixLoader/MediaMillMatrixLoader.h>
```

Inheritance diagram for LibAMM::MediaMillMatrixLoader:



Collaboration diagram for LibAMM::MediaMillMatrixLoader:



## Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual void [calculate\\_correlation](#) ()  
*Calculate the correlation by mm, and generate tensor Sxx, Sxy, Syy, M, correlation.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*
- virtual torch::Tensor [getAt](#) ()  
*get the transpose of A matrix*
- virtual torch::Tensor [getBt](#) ()  
*get the transpose of B matrix*
- virtual torch::Tensor [getSxx](#) ()  
*get the Sxx matrix*
- virtual torch::Tensor [getSyy](#) ()  
*get the Sxyymatrix*
- virtual torch::Tensor [getSxy](#) ()  
*get the Sxy matrix*
- virtual torch::Tensor [getSxxNegativeHalf](#) ()  
*get the SxxNegativeHalf matrix*
- virtual torch::Tensor [getSyyNegativeHalf](#) ()  
*get the SyyNegativeHalf matrix*
- virtual torch::Tensor [getM](#) ()  
 $M = mm(mm(SxxNegativeHalf.t(), Sxy), SyyNegativeHalf)$
- virtual torch::Tensor [getM1](#) ()  
 $M1 = mm(SxxNegativeHalf.t(), Sxy)$
- virtual torch::Tensor [getCorrelation](#) ()  
*get the correlation value*

## Protected Member Functions

- void [paraseConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- std::string **filePath** ="datasets/MediaMill/MediaMill.pth"
- torch::Tensor **A**
- torch::Tensor **B**
- torch::Tensor **At**
- torch::Tensor **Bt**
- torch::Tensor **Sxx**
- torch::Tensor **Syy**
- torch::Tensor **Sxy**
- torch::Tensor **SxxNegativeHalf**
- torch::Tensor **SyyNegativeHalf**
- torch::Tensor **M**
- torch::Tensor **M1**
- torch::Tensor **correlation**

### 8.92.1 Detailed Description

Load MediaMill 2005-2006 data ( <https://rdr.r.io/github/fcharte/mlr.datasets/man/mediamill.html> )

2005-2006

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking `torch.mm(A,B)`)

: does not need config

: default name tags "MediaMill": [MediaMillMatrixLoader](#)

### 8.92.2 Member Function Documentation

#### 8.92.2.1 `getA()`

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getA ( ) [virtual]
```

get the A matrix

Returns

the generated A matrix

Reimplemented from [LibAMM::CCAMatrixLoader](#).

#### 8.92.2.2 `getAt()`

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getAt ( ) [virtual]
```

get the transpose of A matrix

Returns

the `A.t().contiguous()` matrix, which is not a view but has its own memory space

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.3 getB()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.4 getBt()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getBt ( ) [virtual]
```

get the transpose of B matrix

#### Returns

the B.t().contiguous() matrix, which is not a view but has its own memory space

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.5 getCorrelation()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getCorrelation ( ) [virtual]
```

get the correlation value

#### Returns

the generated correlation by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.6 getM()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getM ( ) [virtual]
```

$M = \text{mm}(\text{mm}(S_{xx}\text{NegativeHalf.t}(), S_{xy}), S_{yy}\text{NegativeHalf})$

#### Returns

the generated M matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.7 getM1()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getM1 ( ) [virtual]
```

$M1 = \text{mm}(\text{SxxNegativeHalf.t()}, \text{Sxy})$

#### Returns

the generated M1 matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.8 getSxx()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getSxx ( ) [virtual]
```

get the Sxx matrix

#### Returns

the generated Sxx matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.9 getSxxNegativeHalf()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getSxxNegativeHalf ( ) [virtual]
```

get the SxxNegativeHalf matrix

#### Returns

the generated SxxNegativeHalf matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.10 getSxy()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getSxy ( ) [virtual]
```

get the Sxy matrix

#### Returns

the generated Sxy matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.11 getSyy()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getSyy ( ) [virtual]
```

get the Sxyymatrix

#### Returns

the generated Syy matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.12 getSyyNegativeHalf()

```
torch::Tensor LibAMM::MediaMillMatrixLoader::getSyyNegativeHalf ( ) [virtual]
```

get the SyyNegativeHalf matrix

#### Returns

the generated SyyNegativeHalf matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.92.2.13 paraseConfig()

```
void LibAMM::MediaMillMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

#### Parameters

<i>cfg</i>	the config
------------	------------

### 8.92.2.14 setConfig()

```
bool LibAMM::MediaMillMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

## Note

Reimplemented from [LibAMM::CCAMatrixLoader](#).

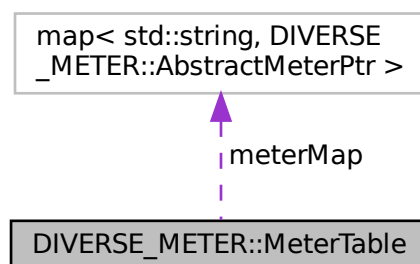
The documentation for this class was generated from the following files:

- include/MatrixLoader/MediaMillMatrixLoader.h
- src/MatrixLoader/MediaMillMatrixLoader.cpp

## 8.93 DIVERSE\_METER::MeterTable Class Reference

The table class to index all meters.

Collaboration diagram for DIVERSE\_METER::MeterTable:



### Public Types

- typedef std::shared\_ptr< class [DIVERSE\\_METER::MeterTable](#) > [MeterTablePtr](#)  
*The class to describe a shared pointer to [MeterTable](#).*



## Public Member Functions

- [MeterTable](#) ()  
*The constructing function.*
- void [registerNewMeter](#) (DIVERSE\_METER::AbstractMeterPtr dnew, std::string tag)  
*To register a new meter.*
- DIVERSE\_METER::AbstractMeterPtr [findMeter](#) (std::string name)  
*find a meter in the table according to its name*

## Protected Attributes

- std::map< std::string, DIVERSE\_METER::AbstractMeterPtr > **meterMap**

### 8.93.1 Detailed Description

The table class to index all meters.

#### Note

Default behavior

- create
- (optional) call [registerNewMeter](#) for new meter
- find a loader by [findMeter](#) using its tag

default tags

- espUart [EspMeterUart](#)
- intelMsr [IntelMeter](#)

### 8.93.2 Constructor & Destructor Documentation

#### 8.93.2.1 MeterTable()

```
DIVERSE_METER::MeterTable::MeterTable ( )
```

The constructing function.

#### Note

If new MatrixLoader wants to be included by default, please revise the following in \*.cpp  
revise me if you need new loader

### 8.93.3 Member Function Documentation

#### 8.93.3.1 findMeter()

```
DIVERSE_METER::AbstractMeterPtr DIVERSE_METER::MeterTable::findMeter (
    std::string name ) [inline]
```

find a meter in the table according to its name

## Parameters

<i>name</i>	The nameTag of loader
-------------	-----------------------

## Returns

The Meter, nullptr if not found

**8.93.3.2 registerNewMeter()**

```
void DIVERSE_METER::MeterTable::registerNewMeter (
    DIVERSE_METER::AbstractMeterPtr dnew,
    std::string tag ) [inline]
```

To register a new meter.

## Parameters

<i>onew</i>	The new operator
<i>tag</i>	The name tag

The documentation for this class was generated from the following files:

- include/Utils/Meters/MeterTable.h
- src/Utils/Meters/MeterTable.cpp

**8.94 INTELLI::MicroDataSet Class Reference**

The all-in-one class for the Micro dataset.

```
#include <Utils/MicroDataSet.hpp>
```

**Public Member Functions**

- [MicroDataSet](#) ()=default  
*default construction, with auto random generator*
- [MicroDataSet](#) (uint64\_t \_seed)  
*construction with seed*
- void [setSeed](#) (uint64\_t \_seed)  
*construction with seed*
- template<class dType = uint32\_t>  
vector< dType > [genIncrementalAlphabet](#) (size\_t len)  
*To generate incremental alphabet, starting from 0 and end at len.*
- template<class tsType = size\_t>  
vector< tsType > [genZipfInt](#) (size\_t len, tsType maxV, double fac)

*The function to generate a vector of integers which has zipf distribution.*

- `template<class tsType = uint32_t, class genType = std::mt19937>`  
`vector< tsType > genRandInt (size_t len, tsType maxV, tsType minV=0)`  
*generate the vector of random integer*
- `template<class dType = double>`  
`vector< dType > genZipfLut (size_t len, dType fac)`  
*To generate the zipf Lut.*
- `template<class tsType = size_t>`  
`vector< tsType > genSmoothTimeStamp (size_t len, size_t step, size_t interval)`  
*The function to generate a vector of timestamp which grows smoothly.*
- `template<class tsType = size_t>`  
`vector< tsType > genSmoothTimeStamp (size_t len, size_t maxTime)`
- `template<class tsType = size_t>`  
`vector< tsType > genZipfTimeStamp (size_t len, tsType maxTime, double fac)`  
*The function to generate a vector of timestamp which has zipf distribution.*

### 8.94.1 Detailed Description

The all-in-one class for the Micro dataset.

The documentation for this class was generated from the following file:

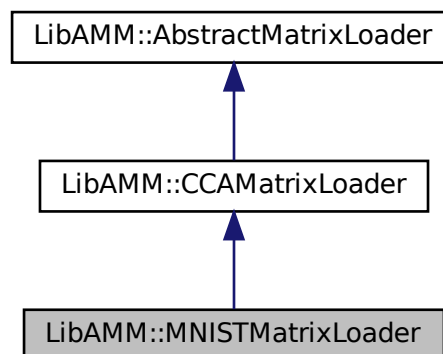
- `include/Utils/MicroDataSet.hpp`

## 8.95 LibAMM::MNISTMatrixLoader Class Reference

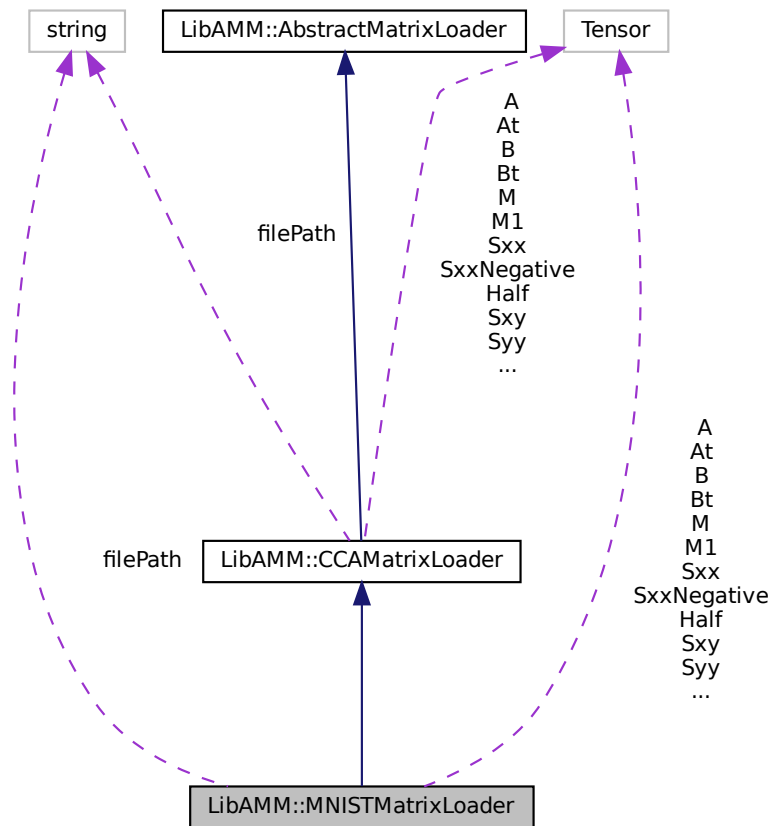
The MNIST class of matrix loader <https://www.kaggle.com/datasets/hojjatk/mnist-dataset>.

```
#include <MatrixLoader/MNISTMatrixLoader.h>
```

Inheritance diagram for LibAMM::MNISTMatrixLoader:



Collaboration diagram for LibAMM::MNISTMatrixLoader:



## Public Member Functions

- virtual bool [setConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual void [calculate\\_correlation](#) ()  
*Calculate the correlation by mm, and generate tensor Sxx, Sxy, Syy, M, correlation.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*
- virtual torch::Tensor [getAt](#) ()  
*get the transpose of A matrix*
- virtual torch::Tensor [getBt](#) ()  
*get the transpose of B matrix*
- virtual torch::Tensor [getSxx](#) ()  
*get the Sxx matrix*
- virtual torch::Tensor [getSyy](#) ()  
*get the Sxyymatrix*
- virtual torch::Tensor [getSxy](#) ()

- *get the Sxy matrix*
- virtual torch::Tensor [getSxxNegativeHalf](#) ()
- *get the SxxNegativeHalf matrix*
- virtual torch::Tensor [getSyyNegativeHalf](#) ()
- *get the SyyNegativeHalf matrix*
- virtual torch::Tensor [getM](#) ()
- $M = mm(mm(SxxNegativeHalf.t()), Sxy, SyyNegativeHalf)$
- virtual torch::Tensor [getM1](#) ()
- $M1 = mm(SxxNegativeHalf.t(), Sxy)$
- virtual torch::Tensor [getCorrelation](#) ()
- *get the correlation value*

## Protected Member Functions

- void [paraseConfig](#) (INTELLI::ConfigMapPtr cfg)
- *Inline logic of reading a config file.*
- void [generateAB](#) ()
- *inline logic of generating A and B*

## Protected Attributes

- std::string **filePath** ="datasets/SIFT/MNIST/train-images.idx3-ubyte"
- torch::Tensor **A**
- torch::Tensor **B**
- torch::Tensor **At**
- torch::Tensor **Bt**
- torch::Tensor **Sxx**
- torch::Tensor **Syy**
- torch::Tensor **Sxy**
- torch::Tensor **SxxNegativeHalf**
- torch::Tensor **SyyNegativeHalf**
- torch::Tensor **M**
- torch::Tensor **M1**
- torch::Tensor **correlation**

### 8.95.1 Detailed Description

The MNIST class of matrix loader <https://www.kaggle.com/datasets/hojjatk/mnist-dataset>.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: does not need config

: default name tags "MNIST": [MNISTMatrixLoader](#)

## 8.95.2 Member Function Documentation

### 8.95.2.1 `getA()`

```
torch::Tensor LibAMM::MNISTMatrixLoader::getA ( ) [virtual]
```

get the A matrix

#### Returns

the generated A matrix

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.95.2.2 `getAt()`

```
torch::Tensor LibAMM::MNISTMatrixLoader::getAt ( ) [virtual]
```

get the transpose of A matrix

#### Returns

the `A.t().contiguous()` matrix, which is not a view but has its own memory space

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.95.2.3 `getB()`

```
torch::Tensor LibAMM::MNISTMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::CCAMatrixLoader](#).

#### 8.95.2.4 getBt()

`torch::Tensor LibAMM::MNISTMatrixLoader::getBt ( ) [virtual]`

get the transpose of B matrix

##### Returns

the `B.t().contiguous()` matrix, which is not a view but has its own memory space

Reimplemented from [LibAMM::CCAMatrixLoader](#).

#### 8.95.2.5 getCorrelation()

`torch::Tensor LibAMM::MNISTMatrixLoader::getCorrelation ( ) [virtual]`

get the correlation value

##### Returns

the generated correlation by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

#### 8.95.2.6 getM()

`torch::Tensor LibAMM::MNISTMatrixLoader::getM ( ) [virtual]`

$M = \text{mm}(\text{mm}(\text{SxxNegativeHalf.t()}, \text{Sxy}), \text{SyyNegativeHalf})$

##### Returns

the generated M matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

#### 8.95.2.7 getM1()

`torch::Tensor LibAMM::MNISTMatrixLoader::getM1 ( ) [virtual]`

$M1 = \text{mm}(\text{SxxNegativeHalf.t()}, \text{Sxy})$

##### Returns

the generated M1 matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

#### 8.95.2.8 `getSxx()`

```
torch::Tensor LibAMM::MNISTMatrixLoader::getSxx ( ) [virtual]
```

get the Sxx matrix

##### Returns

the generated Sxx matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

#### 8.95.2.9 `getSxxNegativeHalf()`

```
torch::Tensor LibAMM::MNISTMatrixLoader::getSxxNegativeHalf ( ) [virtual]
```

get the SxxNegativeHalf matrix

##### Returns

the generated SxxNegativeHalf matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

#### 8.95.2.10 `getSxy()`

```
torch::Tensor LibAMM::MNISTMatrixLoader::getSxy ( ) [virtual]
```

get the Sxy matrix

##### Returns

the generated Sxy matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

#### 8.95.2.11 `getSyy()`

```
torch::Tensor LibAMM::MNISTMatrixLoader::getSyy ( ) [virtual]
```

get the Sxyymatrix

##### Returns

the generated Syy matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).



### 8.95.2.12 getSyyNegativeHalf()

```
torch::Tensor LibAMM::MNISTMatrixLoader::getSyyNegativeHalf ( ) [virtual]
```

get the SyyNegativeHalf matrix

#### Returns

the generated SyyNegativeHalf matrix by calling [calculate\\_correlation\(\)](#)

Reimplemented from [LibAMM::CCAMatrixLoader](#).

### 8.95.2.13 paraseConfig()

```
void LibAMM::MNISTMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

#### Parameters

<i>cfg</i>	the config
------------	------------

### 8.95.2.14 setConfig()

```
bool LibAMM::MNISTMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

#### Parameters

<i>cfg</i>	The config map
------------	----------------

#### Returns

bool whether the config is successfully set

#### Note

Reimplemented from [LibAMM::CCAMatrixLoader](#).

The documentation for this class was generated from the following files:

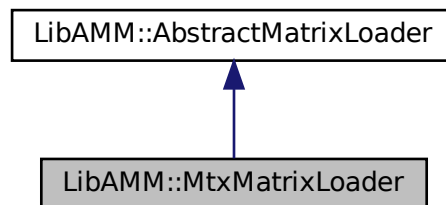
- include/MatrixLoader/MNISTMatrixLoader.h
- src/MatrixLoader/MNISTMatrixLoader.cpp

## 8.96 LibAMM::MtxMatrixLoader Class Reference

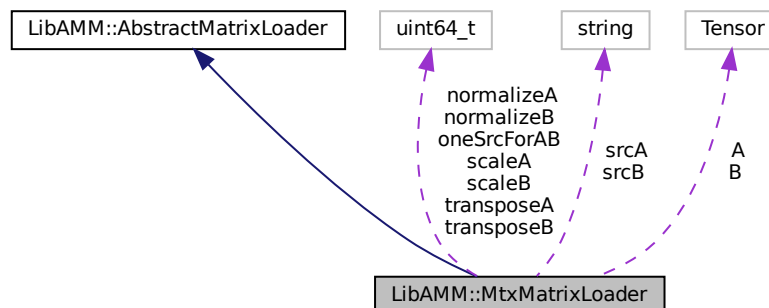
The matrix loader to load matrixes stored in matrix market mtx format.

```
#include <MatrixLoader/MtxMatrixLoader.h>
```

Inheritance diagram for LibAMM::MtxMatrixLoader:



Collaboration diagram for LibAMM::MtxMatrixLoader:



### Public Member Functions

- virtual bool [setConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual [torch::Tensor](#) [getA](#) ()  
*get the A matrix*
- virtual [torch::Tensor](#) [getB](#) ()  
*get the B matrix*

### Protected Member Functions

- void [parseConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- std::string **srcA**
- std::string **srcB**
- uint64\_t **oneSrcForAB**
- uint64\_t **transposeA**
- uint64\_t **transposeB**
- uint64\_t **normalizeA**
- uint64\_t **normalizeB**
- uint64\_t **scaleA**
- uint64\_t **scaleB**

### 8.96.1 Detailed Description

The matrix loader to load matrixes stored in matrix market mtx format.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: require config parameters and default values

- "srcA" The file source for A matrix, String, "datasets/ZENIOS/zenios.mtx"
- "oneSrcForAB", U64, whether A and B shares the same source file
- "srcB" The file source for B matrix, String, "datasets/ZENIOS/zenios.mtx"
- "transposeA" Whether or not transpose A matrix, U64, 0
- "transposeB" Whether or not transpose B matrix, U64, 1
- "normalizeA" Whether or not normalize A matrix (Normalization will force the minimum value to be -1) , U64, 0
- "normalizeB" Whether or not transpose B matrix, U64, 0
- "scaleA" Whether or not scale A matrix (scale will force the maximum value to be 1) , U64, 0 -

: do not normalize and scale at the same time

- "scaleB" Whether or not scale B matrix (scale will force the maximum value to be 1) , U64, 0

: default name tags "mtx": [MtxMatrixLoader](#)

### 8.96.2 Member Function Documentation

### 8.96.2.1 getA()

```
torch::Tensor LibAMM::MtxMatrixLoader::getA ( ) [virtual]
```

get the A matrix

#### Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.96.2.2 getB()

```
torch::Tensor LibAMM::MtxMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.96.2.3 paraseConfig()

```
void LibAMM::MtxMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

#### Parameters

<i>cfg</i>	the config
------------	------------

### 8.96.2.4 setConfig()

```
bool LibAMM::MtxMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

## Parameters

<code>cfg</code>	The config map
------------------	----------------

## Returns

bool whether the config is successfully set

## Note

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

- include/MatrixLoader/[MtxMatrixLoader.h](#)
- src/MatrixLoader/MtxMatrixLoader.cpp

## 8.97 BS::multi\_future< T > Class Template Reference

A helper class to facilitate waiting for and/or getting the results of multiple futures at once.

```
#include <BS_thread_pool.hpp>
```

### Public Member Functions

- [multi\\_future](#) (const size\_t num\_futures\_=0)  
*Construct a [multi\\_future](#) object with the given number of futures.*
- std::conditional\_t< std::is\_void\_v< T >, void, std::vector< T > > [get](#) ()  
*Get the results from all the futures stored in this [multi\\_future](#) object, rethrowing any stored exceptions.*
- std::future< T > & [operator\[\]](#) (const size\_t i)  
*Get a reference to one of the futures stored in this [multi\\_future](#) object.*
- void [push\\_back](#) (std::future< T > future)  
*Append a future to this [multi\\_future](#) object.*
- size\_t [size](#) () const  
*Get the number of futures stored in this [multi\\_future](#) object.*
- void [wait](#) () const  
*Wait for all the futures stored in this [multi\\_future](#) object.*

### 8.97.1 Detailed Description

```
template<typename T>
class BS::multi_future< T >
```

A helper class to facilitate waiting for and/or getting the results of multiple futures at once.

## Template Parameters

<i>T</i>	The return type of the futures.
----------	---------------------------------

## 8.97.2 Constructor & Destructor Documentation

### 8.97.2.1 multi\_future()

```
template<typename T >
BS::multi_future< T >::multi_future (
    const size_t num_futures_ = 0 ) [inline]
```

Construct a [multi\\_future](#) object with the given number of futures.

## Parameters

<i>num_↔ futures_</i>	The desired number of futures to store.
---------------------------	---

## 8.97.3 Member Function Documentation

### 8.97.3.1 get()

```
template<typename T >
std::conditional_t<std::is_void_v<T>, void, std::vector<T> > BS::multi_future< T >::get ( )
[inline]
```

Get the results from all the futures stored in this [multi\\_future](#) object, rethrowing any stored exceptions.

## Returns

If the futures return void, this function returns void as well. Otherwise, it returns a vector containing the results.

### 8.97.3.2 operator[]()

```
template<typename T >
std::future<T>& BS::multi_future< T >::operator[] (
    const size_t i ) [inline]
```

Get a reference to one of the futures stored in this [multi\\_future](#) object.

## Parameters

<i>i</i>	The index of the desired future.
----------	----------------------------------

## Returns

The future.

**8.97.3.3 push\_back()**

```
template<typename T >
void BS::multi_future< T >::push_back (
    std::future< T > future ) [inline]
```

Append a future to this [multi\\_future](#) object.

## Parameters

<i>future</i>	The future to append.
---------------	-----------------------

**8.97.3.4 size()**

```
template<typename T >
size_t BS::multi_future< T >::size ( ) const [inline]
```

Get the number of futures stored in this [multi\\_future](#) object.

## Returns

The number of futures.

The documentation for this class was generated from the following file:

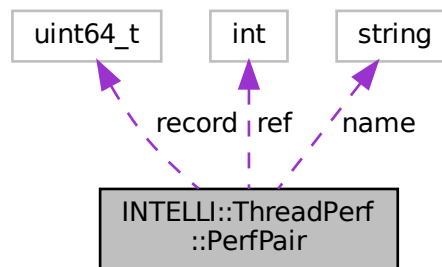
- [include/Utils/BS\\_thread\\_pool.hpp](#)

**8.98 INTELLI::ThreadPerf::PerfPair Class Reference**

a record pair of perf events

```
#include <Utils/ThreadPerf.hpp>
```

Collaboration diagram for INTELLI::ThreadPerf::PerfPair:



## Public Member Functions

- **PerfPair** (int \_ref, std::string \_name)

## Public Attributes

- int **ref**
- std::string **name**
- uint64\_t **record**

### 8.98.1 Detailed Description

a record pair of perf events

The documentation for this class was generated from the following file:

- include/Utils/[ThreadPerf.hpp](#)

## 8.99 INTELLI::ThreadPerf::PerfTool Class Reference

### Public Member Functions

- **PerfTool** (pid\_t pid, int cpu)
- uint64\_t **readPerf** (size\_t ch)
- int **startPerf** (size\_t ch)
- int **stopPerf** (size\_t ch)
- bool **isValidChannel** (size\_t ch)

The documentation for this class was generated from the following file:

- include/Utils/[ThreadPerf.hpp](#)

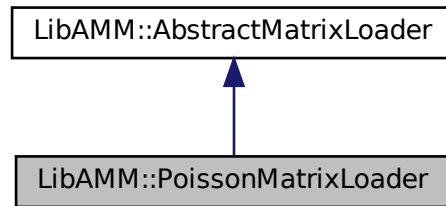


## 8.100 LibAMM::PoissonMatrixLoader Class Reference

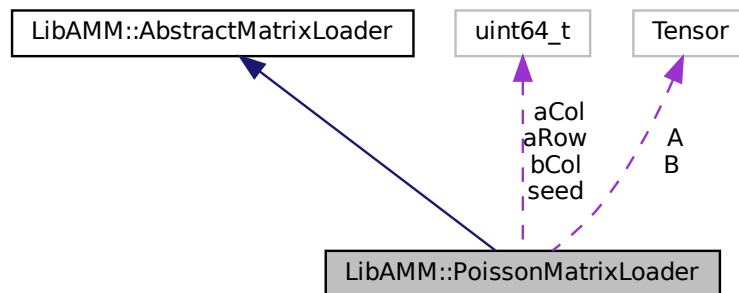
The Poisson class of matrix loader.

```
#include <MatrixLoader/PoissonMatrixLoader.h>
```

Inheritance diagram for LibAMM::PoissonMatrixLoader:



Collaboration diagram for LibAMM::PoissonMatrixLoader:



### Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
Set the GLOBAL config map related to this loader.
- virtual torch::Tensor [getA](#) ()  
get the A matrix
- virtual torch::Tensor [getB](#) ()  
get the B matrix

## Protected Member Functions

- void [paraseConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- uint64\_t **aRow**
- uint64\_t **aCol**
- uint64\_t **bCol**
- uint64\_t **seed**

### 8.100.1 Detailed Description

The Poisson class of matrix loader.

#### Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: require config parameters and default values

- "aRow" The rows in matrix A, U64, 100
- "aCol" The cols in matrix B, U64, 1000
- "bCol" The rows in matrix B, U64, 500
- "seed" The seed of inline random generator,U64,114514

: default name tags "random": [PoissonMatrixLoader](#)

### 8.100.2 Member Function Documentation

#### 8.100.2.1 [getA\(\)](#)

```
torch::Tensor LibAMM::PoissonMatrixLoader::getA ( ) [virtual]
```

get the A matrix

#### Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.100.2.2 getB()

```
torch::Tensor LibAMM::PoissonMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.100.2.3 paraseConfig()

```
void LibAMM::PoissonMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

#### Parameters

<i>cfg</i>	the config
------------	------------

### 8.100.2.4 setConfig()

```
bool LibAMM::PoissonMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

#### Parameters

<i>cfg</i>	The config map
------------	----------------

#### Returns

bool whether the config is successfully set

#### Note

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

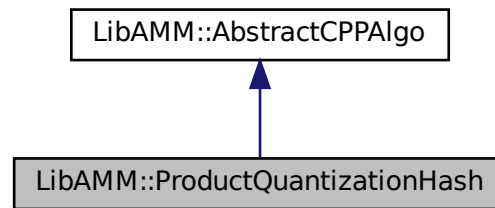
- include/MatrixLoader/PoissonMatrixLoader.h
- src/MatrixLoader/PoissonMatrixLoader.cpp

## 8.101 LibAMM::ProductQuantizationHash Class Reference

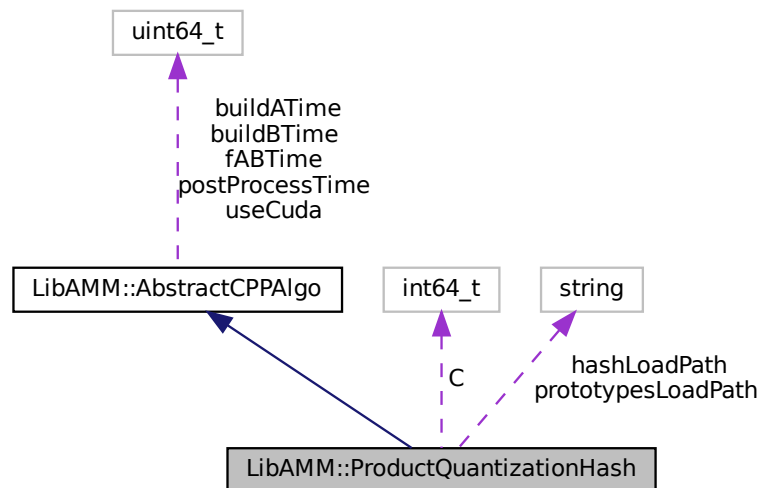
The Product Quantization AMM class of c++ algos, using hash function to find matching prototypes.

```
#include <CPPAlgos/ProductQuantizationHash.h>
```

Inheritance diagram for LibAMM::ProductQuantizationHash:



Collaboration diagram for LibAMM::ProductQuantizationHash:



### Public Member Functions

- virtual void [setConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*set the alo-specific config related to one algorithm*
- virtual [torch::Tensor amm](#) ([torch::Tensor](#) A, [torch::Tensor](#) B, [uint64\\_t](#) sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Protected Attributes

- string **prototypesLoadPath**
- string **hashLoadPath**
- int64\_t **C**

### 8.101.1 Detailed Description

The Product Quantization AMM class of c++ algos, using hash function to find matching prototypes.

++

### 8.101.2 Member Function Documentation

#### 8.101.2.1 amm()

```
torch::Tensor LibAMM::ProductQuantizationHash::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

#### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

#### 8.101.2.2 setConfig()

```
void LibAMM::ProductQuantizationHash::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

set the alo-specific config related to one algorithm

## Parameters

<i>prototypesLoadPath</i>	where to load prototypes
<i>hashLoadPath</i>	where to load hash

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

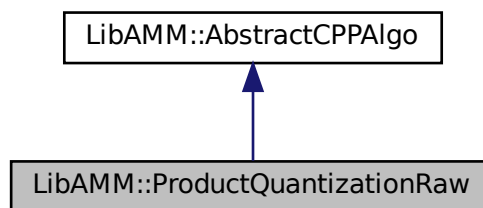
- include/CPPALgos/[ProductQuantizationHash.h](#)
- src/CPPALgos/ProductQuantizationHash.cpp

## 8.102 LibAMM::ProductQuantizationRaw Class Reference

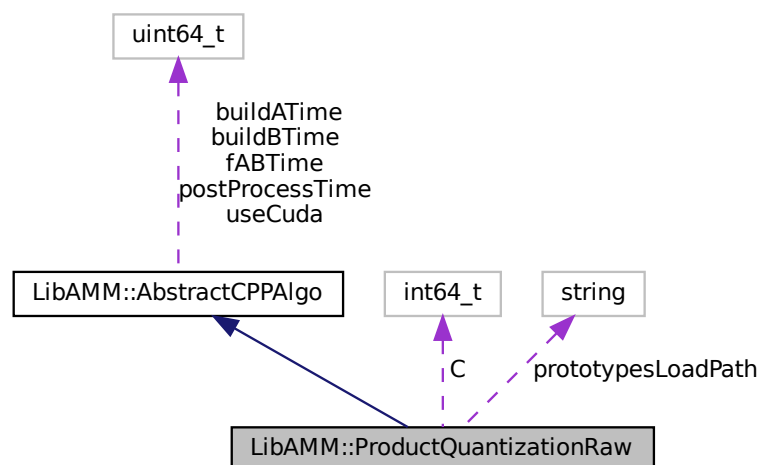
The Product Quantization AMM class of c++ algos, using Euclidean distance.

```
#include <CPPALgos/ProductQuantizationRaw.h>
```

Inheritance diagram for LibAMM::ProductQuantizationRaw:



Collaboration diagram for LibAMM::ProductQuantizationRaw:



## Public Member Functions

- virtual torch::Tensor [amm](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*
- virtual void [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*set the alo-specific config related to one algorithm*

## Protected Attributes

- string [prototypesLoadPath](#)
- int64\_t [C](#)

### 8.102.1 Detailed Description

The Product Quantization AMM class of c++ algos, using Euclidean distance.

++

### 8.102.2 Member Function Documentation

#### 8.102.2.1 amm()

```
torch::Tensor LibAMM::ProductQuantizationRaw::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

#### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

### 8.102.2.2 setConfig()

```
void LibAMM::ProductQuantizationRaw::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

set the algo-specific config related to one algorithm

#### Parameters

<i>prototypesLoadPath</i>	where to load prototypes
---------------------------	--------------------------

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

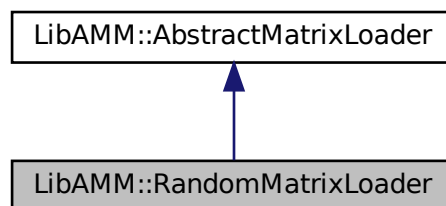
- include/CPPAlgos/[ProductQuantizationRaw.h](#)
- src/CPPAlgos/ProductQuantizationRaw.cpp

## 8.103 LibAMM::RandomMatrixLoader Class Reference

The Random class of matrix loader.

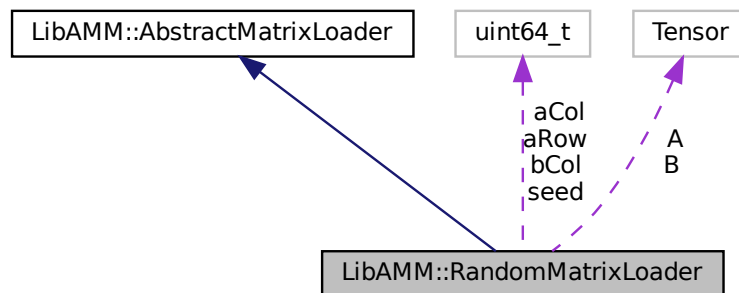
```
#include <MatrixLoader/RandomMatrixLoader.h>
```

Inheritance diagram for LibAMM::RandomMatrixLoader:





Collaboration diagram for LibAMM::RandomMatrixLoader:



## Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*

## Protected Member Functions

- void [parseConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- uint64\_t **aRow**
- uint64\_t **aCol**
- uint64\_t **bCol**
- uint64\_t **seed**

### 8.103.1 Detailed Description

The Random class of matrix loader.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: require config parameters and default values

- "aRow" The rows in matrix A, U64, 100
- "aCol" The cols in matrix B, U64, 1000
- "bCol" The rows in matrix B, U64, 500
- "seed" The seed of inline random generator,U64,114514

: default name tags "random": [RandomMatrixLoader](#)

### 8.103.2 Member Function Documentation

#### 8.103.2.1 getA()

```
torch::Tensor LibAMM::RandomMatrixLoader::getA ( ) [virtual]
```

get the A matrix

Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

#### 8.103.2.2 getB()

```
torch::Tensor LibAMM::RandomMatrixLoader::getB ( ) [virtual]
```

get the B matrix

Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

#### 8.103.2.3 paraseConfig()

```
void LibAMM::RandomMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

## Parameters

<i>cfg</i>	the config
------------	------------

## 8.103.2.4 setConfig()

```
bool LibAMM::RandomMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

## Note

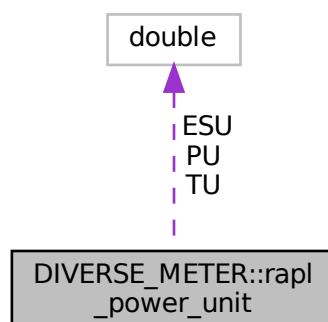
Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

- include/MatrixLoader/[RandomMatrixLoader.h](#)
- src/MatrixLoader/RandomMatrixLoader.cpp

## 8.104 DIVERSE\_METER::rapl\_power\_unit Struct Reference

Collaboration diagram for DIVERSE\_METER::rapl\_power\_unit:



## Public Attributes

- double **PU**
- double **ESU**
- double **TU**

The documentation for this struct was generated from the following file:

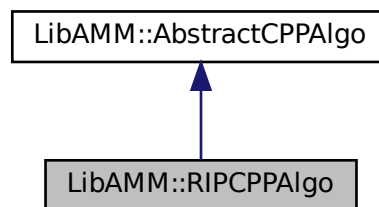
- include/Utils/Meters/IntelMeter/IntelMeter.hpp

## 8.105 LibAMM::RIPCPPAlgo Class Reference

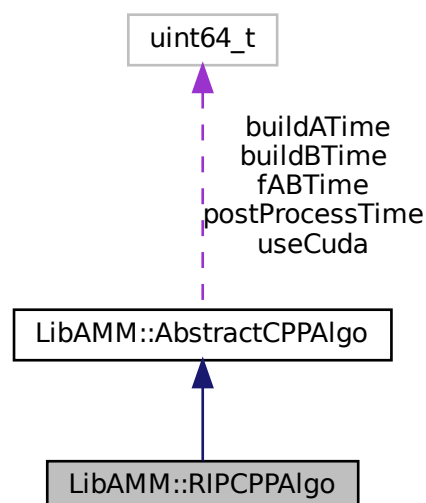
New and improved Johnson-Lindenstrauss embeddings via the Restricted Isometry Property.

```
#include <CPPAlgos/RIPCPPAlgo.h>
```

Inheritance diagram for LibAMM::RIPCPPAlgo:



Collaboration diagram for LibAMM::RIPCPPAlgo:



## Public Member Functions

- virtual torch::Tensor [amm](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.105.1 Detailed Description

New and improved Johnson-Lindenstrauss embeddings via the Restricted Isometry Property.

++

### 8.105.2 Member Function Documentation

#### 8.105.2.1 amm()

```
torch::Tensor LibAMM::RIPCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

#### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

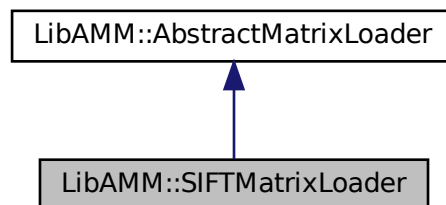
- include/CPPAlgos/[RIPCPPAlgo.h](#)
- src/CPPAlgos/RIPCPPAlgo.cpp

## 8.106 LibAMM::SIFTMatrixLoader Class Reference

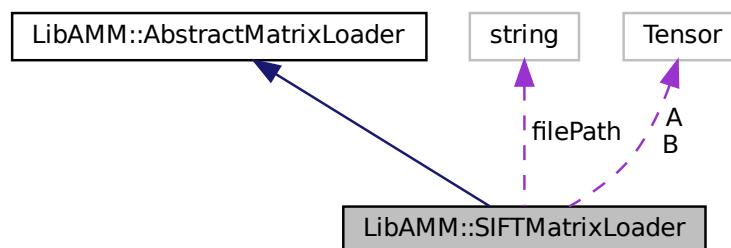
The SIFT class of matrix loader <http://corpus-texmex.irisa.fr/>.

```
#include <MatrixLoader/SIFTMatrixLoader.h>
```

Inheritance diagram for LibAMM::SIFTMatrixLoader:



Collaboration diagram for LibAMM::SIFTMatrixLoader:



### Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*

### Protected Member Functions

- void [parseConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- std::string **filePath** ="datasets/SIFT/siftsmall\_base.fvecs"

### 8.106.1 Detailed Description

The SIFT class of matrix loader <http://corpus-texmex.irisa.fr/>.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: does not need config

: default name tags "SIFT": [SIFTMatrixLoader](#)

### 8.106.2 Member Function Documentation

#### 8.106.2.1 getA()

```
torch::Tensor LibAMM::SIFTMatrixLoader::getA ( ) [virtual]
```

get the A matrix

Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

#### 8.106.2.2 getB()

```
torch::Tensor LibAMM::SIFTMatrixLoader::getB ( ) [virtual]
```

get the B matrix

Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

#### 8.106.2.3 paraseConfig()

```
void LibAMM::SIFTMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

## Parameters

<i>cfg</i>	the config
------------	------------

**8.106.2.4 setConfig()**

```
bool LibAMM::SIFTMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

## Note

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

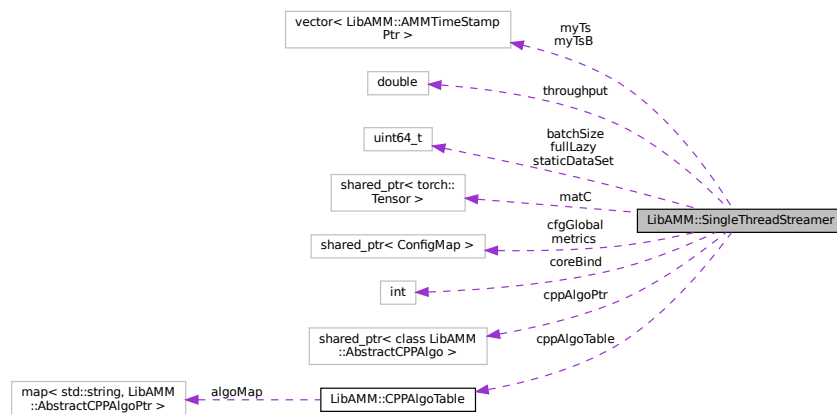
- include/MatrixLoader/SIFTMatrixLoader.h
- src/MatrixLoader/SIFTMatrixLoader.cpp

**8.107 LibAMM::SingleThreadStreamer Class Reference**

The class to run streaming amm under single thread, let each row of A coming in a streaming manner.

```
#include <Streaming/SingleThreadStreamer.h>
```

Collaboration diagram for LibAMM::SingleThreadStreamer:





## Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this TimerStamper.*
- virtual bool [prepareRun](#) (torch::Tensor A, torch::Tensor B)  
*create the time stamps and other datastructures for streaming rn*
- virtual torch::Tensor [streamingAmm](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize=1)  
*To run a streaming Amm, assuming the rows of A coming in a streaming manner and B is fixed.*
- virtual torch::Tensor [streamingAmm2S](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize=1)  
*To run a streaming Amm, assuming the rows of A coming in a streaming manner and the cols of B coming in a streaming manner.*
- double [getThroughput](#) ()  
*to get the throughput of last streaming process, the unit is rows/second*
- double [getLatencyPercentage](#) (double fraction)  
*to get the latency within some fraction, such as 0.95*
- INTELLI::ConfigMapPtr [getMetrics](#) ()  
*get metrics (including the pef result for all threads used in the runner, and elapsed time, throughput..)*

## Public Attributes

- std::vector< LibAMM::AMMTimeStampPtr > [myTs](#)  
*the timestamps to trace the streaming process*
- std::vector< LibAMM::AMMTimeStampPtr > [myTsB](#)  
*the additional timestamps to trace the streaming process, if B is also stream*

## Protected Attributes

- INTELLI::ConfigMapPtr [cfgGlobal](#)
- LibAMM::CPPAlgoTable [cppAlgoTable](#)
- uint64\_t [batchSize](#) = 1
- LibAMM::AbstractCPPAlgoPtr [cppAlgoPtr](#) = nullptr
- LibAMM::TensorPtr [matC](#) = nullptr
- double [throughput](#) = 0.0
- int [coreBind](#)
- INTELLI::ConfigMapPtr [metrics](#) = [newConfigMap\(\)](#)
- uint64\_t [fullLazy](#) = 0
- uint64\_t [staticDataSet](#) = 0

### 8.107.1 Detailed Description

The class to run streaming amm under single thread, let each row of A coming in a streaming manner.

#### Note

Default behavior

- create
- call [setConfig](#), this will also determine how to generate time stamp and config will be passed to [TimeStamper](#)
- run streaming amm:
  - call [streamingAmm](#), if only A matrix will be streamed
  - call [streamingAmm2S](#), if both A and B will be streamed
- call [getThroughput](#), and [getLatencyPercentage](#) to get the streaming performance

configs fullLazy U64, 0 whether or not make everything conducted under lazy mode, will force batchsize to the whole rows of A batchSize, U64, 1 staticDataSet, U64, 0 , whether or not treat a dataset as static

## 8.107.2 Member Function Documentation

### 8.107.2.1 getLatencyPercentage()

```
double LibAMM::SingleThreadStreamer::getLatencyPercentage (
    double fraction )
```

to get the latency within some fraction, such as 0.95

#### Parameters

<i>fraction</i>	the 0~1 fraction
-----------------	------------------

#### Returns

the latency in us

### 8.107.2.2 getMetrics()

```
INTELLI::ConfigMapPtr LibAMM::SingleThreadStreamer::getMetrics ( ) [inline]
```

get metrics (including the pef result for all threads used in the runner, and elapsed time, throughput..)

#### Returns

metrics ConfigMapPtr

### 8.107.2.3 getThroughput()

```
double LibAMM::SingleThreadStreamer::getThroughput ( ) [inline]
```

to get the throughput of last streaming process, the unit is rows/second

#### Returns

the throughput

### 8.107.2.4 prepareRun()

```
bool LibAMM::SingleThreadStreamer::prepareRun (
    torch::Tensor A,
    torch::Tensor B ) [virtual]
```

create the time stamps and other datastructures for streaming rn

## Parameters

<i>A</i>	
----------	--

## Returns

**8.107.2.5 setConfig()**

```
bool LibAMM::SingleThreadStreamer::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this TimerStamper.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

## 1.set the algo

1. set the batch size
2. load other configs

**8.107.2.6 streamingAmm()**

```
torch::Tensor LibAMM::SingleThreadStreamer::streamingAmm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize = 1 ) [virtual]
```

To run a streaming Amm, assuming the rows of A coming in a streaming manner and B is fixed.

## Parameters

<i>A</i>	The A matrix
<i>B</i>	The B matrix

**Returns**

bool whether the config is successfully set

now, the whole batch has arrived, compute

the new arrived A will be no longer probed, so we can assign the processed time now

update the indexes

**8.107.2.7 streamingAmm2S()**

```
torch::Tensor LibAMM::SingleThreadStreamer::streamingAmm2S (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize = 1 ) [virtual]
```

To run a streaming Amm, assuming the rows of A coming in a streaming manner and the cols of B coming in a streaming manner.

**Parameters**

<i>A</i>	The A matrix
<i>B</i>	The B matrix

**Returns**

bool whether the config is successfully set

now, the whole batch has arrived, compute

do the incomingA\*newArrivedB part

do the oldArrivedA\*incomingB part

update the indexes

The latency calculation is different from one stream case here, as older A will still be probed by newer B

The documentation for this class was generated from the following files:

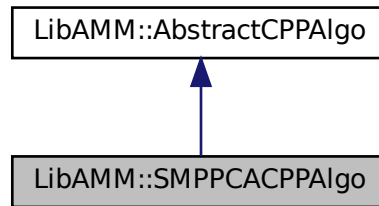
- include/Streaming/SingleThreadStreamer.h
- src/Streaming/SingleThreadStreamer.cpp

## 8.108 LibAMM::SMPPCACPPAlgo Class Reference

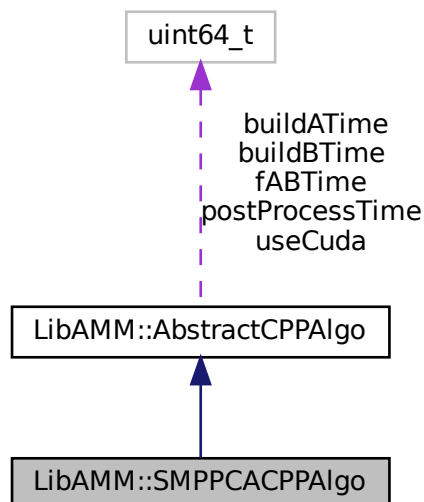
sketch scaled JL class of c++ algos

```
#include <CPPAlgos/SMPPCACPPAlgo.h>
```

Inheritance diagram for LibAMM::SMPPCACPPAlgo:



Collaboration diagram for LibAMM::SMPPCACPPAlgo:



### Public Member Functions

- virtual torch::Tensor **amm** (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.108.1 Detailed Description

sketch scaled JL class of c++ algos

++

### 8.108.2 Member Function Documentation

#### 8.108.2.1 amm()

```
torch::Tensor LibAMM::SMPPCACPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketch

#### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

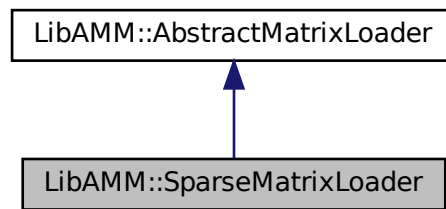
- include/CPPAlgos/[SMPPCACPPAlgo.h](#)
- src/CPPAlgos/SMPPCACPPAlgo.cpp

## 8.109 LibAMM::SparseMatrixLoader Class Reference

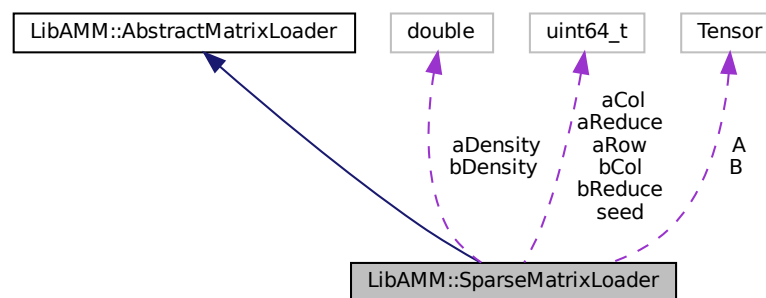
The matrix loader to generate adjustable sparse matrix with adjust rank reduction.

```
#include <MatrixLoader/SparseMatrixLoader.h>
```

Inheritance diagram for LibAMM::SparseMatrixLoader:



Collaboration diagram for LibAMM::SparseMatrixLoader:



## Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*

## Protected Member Functions

- torch::Tensor [genSparseMatrix](#) (uint64\_t m, uint64\_t n, double density, uint64\_t reduceRows)  
*Inline logic of generate the sparse matrix.*
- void [parseConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- uint64\_t **aRow**
- uint64\_t **aCol**
- uint64\_t **bCol**
- uint64\_t **seed**
- uint64\_t **aReduce**
- uint64\_t **bReduce**
- double **aDensity**
- double **bDensity**

### 8.109.1 Detailed Description

The matrix loader to generate adjustable sparse matrix with adjust rank reduction.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: require config parameters and default values

- "aRow" The rows in matrix A, U64, 100
- "aCol" The cols in matrix B, U64, 1000
- "bCol" The rows in matrix B, U64, 500
- "seed" The seed of inline Sparse generator, U64, 114514
- "aDensity" The density factor of matrix A, Double, 1.0
- "bDensity" The density factor of matrix B, Double, 1.0
- "aReduce" Reduce some rows of A to be linearly dependent, U64, 0
- "bReduce" Reduce some rows of A to be linearly dependent, U64, 0

: default name tags "sparse": [SparseMatrixLoader](#)

### 8.109.2 Member Function Documentation

#### 8.109.2.1 genSparseMatrix()

```
torch::Tensor LibAMM::SparseMatrixLoader::genSparseMatrix (
    uint64_t m,
    uint64_t n,
    double density,
    uint64_t reduceRows ) [protected]
```

Inline logic of generate the sparse matrix.



## Parameters

<i>m</i>	the rows
<i>n</i>	the cols
<i>density</i>	the density in 0~1
<i>reduceRows</i>	the number of rows to be reduced

1. gen random mat
2. make it sparse according to density
3. reduce rows

### 8.109.2.2 getA()

```
torch::Tensor LibAMM::SparseMatrixLoader::getA ( ) [virtual]
```

get the A matrix

## Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.109.2.3 getB()

```
torch::Tensor LibAMM::SparseMatrixLoader::getB ( ) [virtual]
```

get the B matrix

## Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.109.2.4 paraseConfig()

```
void LibAMM::SparseMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

## Parameters

<i>cfg</i>	the config
------------	------------

**8.109.2.5 setConfig()**

```
bool LibAMM::SparseMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

## Note

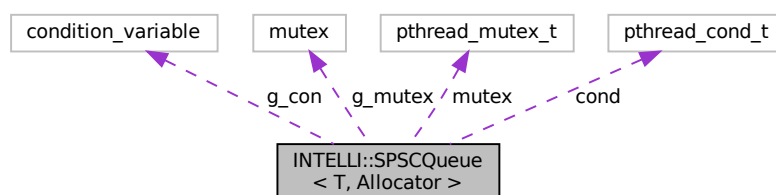
Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

- include/MatrixLoader/[SparseMatrixLoader.h](#)
- src/MatrixLoader/[SparseMatrixLoader.cpp](#)

**8.110 INTELLI::SPSCQueue< T, Allocator > Class Template Reference**

Collaboration diagram for INTELLI::SPSCQueue< T, Allocator >:



## Public Member Functions

- **SPSCQueue** (const size\_t capacity, const Allocator &allocator=Allocator())
- **SPSCQueue** (const **SPSCQueue** &)=delete
- **SPSCQueue** & **operator=** (const **SPSCQueue** &)=delete
- void **wakeUpSink** (void)
- void **waitForSource** (void)
- template<typename... Args>  
void **emplace** (Args &&...args) noexcept(std::is\_nothrow\_constructible< T, Args &&... >::value)
- template<typename... Args>  
bool **try\_emplace** (Args &&...args) noexcept(std::is\_nothrow\_constructible< T, Args &&... >::value)
- void **push** (const T &v) noexcept(std::is\_nothrow\_copy\_constructible< T >::value)
- template<typename P , typename = typename std::enable\_if< std::is\_constructible<T, P &&>::value>::type>  
void **push** (P &&v) noexcept(std::is\_nothrow\_constructible< T, P && >::value)
- bool **try\_push** (const T &v) noexcept(std::is\_nothrow\_copy\_constructible< T >::value)
- template<typename P , typename = typename std::enable\_if< std::is\_constructible<T, P &&>::value>::type>  
bool **try\_push** (P &&v) noexcept(std::is\_nothrow\_constructible< T, P && >::value)
- T \* **front** () noexcept
- void **pop** () noexcept
- size\_t **size** () const noexcept
- bool **empty** () const noexcept
- size\_t **capacity** () const noexcept

## Public Attributes

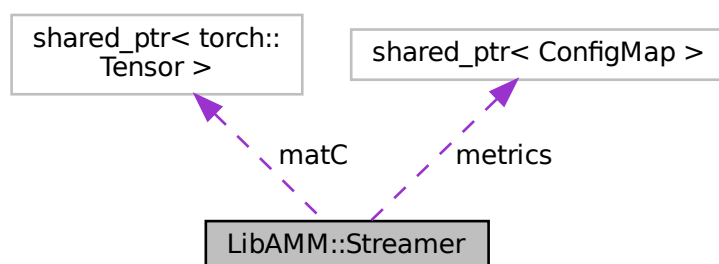
- pthread\_cond\_t **cond**
- pthread\_mutex\_t **mutex**
- std::mutex **g\_mutex**
- condition\_variable **g\_con**

The documentation for this class was generated from the following file:

- include/Utils/SPSCQueue.hpp

## 8.111 LibAMM::Streamer Class Reference

Collaboration diagram for LibAMM::Streamer:



## Public Member Functions

- torch::Tensor **run** (INTELLI::ConfigMapPtr cfg, torch::Tensor A, torch::Tensor B, uint64\_t sketchSize=1, string metricPrefix="")
- INTELLI::ConfigMapPtr **getMetrics** ()

## Protected Attributes

- LibAMM::TensorPtr **matC** = nullptr
- INTELLI::ConfigMapPtr **metrics**

### 8.111.1 Member Function Documentation

#### 8.111.1.1 getMetrics()

```
INTELLI::ConfigMapPtr LibAMM::Streamer::getMetrics ( ) [inline]
```

#### Returns

all the running metrics as a ConfigMap

The documentation for this class was generated from the following files:

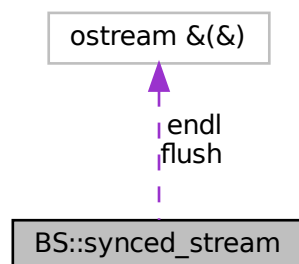
- include/Streaming/Streamer.h
- src/Streaming/Streamer.cpp

## 8.112 BS::synced\_stream Class Reference

A helper class to synchronize printing to an output stream by different threads.

```
#include <BS_thread_pool.hpp>
```

Collaboration diagram for BS::synced\_stream:



## Public Member Functions

- [synced\\_stream](#) (std::ostream &out\_stream\_=std::cout)  
Construct a new synced stream.
- template<typename... T>  
void [print](#) (T &&...items)  
Print any number of items into the output stream. Ensures that no other threads print to this stream simultaneously, as long as they all exclusively use the same [synced\\_stream](#) object to print.
- template<typename... T>  
void [println](#) (T &&...items)  
Print any number of items into the output stream, followed by a newline character. Ensures that no other threads print to this stream simultaneously, as long as they all exclusively use the same [synced\\_stream](#) object to print.

## Static Public Attributes

- static std::ostream &(&) [endl](#) (std::ostream &)  
A stream manipulator to pass to a [synced\\_stream](#) (an explicit cast of std::endl). Prints a newline character to the stream, and then flushes it. Should only be used if flushing is desired, otherwise ' ' should be used instead.
- static std::ostream &(&) [flush](#) (std::ostream &)  
A stream manipulator to pass to a [synced\\_stream](#) (an explicit cast of std::flush). Used to flush the stream.

### 8.112.1 Detailed Description

A helper class to synchronize printing to an output stream by different threads.

### 8.112.2 Constructor & Destructor Documentation

#### 8.112.2.1 synced\_stream()

```
BS::synced_stream::synced_stream (
    std::ostream & out_stream_ = std::cout ) [inline]
```

Construct a new synced stream.

#### Parameters

<i>out_↔ stream_</i>	The output stream to print to. The default value is std::cout.
--------------------------	--

### 8.112.3 Member Function Documentation

### 8.112.3.1 print()

```
template<typename... T>
void BS::synced_stream::print (
    T &&... items ) [inline]
```

Print any number of items into the output stream. Ensures that no other threads print to this stream simultaneously, as long as they all exclusively use the same [synced\\_stream](#) object to print.

#### Template Parameters

<i>T</i>	The types of the items
----------	------------------------

#### Parameters

<i>items</i>	The items to print.
--------------	---------------------

### 8.112.3.2 println()

```
template<typename... T>
void BS::synced_stream::println (
    T &&... items ) [inline]
```

Print any number of items into the output stream, followed by a newline character. Ensures that no other threads print to this stream simultaneously, as long as they all exclusively use the same [synced\\_stream](#) object to print.

#### Template Parameters

<i>T</i>	The types of the items
----------	------------------------

#### Parameters

<i>items</i>	The items to print.
--------------	---------------------

## 8.112.4 Member Data Documentation

### 8.112.4.1 endl

```
std::ostream& (&) BS::synced_stream::endl(std::ostream &) [inline], [static]
```

#### Initial value:

```
=
    static_cast<std::ostream &(&) (std::ostream &)>(std::endl)
```

A stream manipulator to pass to a [synced\\_stream](#) (an explicit cast of `std::endl`). Prints a newline character to the stream, and then flushes it. Should only be used if flushing is desired, otherwise `'` should be used instead.

#### 8.112.4.2 flush

```
std::ostream& (&) BS::synced_stream::flush(std::ostream &) [inline], [static]
```

##### Initial value:

```
=  
static_cast<std::ostream & (&) (std::ostream &)>(std::flush)
```

A stream manipulator to pass to a [synced\\_stream](#) (an explicit cast of `std::flush`). Used to flush the stream.

The documentation for this class was generated from the following file:

- [include/Utils/BS\\_thread\\_pool.hpp](#)

## 8.113 BS::thread\_pool Class Reference

A fast, lightweight, and easy-to-use C++17 thread pool class.

```
#include <BS_thread_pool.hpp>
```

### Public Member Functions

- [thread\\_pool](#) (const [concurrency\\_t](#) thread\_count\_=0)  
*Construct a new thread pool.*
- [~thread\\_pool](#) ()  
*Destruct the thread pool. Waits for all tasks to complete, then destroys all threads. Note that if the pool is paused, then any tasks still in the queue will never be executed.*
- [size\\_t get\\_tasks\\_queued](#) () const  
*Get the number of tasks currently waiting in the queue to be executed by the threads.*
- [size\\_t get\\_tasks\\_running](#) () const  
*Get the number of tasks currently being executed by the threads.*
- [size\\_t get\\_tasks\\_total](#) () const  
*Get the total number of unfinished tasks: either still in the queue, or running in a thread. Note that [get\\_tasks\\_total\(\)](#) == [get\\_tasks\\_queued\(\)](#) + [get\\_tasks\\_running\(\)](#).*
- [concurrency\\_t get\\_thread\\_count](#) () const  
*Get the number of threads in the pool.*
- [bool is\\_paused](#) () const  
*Check whether the pool is currently paused.*
- [template<typename F, typename T1, typename T2, typename T = std::common\\_type\\_t<T1, T2>, typename R = std::invoke\\_result\\_t<std::decay\\_t<F>, T, T>>](#)  
[multi\\_future](#)< R > [parallelize\\_loop](#) (const T1 first\_index, const T2 index\_after\_last, F &&loop, const [size\\_t](#) num\_blocks=0)  
*Parallelize a loop by automatically splitting it into blocks and submitting each block separately to the queue. Returns a [multi\\_future](#) object that contains the futures for all of the blocks.*

- `template<typename F, typename T, typename R = std::invoke_result_t<std::decay_t<F>, T, T>>>`  
`multi_future< R > parallelize_loop (const T index_after_last, F &&loop, const size_t num_blocks=0)`  
*Parallelize a loop by automatically splitting it into blocks and submitting each block separately to the queue. Returns a `multi_future` object that contains the futures for all of the blocks. This overload is used for the special case where the first index is 0.*
- `void pause ()`  
*Pause the pool. The workers will temporarily stop retrieving new tasks out of the queue, although any tasks already executed will keep running until they are finished.*
- `template<typename F, typename T1, typename T2, typename T = std::common_type_t<T1, T2>>>`  
`void push_loop (const T1 first_index, const T2 index_after_last, F &&loop, const size_t num_blocks=0)`  
*Parallelize a loop by automatically splitting it into blocks and submitting each block separately to the queue. Does not return a `multi_future`, so the user must use `wait_for_tasks()` or some other method to ensure that the loop finishes executing, otherwise bad things will happen.*
- `template<typename F, typename T >`  
`void push_loop (const T index_after_last, F &&loop, const size_t num_blocks=0)`  
*Parallelize a loop by automatically splitting it into blocks and submitting each block separately to the queue. Does not return a `multi_future`, so the user must use `wait_for_tasks()` or some other method to ensure that the loop finishes executing, otherwise bad things will happen. This overload is used for the special case where the first index is 0.*
- `template<typename F, typename... A>`  
`void push_task (F &&task, A &&...args)`  
*Push a function with zero or more arguments, but no return value, into the task queue. Does not return a future, so the user must use `wait_for_tasks()` or some other method to ensure that the task finishes executing, otherwise bad things will happen.*
- `void reset (const concurrency_t thread_count_=0)`  
*Reset the number of threads in the pool. Waits for all currently running tasks to be completed, then destroys all threads in the pool and creates a new thread pool with the new number of threads. Any tasks that were waiting in the queue before the pool was reset will then be executed by the new threads. If the pool was paused before resetting it, the new pool will be paused as well.*
- `template<typename F, typename... A, typename R = std::invoke_result_t<std::decay_t<F>, std::decay_t<A>...>>`  
`std::future< R > submit (F &&task, A &&...args)`  
*Submit a function with zero or more arguments into the task queue. If the function has a return value, get a future for the eventual returned value. If the function has no return value, get an `std::future<void>` which can be used to wait until the task finishes.*
- `void unpause ()`  
*Unpause the pool. The workers will resume retrieving new tasks out of the queue.*
- `void wait_for_tasks ()`  
*Wait for tasks to be completed. Normally, this function waits for all tasks, both those that are currently running in the threads and those that are still waiting in the queue. However, if the pool is paused, this function only waits for the currently running tasks (otherwise it would wait forever). Note: To wait for just one specific task, use `submit()` instead, and call the `wait()` member function of the generated future.*

### 8.113.1 Detailed Description

A fast, lightweight, and easy-to-use C++17 thread pool class.

### 8.113.2 Constructor & Destructor Documentation

#### 8.113.2.1 thread\_pool()

```
BS::thread_pool::thread_pool (
    const concurrency_t thread_count_ = 0 ) [inline]
```

Construct a new thread pool.



## Parameters

<i>thread_↵ count_</i>	The number of threads to use. The default value is the total number of hardware threads available, as reported by the implementation. This is usually determined by the number of cores in the CPU. If a core is hyperthreaded, it will count as two threads.
----------------------------	---

### 8.113.3 Member Function Documentation

#### 8.113.3.1 get\_tasks\_queued()

```
size_t BS::thread_pool::get_tasks_queued ( ) const [inline]
```

Get the number of tasks currently waiting in the queue to be executed by the threads.

## Returns

The number of queued tasks.

#### 8.113.3.2 get\_tasks\_running()

```
size_t BS::thread_pool::get_tasks_running ( ) const [inline]
```

Get the number of tasks currently being executed by the threads.

## Returns

The number of running tasks.

#### 8.113.3.3 get\_tasks\_total()

```
size_t BS::thread_pool::get_tasks_total ( ) const [inline]
```

Get the total number of unfinished tasks: either still in the queue, or running in a thread. Note that [get\\_tasks\\_total\(\)](#) == [get\\_tasks\\_queued\(\)](#) + [get\\_tasks\\_running\(\)](#).

## Returns

The total number of tasks.

#### 8.113.3.4 `get_thread_count()`

```
concurrency_t BS::thread_pool::get_thread_count ( ) const [inline]
```

Get the number of threads in the pool.

##### Returns

The number of threads.

#### 8.113.3.5 `is_paused()`

```
bool BS::thread_pool::is_paused ( ) const [inline]
```

Check whether the pool is currently paused.

##### Returns

true if the pool is paused, false if it is not paused.

#### 8.113.3.6 `parallelize_loop()` [1/2]

```
template<typename F , typename T , typename R = std::invoke_result_t<std::decay_t<F>, T, T>>
multi_future<R> BS::thread_pool::parallelize_loop (
    const T index_after_last,
    F && loop,
    const size_t num_blocks = 0 ) [inline]
```

Parallelize a loop by automatically splitting it into blocks and submitting each block separately to the queue. Returns a [multi\\_future](#) object that contains the futures for all of the blocks. This overload is used for the special case where the first index is 0.

##### Template Parameters

<i>F</i>	The type of the function to loop through.
<i>T</i>	The type of the loop indices. Should be a signed or unsigned integer.
<i>R</i>	The return value of the loop function F (can be void).

##### Parameters

<i>index_after_last</i>	The index after the last index in the loop. The loop will iterate from 0 to (index_after_last - 1) inclusive. In other words, it will be equivalent to "for (T i = 0; i < index_after_last; ++i)". Note that if index_after_last == 0, no blocks will be submitted.
<i>loop</i>	The function to loop through. Will be called once per block. Should take exactly two arguments: the first index in the block and the index after the last index in the block. loop(start, end) should typically involve a loop of the form "for (T i = start; i < end; ++i)".

## Parameters

<i>num_blocks</i>	The maximum number of blocks to split the loop into. The default is to use the number of threads in the pool.
-------------------	---

## Returns

A [multi\\_future](#) object that can be used to wait for all the blocks to finish. If the loop function returns a value, the [multi\\_future](#) object can also be used to obtain the values returned by each block.

## 8.113.3.7 parallelize\_loop() [2/2]

```
template<typename F , typename T1 , typename T2 , typename T = std::common_type_t<T1, T2>,
typename R = std::invoke_result_t<std::decay_t<F>, T, T>>
multi_future<R> BS::thread_pool::parallelize_loop (
    const T1 first_index,
    const T2 index_after_last,
    F && loop,
    const size_t num_blocks = 0 ) [inline]
```

Parallelize a loop by automatically splitting it into blocks and submitting each block separately to the queue. Returns a [multi\\_future](#) object that contains the futures for all of the blocks.

## Template Parameters

<i>F</i>	The type of the function to loop through.
<i>T1</i>	The type of the first index in the loop. Should be a signed or unsigned integer.
<i>T2</i>	The type of the index after the last index in the loop. Should be a signed or unsigned integer. If T1 is not the same as T2, a common type will be automatically inferred.
<i>T</i>	The common type of T1 and T2.
<i>R</i>	The return value of the loop function F (can be void).

## Parameters

<i>first_index</i>	The first index in the loop.
<i>index_after_last</i>	The index after the last index in the loop. The loop will iterate from <i>first_index</i> to ( <i>index_after_last</i> - 1) inclusive. In other words, it will be equivalent to "for (T i = <i>first_index</i> ; i < <i>index_after_last</i> ; ++i)". Note that if <i>index_after_last</i> == <i>first_index</i> , no blocks will be submitted.
<i>loop</i>	The function to loop through. Will be called once per block. Should take exactly two arguments: the first index in the block and the index after the last index in the block. <i>loop</i> (start, end) should typically involve a loop of the form "for (T i = start; i < end; ++i)".
<i>num_blocks</i>	The maximum number of blocks to split the loop into. The default is to use the number of threads in the pool.

## Returns

A [multi\\_future](#) object that can be used to wait for all the blocks to finish. If the loop function returns a value, the [multi\\_future](#) object can also be used to obtain the values returned by each block.

**8.113.3.8 push\_loop() [1/2]**

```
template<typename F , typename T >
void BS::thread_pool::push_loop (
    const T index_after_last,
    F && loop,
    const size_t num_blocks = 0 ) [inline]
```

Parallelize a loop by automatically splitting it into blocks and submitting each block separately to the queue. Does not return a [multi\\_future](#), so the user must use [wait\\_for\\_tasks\(\)](#) or some other method to ensure that the loop finishes executing, otherwise bad things will happen. This overload is used for the special case where the first index is 0.

**Template Parameters**

<i>F</i>	The type of the function to loop through.
<i>T</i>	The type of the loop indices. Should be a signed or unsigned integer.

**Parameters**

<i>index_after_last</i>	The index after the last index in the loop. The loop will iterate from 0 to (index_after_last - 1) inclusive. In other words, it will be equivalent to "for (T i = 0; i < index_after_last; ++i)". Note that if index_after_last == 0, no blocks will be submitted.
<i>loop</i>	The function to loop through. Will be called once per block. Should take exactly two arguments: the first index in the block and the index after the last index in the block. loop(start, end) should typically involve a loop of the form "for (T i = start; i < end; ++i)".
<i>num_blocks</i>	The maximum number of blocks to split the loop into. The default is to use the number of threads in the pool.

**8.113.3.9 push\_loop() [2/2]**

```
template<typename F , typename T1 , typename T2 , typename T = std::common_type_t<T1, T2>>
void BS::thread_pool::push_loop (
    const T1 first_index,
    const T2 index_after_last,
    F && loop,
    const size_t num_blocks = 0 ) [inline]
```

Parallelize a loop by automatically splitting it into blocks and submitting each block separately to the queue. Does not return a [multi\\_future](#), so the user must use [wait\\_for\\_tasks\(\)](#) or some other method to ensure that the loop finishes executing, otherwise bad things will happen.

**Template Parameters**

<i>F</i>	The type of the function to loop through.
<i>T1</i>	The type of the first index in the loop. Should be a signed or unsigned integer.
<i>T2</i>	The type of the index after the last index in the loop. Should be a signed or unsigned integer. If T1 is not the same as T2, a common type will be automatically inferred.
<i>T</i>	The common type of T1 and T2.

## Parameters

<i>first_index</i>	The first index in the loop.
<i>index_after_last</i>	The index after the last index in the loop. The loop will iterate from <i>first_index</i> to ( <i>index_after_last</i> - 1) inclusive. In other words, it will be equivalent to "for (T i = <i>first_index</i> ; i < <i>index_after_last</i> ; ++i)". Note that if <i>index_after_last</i> == <i>first_index</i> , no blocks will be submitted.
<i>loop</i>	The function to loop through. Will be called once per block. Should take exactly two arguments: the first index in the block and the index after the last index in the block. <i>loop</i> (start, end) should typically involve a loop of the form "for (T i = start; i < end; ++i)".
<i>num_blocks</i>	The maximum number of blocks to split the loop into. The default is to use the number of threads in the pool.

## 8.113.3.10 push\_task()

```
template<typename F , typename... A>
void BS::thread_pool::push_task (
    F && task,
    A &&... args ) [inline]
```

Push a function with zero or more arguments, but no return value, into the task queue. Does not return a future, so the user must use [wait\\_for\\_tasks\(\)](#) or some other method to ensure that the task finishes executing, otherwise bad things will happen.

## Template Parameters

<i>F</i>	The type of the function.
<i>A</i>	The types of the arguments.

## Parameters

<i>task</i>	The function to push.
<i>args</i>	The zero or more arguments to pass to the function. Note that if the task is a class member function, the first argument must be a pointer to the object, i.e. &object (or this), followed by the actual arguments.

## 8.113.3.11 reset()

```
void BS::thread_pool::reset (
    const concurrency_t thread_count_ = 0 ) [inline]
```

Reset the number of threads in the pool. Waits for all currently running tasks to be completed, then destroys all threads in the pool and creates a new thread pool with the new number of threads. Any tasks that were waiting in the queue before the pool was reset will then be executed by the new threads. If the pool was paused before resetting it, the new pool will be paused as well.

## Parameters

<i>thread_</i> ↵ <i>count_</i>	The number of threads to use. The default value is the total number of hardware threads available, as reported by the implementation. This is usually determined by the number of cores in the CPU. If a core is hyperthreaded, it will count as two threads.
-----------------------------------	---

**8.113.3.12 submit()**

```
template<typename F , typename... A, typename R = std::invoke_result_t<std::decay_t<F>,
std::decay_t<A>...>>
std::future<R> BS::thread_pool::submit (
    F && task,
    A &&... args ) [inline]
```

Submit a function with zero or more arguments into the task queue. If the function has a return value, get a future for the eventual returned value. If the function has no return value, get an `std::future<void>` which can be used to wait until the task finishes.

## Template Parameters

<i>F</i>	The type of the function.
<i>A</i>	The types of the zero or more arguments to pass to the function.
<i>R</i>	The return type of the function (can be void).

## Parameters

<i>task</i>	The function to submit.
<i>args</i>	The zero or more arguments to pass to the function. Note that if the task is a class member function, the first argument must be a pointer to the object, i.e. <code>&amp;object</code> (or <code>this</code> ), followed by the actual arguments.

## Returns

A future to be used later to wait for the function to finish executing and/or obtain its returned value if it has one.

The documentation for this class was generated from the following file:

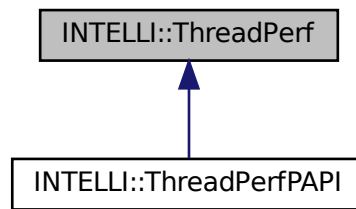
- [include/Utils/BS\\_thread\\_pool.hpp](#)

**8.114 INTELLI::ThreadPerf Class Reference**

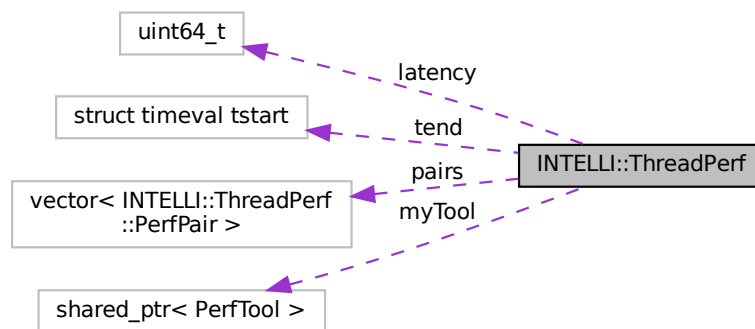
The top entity to provide perf traces, please use this class only UNLESS you know what you are doing.

```
#include <Utils/ThreadPerf.hpp>
```

Inheritance diagram for INTELLI::ThreadPerf:



Collaboration diagram for INTELLI::ThreadPerf:



## Classes

- class [PerfPair](#)  
*a record pair of perf events*
- class [PerfTool](#)

## Public Member Functions

- [ThreadPerf](#) (int cpu)  
*To setup this perf to specific cpu.*
- virtual void [setPerfList](#) ()  
*To set up all your interest perf events.*
- virtual void [start](#) ()  
*To start perf tracing.*
- virtual void [end](#) ()  
*To end a perf tracing.*

- virtual uint64\_t [getResultById](#) (size\_t idx)  
*Get the perf result by its index of [PerfPair](#).*
- virtual uint64\_t [getResultByName](#) (string name)  
*Get the perf result by its name of [PerfPair](#).*
- size\_t **timeLastUs** (struct timeval ts, struct timeval te)
- virtual [ConfigMapPtr](#) [resultToConfigMap](#) ()  
*convert the perf result into a [ConfigMap](#)*
- virtual void [initEventsByCfg](#) ([ConfigMapPtr](#) cfg)  
*init the perf events according to configmap*

## Protected Types

- typedef std::shared\_ptr< [PerfTool](#) > **PerfToolPtr**

## Protected Member Functions

- std::string [getChValueAsString](#) (size\_t idx)

## Protected Attributes

- PerfToolPtr **myTool**
- std::vector< [PerfPair](#) > [pairs](#)  
*To contain all of your interested perf events.*
- struct timeval tstart **tend**
- uint64\_t **latency**

### 8.114.1 Detailed Description

The top entity to provide perf traces, please use this class only UNLESS you know what you are doing.

#### Note

You may overwrite the setPerfList function for your own interested events

#### Warning

only works in Linux, and make sure you have opened perf in your kernel and have the access

#### Note

Requires the [ConfigMap](#) Util

General set up

- create the class
- call [setPerfList](#) or [initEventsByCfg](#), You may overwrite the setPerfList function in child classes for your own interested events
- call [start](#)
- run your own process
- call [end](#)
- get the results, by [getResultById](#), [getResultByName](#), or [resultToConfigMap](#)



## 8.114.2 Constructor & Destructor Documentation

### 8.114.2.1 ThreadPerf()

```
INTELLI::ThreadPerf::ThreadPerf (
    int cpu ) [inline]
```

To setup this perf to specific cpu.

#### Parameters

<i>cpu</i>	>=0 for any specific cpu, =-1 for all cpu that may run this process
------------	---

## 8.114.3 Member Function Documentation

### 8.114.3.1 getResultById()

```
virtual uint64_t INTELLI::ThreadPerf::getResultById (
    size_t idx ) [inline], [virtual]
```

Get the perf result by its index of [PerfPair](#).

#### Parameters

<i>idx</i>	The index
------------	-----------

#### Returns

The value

Reimplemented in [INTELLI::ThreadPerfPAPI](#).

### 8.114.3.2 getResultByName()

```
virtual uint64_t INTELLI::ThreadPerf::getResultByName (
    string name ) [inline], [virtual]
```

Get the perf result by its name of of [PerfPair](#).

**Parameters**

<i>idx</i>	The index
------------	-----------

**Returns**

The value

Reimplemented in [INTELLI::ThreadPerfPAPI](#).

**8.114.3.3 initEventsByCfg()**

```
virtual void INTELLI::ThreadPerf::initEventsByCfg (  
    ConfigMapPtr cfg ) [inline], [virtual]
```

init the perf events according to configmap

**Parameters**

<i>cfg</i>	tyhe configmap
------------	----------------

Reimplemented in [INTELLI::ThreadPerfPAPI](#).

**8.114.3.4 resultToConfigMap()**

```
virtual ConfigMapPtr INTELLI::ThreadPerf::resultToConfigMap ( ) [inline], [virtual]
```

convert the perf result into a [ConfigMap](#)

**Returns**

The key-value store of configMap, in shared pointer

**Note**

must stop after calling stop

Reimplemented in [INTELLI::ThreadPerfPAPI](#).

### 8.114.3.5 start()

```
virtual void INTELLI::ThreadPerf::start ( ) [inline], [virtual]
```

To start perf tracing.

#### Note

call after [setPerfList](#)

Reimplemented in [INTELLI::ThreadPerfPAPI](#).

The documentation for this class was generated from the following file:

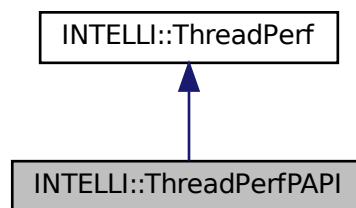
- [include/Utils/ThreadPerf.hpp](#)

## 8.115 INTELLI::ThreadPerfPAPI Class Reference

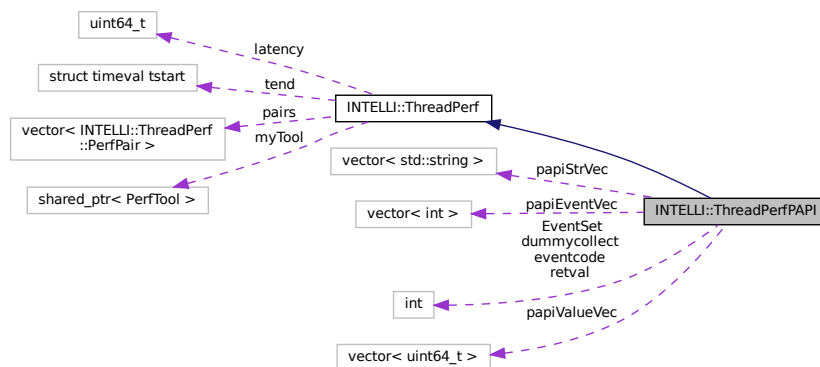
The top entity to provide perf traces by using PAPI lib.

```
#include <Utils/ThreadPerfPAPI.hpp>
```

Inheritance diagram for INTELLI::ThreadPerfPAPI:



Collaboration diagram for INTELLI::ThreadPerfPAPI:



## Public Member Functions

- [ThreadPerfPAPI](#) (int cpu)  
*To setup this perf to specific cpu.*
- void [addPapiTag](#) (std::string displayTag, int code)  
*to add a paipi event to be detected*
- void [addPapiTag](#) (std::string displayTag, std::string papiTag)  
*to add a paipi event to be detected*
- virtual void [setPerfList](#) ()  
*To set up all your interest perf events.*
- virtual void [start](#) ()  
*To start perf tracing.*
- virtual void [end](#) ()  
*To end a perf tracing.*
- virtual uint64\_t [getResultByld](#) (size\_t idx)  
*Get the perf result by its index of PerfPair.*
- virtual uint64\_t [getResultByName](#) (string name)  
*Get the perf result by its name of of PerfPair.*
- virtual [ConfigMapPtr](#) [resultToConfigMap](#) ()  
*convert the perf result into a ConfigMap*
- void [initEventsByCfg](#) ([ConfigMapPtr](#) cfg)  
*init the perf events according to configmap*

## Protected Member Functions

- void [initPapiLib](#) ()
- void [clearPapiLib](#) ()
- void [addPapiEventInline](#) (int ecode)

## Protected Attributes

- std::vector< std::string > [papiStrVec](#)
- std::vector< uint64\_t > [papiValueVec](#)
- std::vector< int > [papiEventVec](#)
- int [retval](#)
- int [EventSet](#) = PAPI\_NULL
- int [dummycollect](#) = 0
- int [eventcode](#)

## Additional Inherited Members

### 8.115.1 Detailed Description

The top entity to provide perf traces by using PAPI lib.

#### Note

You may overwrite the setPerfList function for your own interested events

**Warning**

only works in Linux, and make sure you have opened perf in your kernel and have the access

**Note**

Requires the [ConfigMap](#) Util  
require configs of perf

- perfInstructions, whether or not profile instructions, 1
- perfCycles, to record cpu cycles, 0
- perfMemRead, to record the memory read times, 0
- perfMemWrite, to record the memory write times, 0

General set up

- create the class
- call [initEventsByCfg](#), You may overwrite it function in child classes for your own interested events
- call [start](#)
- run your own process
- call [end](#)
- get the results, by [getResultById](#), [getResultByName](#), or [resultToConfigMap](#)

**8.115.2 Constructor & Destructor Documentation****8.115.2.1 ThreadPerfPAPI()**

```
INTELLI::ThreadPerfPAPI::ThreadPerfPAPI (
    int cpu ) [inline]
```

To setup this perf to specific cpu.

**Parameters**

<i>cpu</i>	>=0 for any specific cpu, =-1 for all cpu that may run this process
------------	---

**8.115.3 Member Function Documentation****8.115.3.1 addPapiTag() [1/2]**

```
void INTELLI::ThreadPerfPAPI::addPapiTag (
    std::string displayTag,
    int code ) [inline]
```

to add a paipi event to be detected

## Parameters

<i>displayTag</i>	the tag to be displayed in your results
<i>code</i>	the papi lib event code

**8.115.3.2 addPapiTag()** [2/2]

```
void INTELLI::ThreadPerfPAPI::addPapiTag (
    std::string displayTag,
    std::string papiTag ) [inline]
```

to add a paipi event to be detected

## Parameters

<i>displayTag</i>	the tag to be displayed in your results
<i>papiTag</i>	the built-in tag of papi lib

**8.115.3.3 getResultById()**

```
virtual uint64_t INTELLI::ThreadPerfPAPI::getResultById (
    size_t idx ) [inline], [virtual]
```

Get the perf result by its index of PerfPair.

## Parameters

<i>idx</i>	The index
------------	-----------

## Returns

The value

Reimplemented from [INTELLI::ThreadPerf](#).

**8.115.3.4 getResultByName()**

```
virtual uint64_t INTELLI::ThreadPerfPAPI::getResultByName (
    string name ) [inline], [virtual]
```

Get the perf result by its name of of PerfPair.

#### Parameters

<i>idx</i>	The index
------------	-----------

#### Returns

The value

Reimplemented from [INTELLI::ThreadPerf](#).

### 8.115.3.5 initEventsByCfg()

```
void INTELLI::ThreadPerfPAPI::initEventsByCfg (
    ConfigMapPtr cfg ) [inline], [virtual]
```

init the perf events according to configmap

#### Parameters

<i>cfg</i>	tyhe configmap
------------	----------------

Reimplemented from [INTELLI::ThreadPerf](#).

### 8.115.3.6 resultToConfigMap()

```
virtual ConfigMapPtr INTELLI::ThreadPerfPAPI::resultToConfigMap ( ) [inline], [virtual]
```

convert the perf result into a [ConfigMap](#)

#### Returns

The key-value store of configMap, in shared pointer

#### Note

must stop after calling stop

Reimplemented from [INTELLI::ThreadPerf](#).

### 8.115.3.7 start()

```
virtual void INTELLI::ThreadPerfPAPI::start ( ) [inline], [virtual]
```

To start perf tracing.

#### Note

call after [setPerfList](#)

Reimplemented from [INTELLI::ThreadPerf](#).

The documentation for this class was generated from the following file:

- [include/Utils/ThreadPerfPAPI.hpp](#)

## 8.116 BS::timer Class Reference

A helper class to measure execution time for benchmarking purposes.

```
#include <BS_thread_pool.hpp>
```

### Public Member Functions

- void [start](#) ()  
*Start (or restart) measuring time.*
- void [stop](#) ()  
*Stop measuring time and store the elapsed time since [start\(\)](#).*
- std::chrono::milliseconds::rep [ms](#) () const  
*Get the number of milliseconds that have elapsed between [start\(\)](#) and [stop\(\)](#).*

### 8.116.1 Detailed Description

A helper class to measure execution time for benchmarking purposes.

### 8.116.2 Member Function Documentation

#### 8.116.2.1 ms()

```
std::chrono::milliseconds::rep BS::timer::ms ( ) const [inline]
```

Get the number of milliseconds that have elapsed between [start\(\)](#) and [stop\(\)](#).

#### Returns

The number of milliseconds.

The documentation for this class was generated from the following file:

- [include/Utils/BS\\_thread\\_pool.hpp](#)

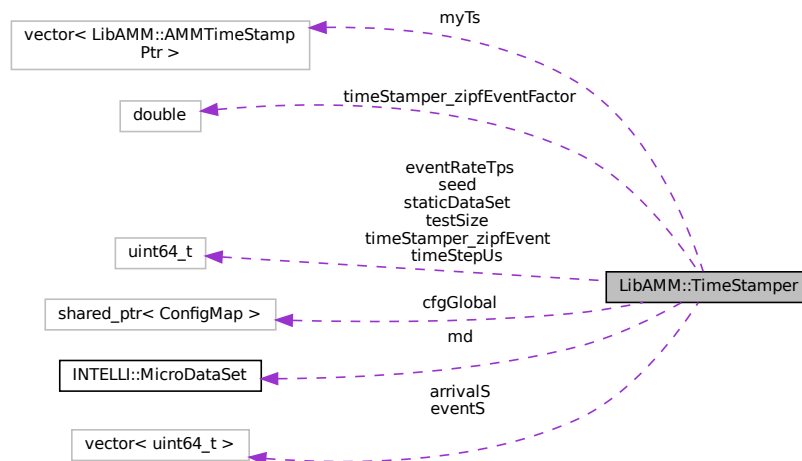


## 8.117 LibAMM::TimeStamper Class Reference

The basic class to generate time stamps.

```
#include <Streaming/TimeStamper.h>
```

Collaboration diagram for LibAMM::TimeStamper:



### Public Member Functions

- void [setSeed](#) (uint64\_t \_seed)  
*to set the seed of this timerstamper*
- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this TimerStamper.*
- virtual std::vector< LibAMM::AMMTimeStampPtr > [getTimeStamps](#) ()  
*get the vector of R tuple*

### Public Attributes

- std::vector< LibAMM::AMMTimeStampPtr > **myTs**

### Protected Member Functions

- void [generateEvent](#) ()  
*generate the vector of event*
- void [generateArrival](#) ()  
*generate the vector of arrival*
- void [generateFinal](#) ()  
*generate the final result of s and r*
- std::vector< LibAMM::AMMTimeStampPtr > **constructTimeStamps** (std::vector< uint64\_t > eventS, std::vector< uint64\_t > arrivalS)

## Protected Attributes

- [INTELLI::ConfigMapPtr](#) **cfgGlobal**
- [INTELLI::MicroDataSet](#) **md**
- `uint64_t` **timeStamper\_zipfEvent** = 0
- `double` **timeStamper\_zipfEventFactor** = 0
- `uint64_t` **testSize**
- `std::vector< uint64_t >` **eventS**
- `std::vector< uint64_t >` **arrivalS**
- `uint64_t` **eventRateTps** = 0
- `uint64_t` **timeStepUs** = 40
- `uint64_t` **seed** = 114514
- `uint64_t` **staticDataSet** = 0

### 8.117.1 Detailed Description

The basic class to generate time stamps.

#### Note

require configs:

- `eventRateTps` U64 The real-world rate of spawn event, in Tuples/s
- `streamingTupleCnt` U64 The number of "streaming tuples", can be set to the #rows or #cols of a matrix
- `timeStamper_zipfEvent`, U64, whether or not using the zipf for event rate, default 0
- `timeStamper_zipfEventFactor`, Double, the zipf factor for event rate, default 0.1, should be 0~1
- `staticDataSet`, U64, 0 , whether or not treat a dataset as static

Default behavior

- `create`
- call `setSeed` if you want different seed, default seed is 114514
- call [setConfig](#) to generate the timestamp under instructions
- call [getTimeStamps](#) to get the timestamp

### 8.117.2 Member Function Documentation

#### 8.117.2.1 generateArrival()

```
void LibAMM::TimeStamper::generateArrival ( ) [protected]
```

generate the vector of arrival

#### Note

As we do not consider OoO now, this is a dummy function

### 8.117.2.2 getTimeStamps()

```
virtual std::vector<LibAMM::AMMTimeStampPtr> LibAMM::TimeStamper::getTimeStamps ( ) [inline],
[virtual]
```

get the vector of R tuple

#### Returns

the vector

### 8.117.2.3 setConfig()

```
bool LibAMM::TimeStamper::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this TimerStamper.

#### Parameters

<i>cfg</i>	The config map
------------	----------------

#### Returns

bool whether the config is successfully set

### 8.117.2.4 setSeed()

```
void LibAMM::TimeStamper::setSeed (
    uint64_t _seed ) [inline]
```

to set the seed of this timestamer

#### Parameters

<i>_seed</i>	
--------------	--

The documentation for this class was generated from the following files:

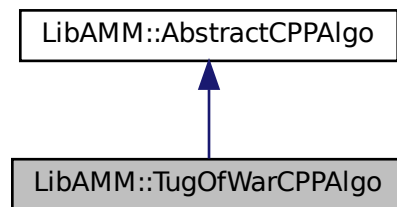
- include/Streaming/TimeStamper.h
- src/Streaming/TimeStamper.cpp

## 8.118 LibAMM::TugOfWarCPPAlgo Class Reference

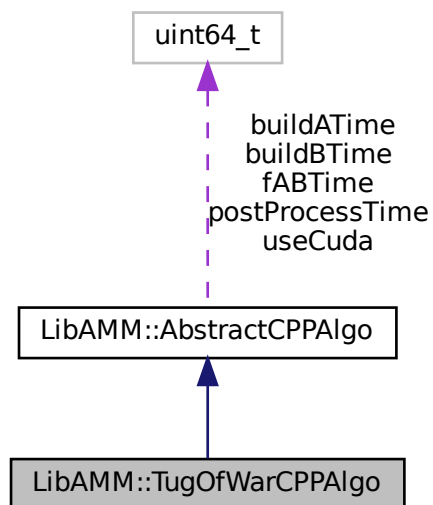
The tug of war class of c++ algoS.

```
#include <CPPAlgos/TugOfWarCPPAlgo.h>
```

Inheritance diagram for LibAMM::TugOfWarCPPAlgo:



Collaboration diagram for LibAMM::TugOfWarCPPAlgo:



## Public Member Functions

- virtual void `setConfig` (`INTELLI::ConfigMapPtr` cfg)  
*set the algo-specific config related to one algorithm*
- virtual `torch::Tensor amm` (`torch::Tensor` A, `torch::Tensor` B, `uint64_t` sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*

## Additional Inherited Members

### 8.118.1 Detailed Description

The tug of war class of c++ algoS.

++

#### Note

parameters

- algoDelta Double, the delta parameter in this algo, default 0.02

### 8.118.2 Member Function Documentation

#### 8.118.2.1 amm()

```
torch::Tensor LibAMM::TugOfWarCPPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

#### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

- include/CPPAlgos/[TugOfWarCPPAlgo.h](#)
- src/CPPAlgos/TugOfWarCPPAlgo.cpp

## 8.119 INTELLI::UtilityFunctions Class Reference

### Static Public Member Functions

- static size\_t **timeLast** (struct timeval past, struct timeval now)

- static size\_t **timeLastUs** (struct timeval past)
- static int **bind2Core** (int id)
- static std::vector< size\_t > **avgPartitionSizeFinal** (size\_t inS, std::vector< size\_t > partitionWeight)
- static std::vector< size\_t > **weightedPartitionSizeFinal** (size\_t inS, std::vector< size\_t > partitionWeight)
- static size\_t **to\_periodical** (size\_t val, size\_t period)
- static double **relativeFrobeniusNorm** (torch::Tensor A, torch::Tensor B)
- static double **errorBoundRatio** (torch::Tensor A, torch::Tensor B)

### 8.119.1 Member Function Documentation

#### 8.119.1.1 bind2Core()

```
int INTELLI::UtilityFunctions::bind2Core (
    int id ) [static]
```

bind to CPU

- bind the thread to core according to id

##### Parameters

<i>id</i>	the core you plan to bind, -1 means let os decide
-----------	---

##### Returns

cpuld, the real core that bind to

**Todo** unsure about hyper-thread

fixed some core bind bugs

The documentation for this class was generated from the following files:

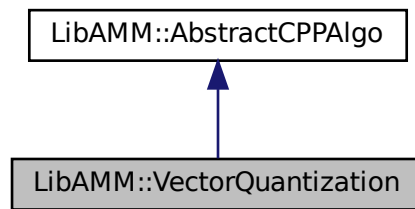
- include/Utils/UtilityFunctions.h
- src/Utils/UtilityFunctions.cpp

## 8.120 LibAMM::VectorQuantization Class Reference

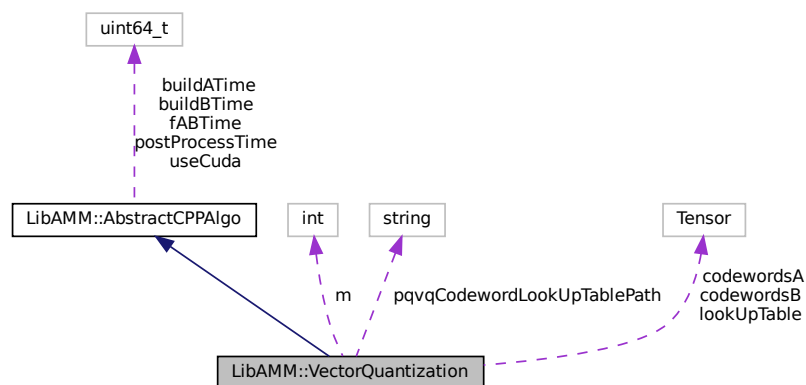
The Vector Quantization AMM class of c++ algos.

```
#include <CPPAlgos/VectorQuantization.h>
```

Inheritance diagram for LibAMM::VectorQuantization:



Collaboration diagram for LibAMM::VectorQuantization:



## Public Member Functions

- virtual torch::Tensor **amm** (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
*the virtual function provided for outside callers, rewrite in children classes*
- virtual void **setConfig** (INTELLI::ConfigMapPtr cfg)  
*set the alo-specific config related to one algorithm*

## Protected Attributes

- string **pqvqCodewordLookUpTablePath**
- int **m**
- torch::Tensor **codewordsA**
- torch::Tensor **codewordsB**
- torch::Tensor **lookUpTable**

### 8.120.1 Detailed Description

The Vector Quantization AMM class of c++ algos.

++

### 8.120.2 Member Function Documentation

#### 8.120.2.1 amm()

```
torch::Tensor LibAMM::VectorQuantization::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

##### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

##### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

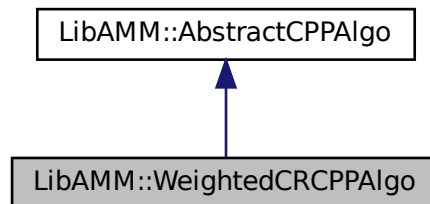
The documentation for this class was generated from the following files:

- include/CPPAlgos/VectorQuantization.h
- src/CPPAlgos/VectorQuantization.cpp

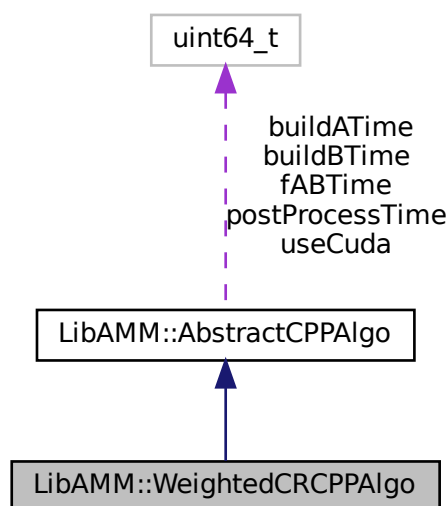


## 8.121 LibAMM::WeightedCRCPAlgo Class Reference

Inheritance diagram for LibAMM::WeightedCRCPAlgo:



Collaboration diagram for LibAMM::WeightedCRCPAlgo:



### Public Member Functions

- virtual torch::Tensor [amm](#) (torch::Tensor A, torch::Tensor B, uint64\_t sketchSize)  
the virtual function provided for outside callers, rewrite in children classes

### Additional Inherited Members

#### 8.121.1 Member Function Documentation

### 8.121.1.1 amm()

```
torch::Tensor LibAMM::WeightedCRCPAlgo::amm (
    torch::Tensor A,
    torch::Tensor B,
    uint64_t sketchSize ) [virtual]
```

the virtual function provided for outside callers, rewrite in children classes

#### Parameters

<i>A</i>	the A matrix
<i>B</i>	the B matrix
<i>sketchSize</i>	the size of sketc or sampling

#### Returns

the output c matrix

Reimplemented from [LibAMM::AbstractCPPAlgo](#).

The documentation for this class was generated from the following files:

- include/CPPAlgos/[WeightedCRCPAlgo.h](#)
- src/CPPAlgos/WeightedCRCPAlgo.cpp

## 8.122 WeightedCRCPPlgo Class Reference

The weighted cloumn row sampling class of c++ algos.

```
#include <CPPAlgos/WeightedCRCPAlgo.h>
```

### 8.122.1 Detailed Description

The weighted cloumn row sampling class of c++ algos.

```
++
```

The documentation for this class was generated from the following file:

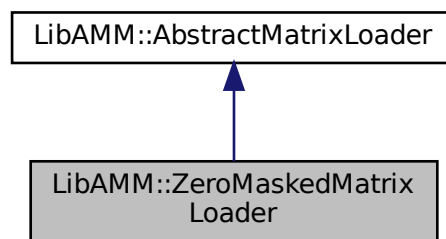
- include/CPPAlgos/[WeightedCRCPAlgo.h](#)

## 8.123 LibAMM::ZeroMaskedMatrixLoader Class Reference

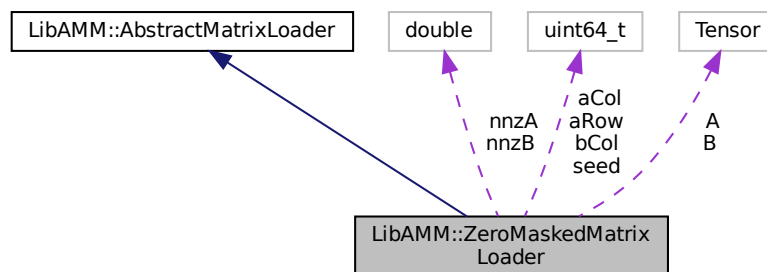
The zero masked class of matrix loader, given generate a  $n \times m$  matrix, where only the left-top  $n_1 \times m_2$  contents are not zero.

```
#include <MatrixLoader/ZeroMaskedMatrixLoader.h>
```

Inheritance diagram for LibAMM::ZeroMaskedMatrixLoader:



Collaboration diagram for LibAMM::ZeroMaskedMatrixLoader:



### Public Member Functions

- virtual bool [setConfig](#) (INTELLI::ConfigMapPtr cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*

## Protected Member Functions

- void [paraseConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- uint64\_t **aRow**
- uint64\_t **aCol**
- uint64\_t **bCol**
- uint64\_t **seed**
- double **nnzA**
- double **nnzB**

### 8.123.1 Detailed Description

The zero masked class of matrix loader, given generate a n\*m matrix, where only the left-top n1\*m2 contents are not zero.

#### Note

:

- Must have a global config by [setConfig](#)

#### Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: require config parameters and default values

- "aRow" The rows in matrix A, U64, 100
- "aCol" The cols in matrix B, U64, 1000
- "bCol" The rows in matrix B, U64, 500
- "seed" The seed of inline random generator,U64,114514
- "nnzA" the ratio of nnz values in matrix A, Double, 1.0
- "nnzB" the ratio of nnz values in matrix B, Double, 1.0

: default name tags "zeroMasked": [ZeroMaskedMatrixLoader](#)

### 8.123.2 Member Function Documentation

### 8.123.2.1 getA()

```
torch::Tensor LibAMM::ZeroMaskedMatrixLoader::getA ( ) [virtual]
```

get the A matrix

#### Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.123.2.2 getB()

```
torch::Tensor LibAMM::ZeroMaskedMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.123.2.3 paraseConfig()

```
void LibAMM::ZeroMaskedMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

#### Parameters

<i>cfg</i>	the config
------------	------------

### 8.123.2.4 setConfig()

```
bool LibAMM::ZeroMaskedMatrixLoader::setConfig (
    INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

## Parameters

<i>cfg</i>	The config map
------------	----------------

## Returns

bool whether the config is successfully set

## Note

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

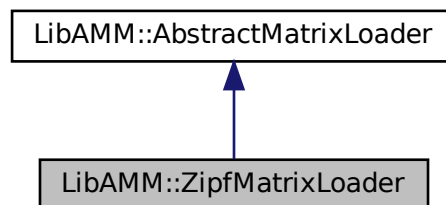
- include/MatrixLoader/[ZeroMaskedMatrixLoader.h](#)
- src/MatrixLoader/ZeroMaskedMatrixLoader.cpp

## 8.124 LibAMM::ZipfMatrixLoader Class Reference

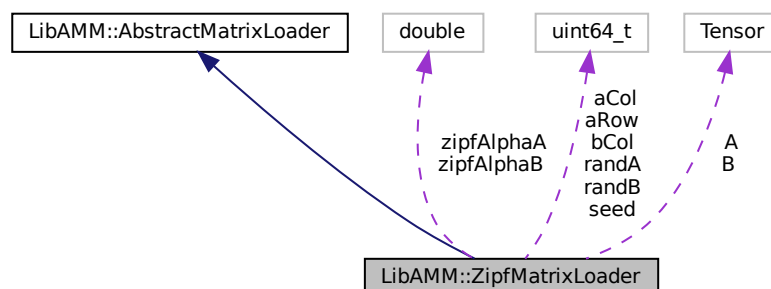
The Zipf class of matrix loader.

```
#include <MatrixLoader/ZipfMatrixLoader.h>
```

Inheritance diagram for LibAMM::ZipfMatrixLoader:



Collaboration diagram for LibAMM::ZipfMatrixLoader:



## Public Member Functions

- virtual bool [setConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Set the GLOBAL config map related to this loader.*
- virtual torch::Tensor [getA](#) ()  
*get the A matrix*
- virtual torch::Tensor [getB](#) ()  
*get the B matrix*

## Protected Member Functions

- void [parseConfig](#) ([INTELLI::ConfigMapPtr](#) cfg)  
*Inline logic of reading a config file.*
- void [generateAB](#) ()  
*inline logic of generating A and B*
- torch::Tensor [generateZipfDistribution](#) (int64\_t rows, int64\_t cols, double alpha)

## Protected Attributes

- torch::Tensor **A**
- torch::Tensor **B**
- uint64\_t **aRow**
- uint64\_t **aCol**
- uint64\_t **bCol**
- uint64\_t **seed**
- uint64\_t **randA**
- uint64\_t **randB**
- double **zipfAlphaA**
- double **zipfAlphaB**

### 8.124.1 Detailed Description

The Zipf class of matrix loader.

Note

:

- Must have a global config by [setConfig](#)

Default behavior

- create
- call [setConfig](#), this function will also generate the tensor A and B correspondingly
- call [getA](#) and [getB](#) (assuming we are benchmarking torch.mm(A,B))

: require config parameters and default values

- "aRow" The rows in matrix A, U64, 100
- "aCol" The cols in matrix B, U64, 1000
- "bCol" The rows in matrix B, U64, 500
- "seed" The seed of inline random generator, U64, 114514
- "zipfAlphaA" The zipf factor for A, Double, 0-highly skewed value. 1- uniform dist.
- "zipfAlphaB" The zipf factor for B, Double, 0-highly skewed value. 1- uniform dist.
- "randA" whether let A a random matrix. U64 0
- "randB" whether let B a random matrix. U64 0

: default name tags "random": [ZipfMatrixLoader](#)

## 8.124.2 Member Function Documentation

### 8.124.2.1 `getA()`

```
torch::Tensor LibAMM::ZipfMatrixLoader::getA ( ) [virtual]
```

get the A matrix

#### Returns

the generated A matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.124.2.2 `getB()`

```
torch::Tensor LibAMM::ZipfMatrixLoader::getB ( ) [virtual]
```

get the B matrix

#### Returns

the generated B matrix

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

### 8.124.2.3 `paraseConfig()`

```
void LibAMM::ZipfMatrixLoader::paraseConfig (
    INTELLI::ConfigMapPtr cfg ) [protected]
```

Inline logic of reading a config file.

#### Parameters

<i>cfg</i>	the config
------------	------------

### 8.124.2.4 `setConfig()`

```
bool LibAMM::ZipfMatrixLoader::setConfig (
```



```
INTELLI::ConfigMapPtr cfg ) [virtual]
```

Set the GLOBAL config map related to this loader.

#### Parameters

<i>cfg</i>	The config map
------------	----------------

#### Returns

bool whether the config is successfully set

#### Note

Reimplemented from [LibAMM::AbstractMatrixLoader](#).

The documentation for this class was generated from the following files:

- include/MatrixLoader/[ZipfMatrixLoader.h](#)
- src/MatrixLoader/ZipfMatrixLoader.cpp



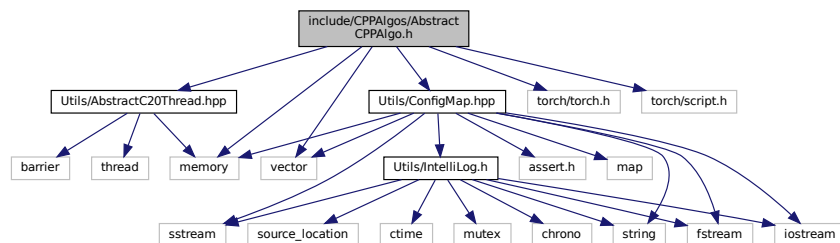
## Chapter 9

# File Documentation

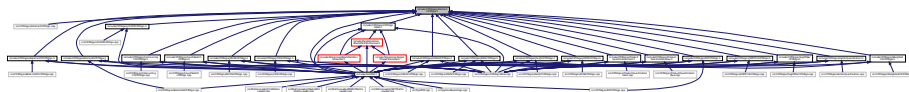
### 9.1 include/CPPALgos/AbstractCPPALgo.h File Reference

```
#include <Utils/AbstractC20Thread.hpp>
#include <Utils/ConfigMap.hpp>
#include <torch/torch.h>
#include <torch/script.h>
#include <memory>
#include <vector>
```

Include dependency graph for AbstractCPPALgo.h:



This graph shows which files directly or indirectly include this file:



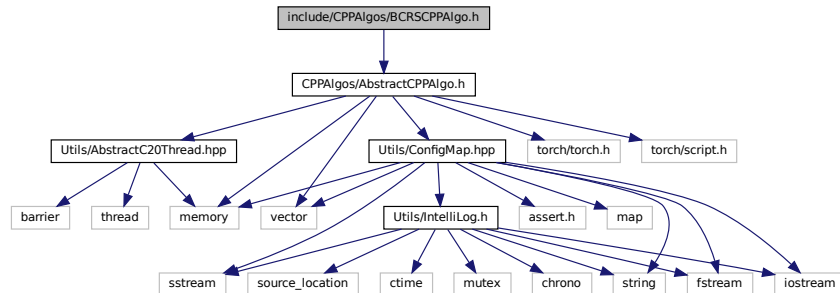
## Classes

- class [LibAMM::AbstractCPPALgo](#)  
*The abstract class of c++ algos.*
- `#define newAbstractCPPALgo std::make_shared<LibAMM::AbstractCPPALgo>`
- `typedef std::shared_ptr< class LibAMM::AbstractCPPALgo > LibAMM::AbstractCPPALgoPtr`

## 9.2 include/CPPALgos/BCRSCPPAlgo.h File Reference

```
#include <CPPALgos/AbstractCPPAlgo.h>
```

Include dependency graph for BCRSCPPAlgo.h:



This graph shows which files directly or indirectly include this file:



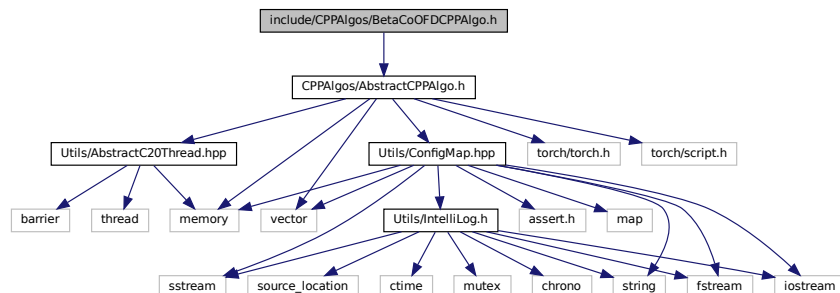
### Classes

- class [LibAMM::BCRSCPPAlgo](#)  
The Bernoulli column row sampling (BCRS) class of c++ algos.
- #define **newBCRSCPPAlgo** std::make\_shared<[LibAMM::BCRSCPPAlgo](#)>
- typedef std::shared\_ptr< class [LibAMM::BCRSCPPAlgo](#) > **LibAMM::BCRSCPPAlgoPtr**

## 9.3 include/CPPALgos/BetaCoOFDCPPAlgo.h File Reference

```
#include <CPPALgos/AbstractCPPAlgo.h>
```

Include dependency graph for BetaCoOFDCPPAlgo.h:



This graph shows which files directly or indirectly include this file:



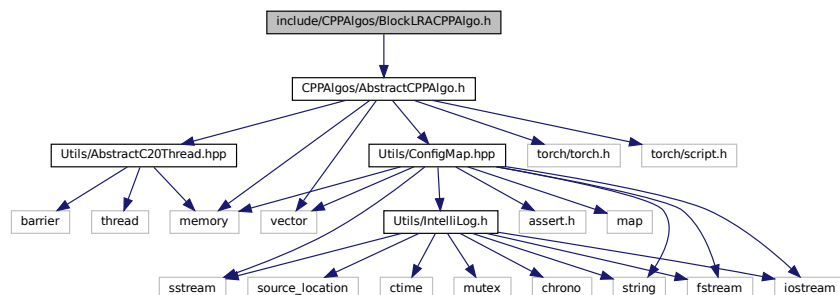
## Classes

- class [LibAMM::BetaCoOFDCPPAlgo](#)  
The Beta Co-Occurring FD AMM class of c++ algos.
- #define **newBetaCoOFDCPPAlgo** std::make\_shared<[LibAMM::BetaCoOFDCPPAlgo](#)>
- typedef std::shared\_ptr< class [LibAMM::BetaCoOFDCPPAlgo](#) > **LibAMM::BetaCoOFDCPPAlgoPtr**

## 9.4 include/CPPALgos/BlockLRACPPAlgo.h File Reference

```
#include <CPPALgos/AbstractCPPAlgo.h>
```

Include dependency graph for BlockLRACPPAlgo.h:



This graph shows which files directly or indirectly include this file:



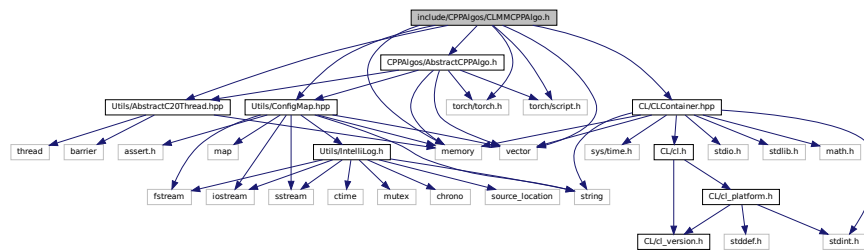
## Classes

- class [LibAMM::BlockLRACPPAlgo](#)
- #define **newBlockLRACPPAlgo** std::make\_shared<[LibAMM::BlockLRACPPAlgo](#)>  
(Macro) To creat a new BlockLRACPPAlgounder shared pointer.
- typedef std::shared\_ptr< class [LibAMM::BlockLRACPPAlgo](#) > **LibAMM::BlockLRACPPAlgoPtr**

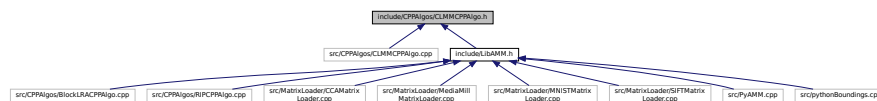
## 9.5 include/CPPAlgos/CLMMCPPAlgo.h File Reference

```
#include <Utils/AbstractC20Thread.hpp>
#include <Utils/ConfigMap.hpp>
#include <torch/torch.h>
#include <torch/script.h>
#include <memory>
#include <vector>
#include <CPPAlgos/AbstractCPPAlgo.h>
#include <CL/CLContainer.hpp>
```

Include dependency graph for CLMMCPPAlgo.h:



This graph shows which files directly or indirectly include this file:



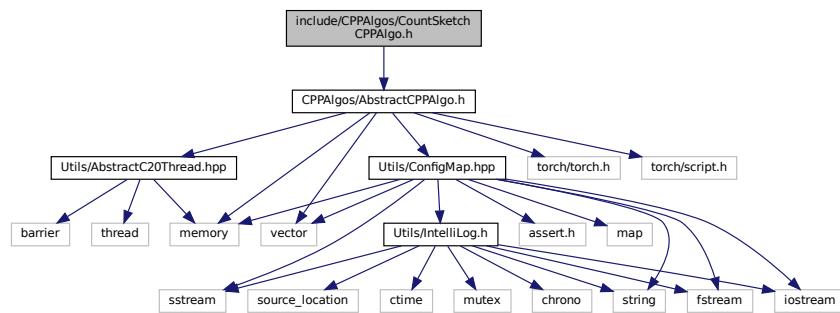
### Classes

- class [LibAMM::CLMMCPPAlgo](#)  
The MM class of c++ algos using opencl.
- #define **newCLMMCPPAlgo** std::make\_shared<[LibAMM::CLMMCPPAlgo](#)>
- typedef std::shared\_ptr< class [LibAMM::CLMMCPPAlgo](#) > **LibAMM::CLMMCPPAlgoPtr**

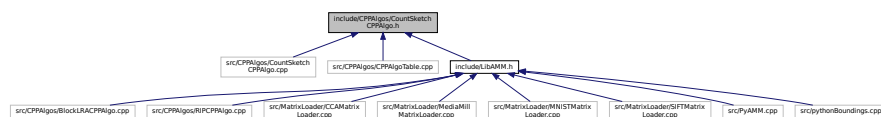
## 9.6 include/CPPAlgos/CountSketchCPPAlgo.h File Reference

```
#include <CPPAlgos/AbstractCPPAlgo.h>
```

Include dependency graph for CountSketchCPPALgo.h:



This graph shows which files directly or indirectly include this file:



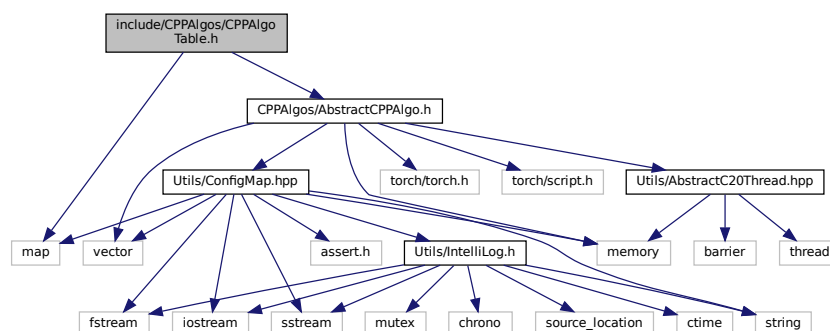
## Classes

- class [LibAMM::CountSketchCPPALgo](#)  
The counter sketch class of c++ algos.
- #define **newCountSketchCPPALgo** std::make\_shared<[LibAMM::CountSketchCPPALgo](#)>
- typedef std::shared\_ptr< class [LibAMM::CountSketchCPPALgo](#) > **LibAMM::CountSketchCPPALgoPtr**

## 9.7 include/CPPALgos/CPPALgoTable.h File Reference

```
#include <map>
#include <CPPALgos/AbstractCPPALgo.h>
```

Include dependency graph for CPALgoTable.h:



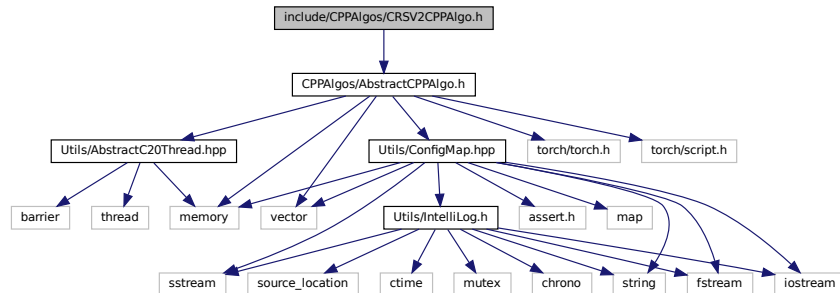




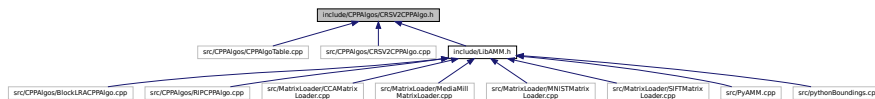
## 9.9 include/CPPALgos/CRSV2CPPAlgo.h File Reference

```
#include <CPPALgos/AbstractCPPAlgo.h>
```

Include dependency graph for CRSV2CPPAlgo.h:



This graph shows which files directly or indirectly include this file:



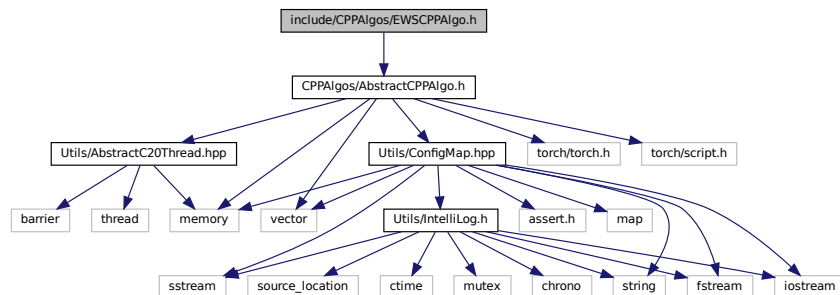
### Classes

- class [LibAMM::CRSV2CPPAlgo](#)  
The column row sampling (CRS) class of c++ algos, a second implementation.
- #define **newCRSV2CPPAlgo** std::make\_shared<[LibAMM::CRSV2CPPAlgo](#)>
- typedef std::shared\_ptr< class [LibAMM::CRSV2CPPAlgo](#) > **LibAMM::CRSV2CPPAlgoPtr**

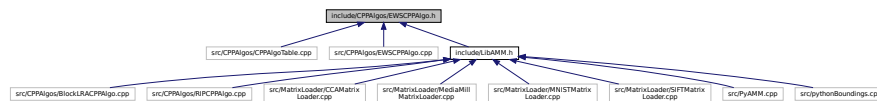
## 9.10 include/CPPALgos/EWSCPPAlgo.h File Reference

```
#include <CPPALgos/AbstractCPPAlgo.h>
```

Include dependency graph for EWSCPPAlgo.h:



This graph shows which files directly or indirectly include this file:



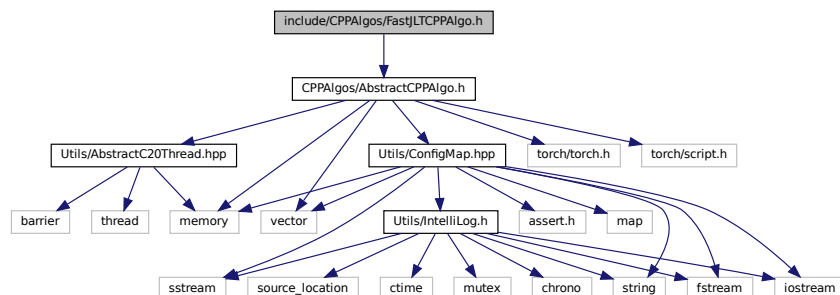
## Classes

- class [LibAMM::EWSCPPAlgo](#)  
*The Element Wise Sampling (EWS) class of c++ algos.*
- #define **newEWSCPPAlgo** std::make\_shared<[LibAMM::EWSCPPAlgo](#)>
- typedef std::shared\_ptr< class [LibAMM::EWSCPPAlgo](#) > **LibAMM::EWSCPPAlgoPtr**

## 9.11 include/CPPAlgos/FastJLTCPPAlgo.h File Reference

```
#include <CPPAlgos/AbstractCPPAlgo.h>
```

Include dependency graph for FastJLTCPPAlgo.h:



This graph shows which files directly or indirectly include this file:



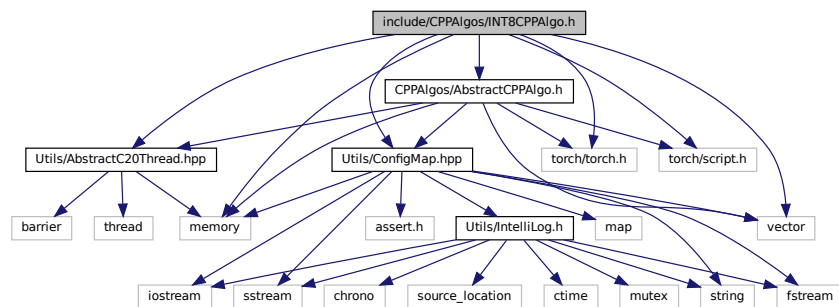
## Classes

- class [LibAMM::FastJLTCPPAlgo](#)  
*The tug of war class of c++ algoS.*
- #define **newFastJLTCPPAlgo** std::make\_shared<[LibAMM::FastJLTCPPAlgo](#)>
- typedef std::shared\_ptr< class [LibAMM::FastJLTCPPAlgo](#) > **LibAMM::FastJLTCPPAlgoPtr**

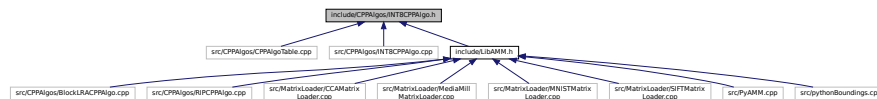
## 9.12 include/CPPAlgos/INT8CPPAlgo.h File Reference

```
#include <Utils/AbstractC20Thread.hpp>
#include <Utils/ConfigMap.hpp>
#include <torch/torch.h>
#include <torch/script.h>
#include <memory>
#include <vector>
#include <CPPAlgos/AbstractCPPAlgo.h>
```

Include dependency graph for INT8CPPAlgo.h:



This graph shows which files directly or indirectly include this file:



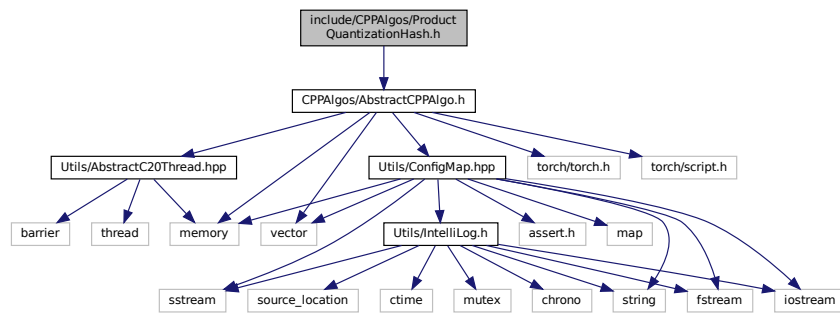
## Classes

- class [LibAMM::INT8CPPAlgo](#)  
The INT8 MM class of c++ algos.
- #define `newINT8CPPAlgo` `std::make_shared<LibAMM::INT8CPPAlgo>`
- typedef `std::shared_ptr< class LibAMM::INT8CPPAlgo >` `LibAMM::INT8CPPAlgoPtr`

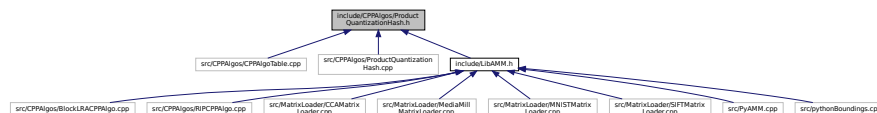
## 9.13 include/CPPAlgos/ProductQuantizationHash.h File Reference

```
#include <CPPAlgos/AbstractCPPAlgo.h>
```

Include dependency graph for ProductQuantizationHash.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [LibAMM::ProductQuantizationHash](#)

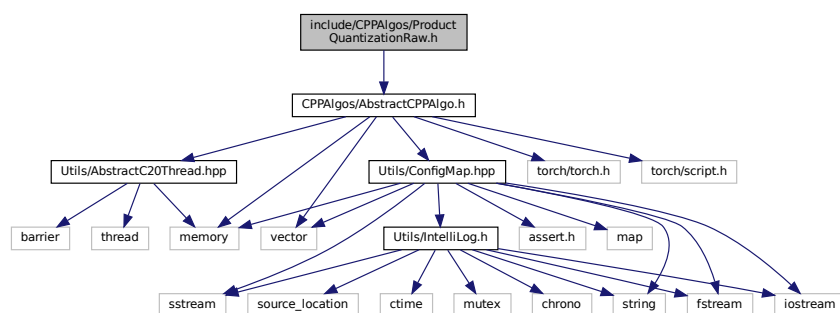
*The Product Quantization AMM class of c++ algos, using hash function to find matching prototypes.*

- #define [newProductQuantizationHashAlgo](#) std::make\_shared<[LibAMM::ProductQuantizationHash](#)>  
(Macro) To creat a new ProductQuantizationHashAlgounder shared pointer.
- typedef std::shared\_ptr< class [LibAMM::ProductQuantizationHash](#) > [LibAMM::ProductQuantizationHashPtr](#)

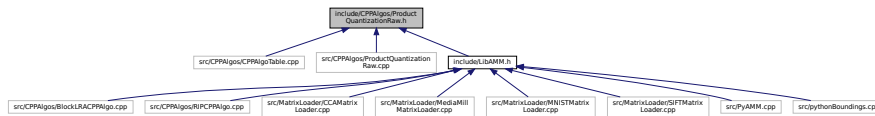
## 9.14 include/CPPAlgos/ProductQuantizationRaw.h File Reference

```
#include <CPPAlgos/AbstractCPPAlgo.h>
```

Include dependency graph for ProductQuantizationRaw.h:



This graph shows which files directly or indirectly include this file:



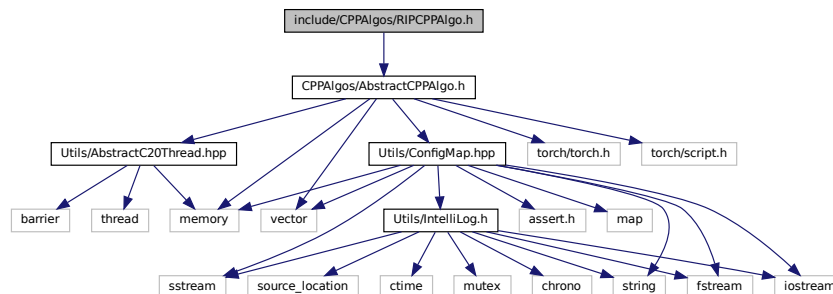
## Classes

- class [LibAMM::ProductQuantizationRaw](#)  
The Product Quantization AMM class of c++ algos, using Euclidean distance.
- #define [newProductQuantizationRawAlgo](#) std::make\_shared<[LibAMM::ProductQuantizationRaw](#)>  
(Macro) To creat a new ProductQuantizationRawAlgounder shared pointer.
- typedef std::shared\_ptr< class [LibAMM::ProductQuantizationRaw](#) > [LibAMM::ProductQuantizationRaw](#)Ptr

## 9.15 include/CPPAlgos/RIPCPPAlgo.h File Reference

```
#include <CPPAlgos/AbstractCPPAlgo.h>
```

Include dependency graph for RIPCPPAlgo.h:



This graph shows which files directly or indirectly include this file:



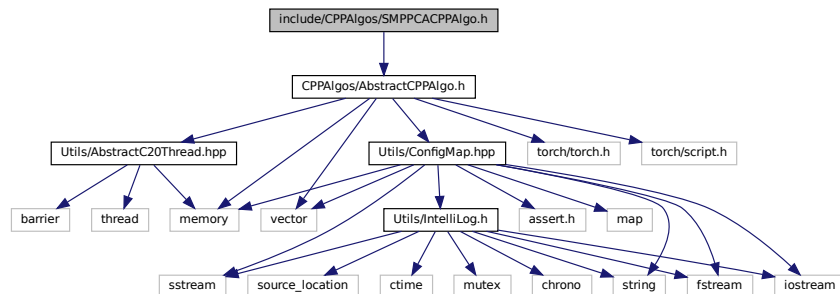
## Classes

- class [LibAMM::RIPCPPAlgo](#)  
New and improved Johnson-Lindenstrauss embeddings via the Restricted Isometry Property.
- #define [newRIPCPPAlgo](#) std::make\_shared<[LibAMM::RIPCPPAlgo](#)>
- typedef std::shared\_ptr< class [LibAMM::RIPCPPAlgo](#) > [LibAMM::RIPCPPAlgo](#)Ptr

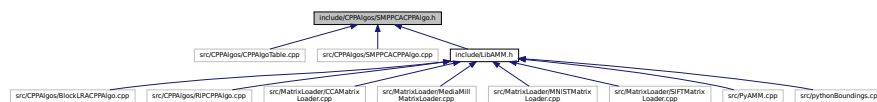
## 9.16 include/CPPAlgos/SMPPCACPPAlgo.h File Reference

```
#include <CPPAlgos/AbstractCPPAlgo.h>
```

Include dependency graph for SMPPCACPPAlgo.h:



This graph shows which files directly or indirectly include this file:



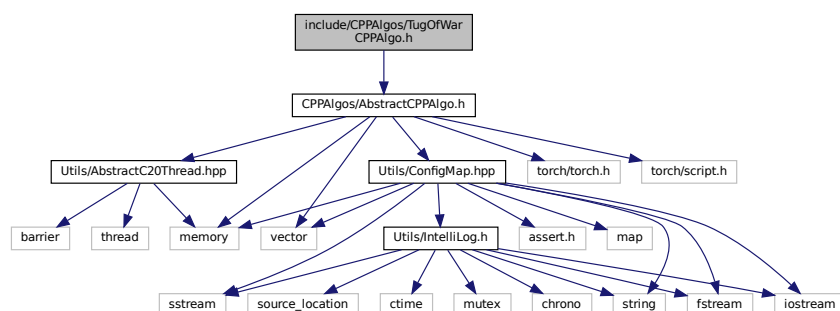
### Classes

- class [LibAMM::SMPPCACPPAlgo](#)  
*sketch scaled JL class of c++ algos*
- #define **newSMPPCACPPAlgo** std::make\_shared<[LibAMM::SMPPCACPPAlgo](#)>
- typedef std::shared\_ptr< class [LibAMM::SMPPCACPPAlgo](#) > **LibAMM::SMPPCACPPAlgoPtr**

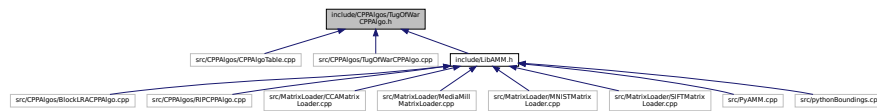
## 9.17 include/CPPAlgos/TugOfWarCPPAlgo.h File Reference

```
#include <CPPAlgos/AbstractCPPAlgo.h>
```

Include dependency graph for TugOfWarCPPAlgo.h:



This graph shows which files directly or indirectly include this file:



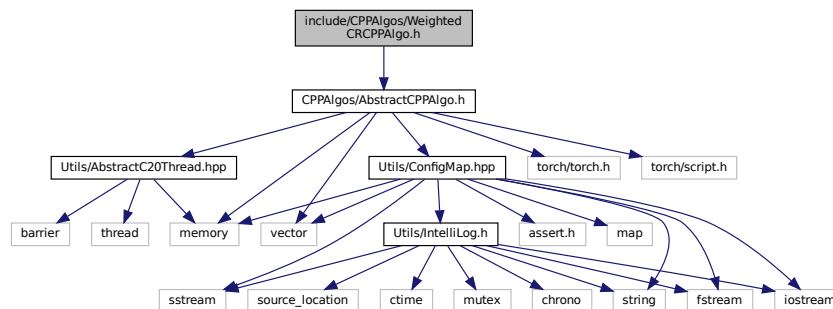
## Classes

- class [LibAMM::TugOfWarCPPAlgo](#)  
*The tug of war class of c++ algoS.*
- #define **newTugOfWarCPPAlgo** `std::make_shared<LibAMM::TugOfWarCPPAlgo>`
- typedef `std::shared_ptr< class LibAMM::TugOfWarCPPAlgo >` **LibAMM::TugOfWarCPPAlgoPtr**

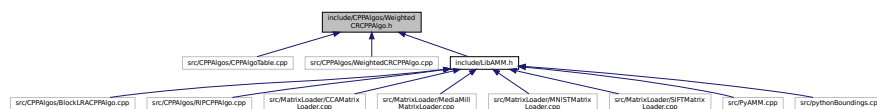
## 9.18 include/CPPAlgos/WeightedCRCPPAlgo.h File Reference

```
#include <CPPAlgos/AbstractCPPAlgo.h>
```

Include dependency graph for WeightedCRCPPAlgo.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [LibAMM::WeightedCRCPPAlgo](#)
- #define **newWeightedCRCPPAlgo** `std::make_shared<LibAMM::WeightedCRCPPAlgo>`  
*(Macro) To creat a new WeightedCRCPPAlgounder shared pointer.*
- typedef `std::shared_ptr< class LibAMM::WeightedCRCPPAlgo >` **LibAMM::WeightedCRCPPAlgoPtr**

## 9.19 include/LibAMM.h File Reference

```
#include <torch/torch.h>
#include <iostream>
#include <torch/script.h>
#include <string>
#include <memory>
#include <MatrixLoader/AbstractMatrixLoader.h>
#include <MatrixLoader/RandomMatrixLoader.h>
#include <MatrixLoader/SparseMatrixLoader.h>
#include <MatrixLoader/GaussianMatrixLoader.h>
#include <MatrixLoader/ExponentialMatrixLoader.h>
#include <MatrixLoader/BinomialMatrixLoader.h>
#include <MatrixLoader/PoissonMatrixLoader.h>
#include <MatrixLoader/BetaMatrixLoader.h>
#include <MatrixLoader/SIFTMatrixLoader.h>
#include <MatrixLoader/MNISTMatrixLoader.h>
#include <MatrixLoader/MediaMillMatrixLoader.h>
#include <MatrixLoader/CCAMatrixLoader.h>
#include <MatrixLoader/MatrixLoaderTable.h>
#include <Parallelization/BlockPartitionRunner.h>
#include <Streaming/TimeStamper.h>
#include <Streaming/Streamer.h>
#include <Streaming/SingleThreadStreamer.h>
#include <Streaming/BlockPartitionStreamer.h>
#include <CPPAlgos/AbstractCPPAlgo.h>
#include <CPPAlgos/CPPAlgoTable.h>
#include <CPPAlgos/CRSCPPAlgo.h>
#include <CPPAlgos/CRSV2CPPAlgo.h>
#include <CPPAlgos/CountSketchCPPAlgo.h>
#include <CPPAlgos/BCRSCPPAlgo.h>
#include <CPPAlgos/EWSCPPAlgo.h>
#include <CPPAlgos/CoOccurringFDCPPAlgo.h>
#include <CPPAlgos/BetaCoOFDCPPAlgo.h>
#include <CPPAlgos/ProductQuantizationRaw.h>
#include <CPPAlgos/ProductQuantizationHash.h>
#include <CPPAlgos/VectorQuantization.h>
#include <CPPAlgos/INT8CPPAlgo.h>
#include <CPPAlgos/TugOfWarCPPAlgo.h>
#include <CPPAlgos/WeightedCRCPPAlgo.h>
#include <CPPAlgos/SMPPCACPPAlgo.h>
#include <CPPAlgos/FastJLTCPPAlgo.h>
#include <CPPAlgos/RIPCPPAlgo.h>
#include <CPPAlgos/BlockLRACPPAlgo.h>
#include <CPPAlgos/CLMMCPPAlgo.h>
#include <Utils/ConfigMap.hpp>
#include <Utils/Meters/MeterTable.h>
#include <Utils/C20Buffers.hpp>
#include <Utils/ThreadPerf.hpp>
#include <Utils/IntelliLog.h>
#include <Utils/UtilityFunctions.h>
#include <Utils/BS_thread_pool.hpp>
```

This graph shows which files directly or indirectly include this file:

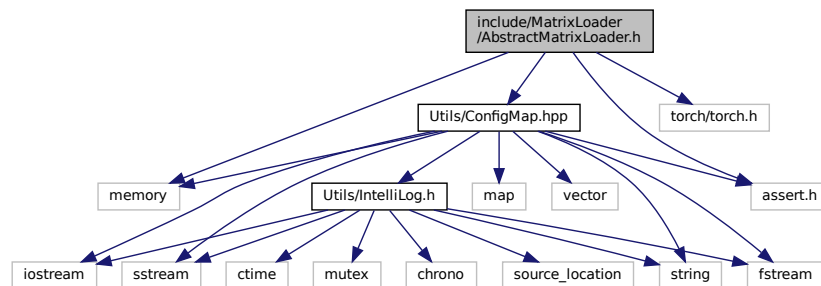




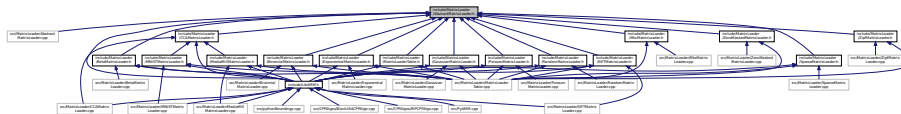
## 9.20 include/MatrixLoader/AbstractMatrixLoader.h File Reference

```
#include <Utils/ConfigMap.hpp>
#include <assert.h>
#include <torch/torch.h>
#include <memory>
```

Include dependency graph for AbstractMatrixLoader.h:



This graph shows which files directly or indirectly include this file:



### Classes

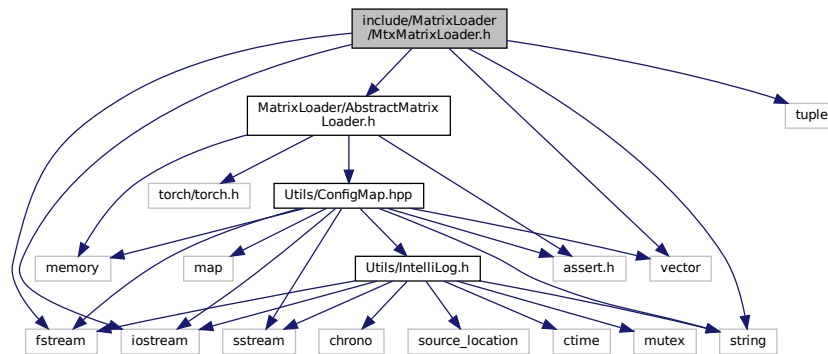
- class [LibAMM::AbstractMatrixLoader](#)  
The abstract class of matrix loader, parent for all loaders.
- #define [newAbstractMatrixLoader](#) `std::make_shared<LibAMM::AbstractMatrixLoader>`  
(Macro) To creat a new AbstractMatrixLoader under shared pointer.
- typedef `std::shared_ptr< class LibAMM::AbstractMatrixLoader >` [LibAMM::AbstractMatrixLoaderPtr](#)  
The class to describe a shared pointer to [AbstractMatrixLoader](#).

## 9.21 include/MatrixLoader/MtxMatrixLoader.h File Reference

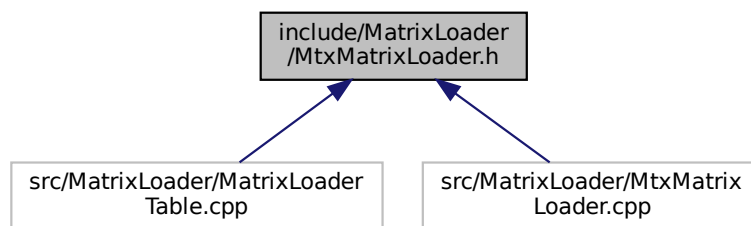
```
#include <MatrixLoader/AbstractMatrixLoader.h>
#include <string>
#include <iostream>
#include <fstream>
#include <vector>
```

```
#include <tuple>
```

Include dependency graph for MtxMatrixLoader.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [LibAMM::MtxMatrixLoader](#)

*The matrix loader to load matrixes stored in matrix market mtx format.*

- #define [newMtxMatrixLoader](#) std::make\_shared<[LibAMM::MtxMatrixLoader](#)>  
*(Macro) To creat a new MtxMatrixLoader under shared pointer.*
- typedef std::shared\_ptr< class [LibAMM::MtxMatrixLoader](#) > [LibAMM::MtxMatrixLoaderPtr](#)  
*The class to describe a shared pointer to [MtxMatrixLoader](#).*
- torch::Tensor [LibAMM::loadMatrixFromMatrixMarket](#) (const string &filename)  
*the stan-alone function to load a matrix from matrix market mitx file*
- torch::Tensor [LibAMM::normalizeIntoPN1](#) (torch::Tensor a)  
*to normalize a tensor into +-1: will be biased by the min value*
- torch::Tensor [LibAMM::scaleIntoPN1](#) (torch::Tensor a)  
*to scale a tensor into +-1: will NOT change the bias*

## 9.21.1 Function Documentation

### 9.21.1.1 normalizeIntoPN1()

```
torch::Tensor LibAMM::normalizeIntoPN1 (
    torch::Tensor a )
```

to normalize a tensor into +-1: will be biased by the min value

#### Parameters

<i>a</i>	the input
----------	-----------

#### Returns

the normalized tensor

### 9.21.1.2 scaleIntoPN1()

```
torch::Tensor LibAMM::scaleIntoPN1 (
    torch::Tensor a )
```

to scale a tensor into +-1: will NOT change the bias

#### Parameters

<i>a</i>	the input
----------	-----------

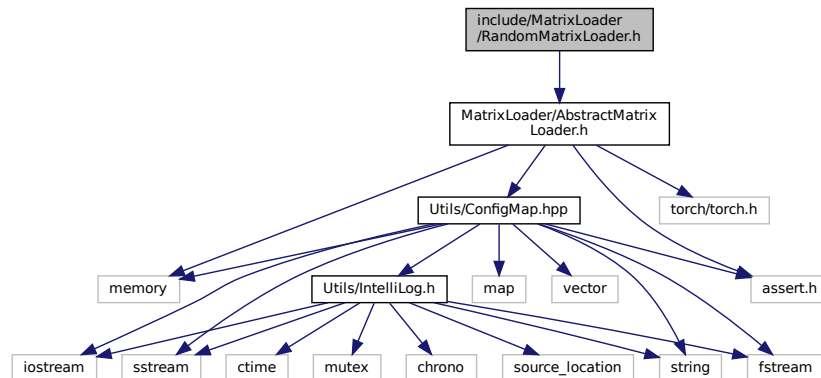
#### Returns

the normalized tensor

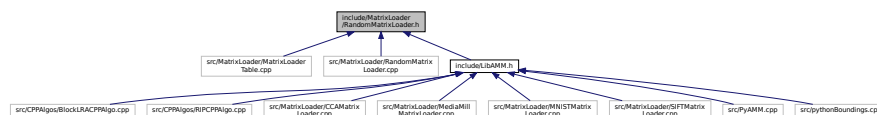
## 9.22 include/MatrixLoader/RandomMatrixLoader.h File Reference

```
#include <MatrixLoader/AbstractMatrixLoader.h>
```

Include dependency graph for RandomMatrixLoader.h:



This graph shows which files directly or indirectly include this file:



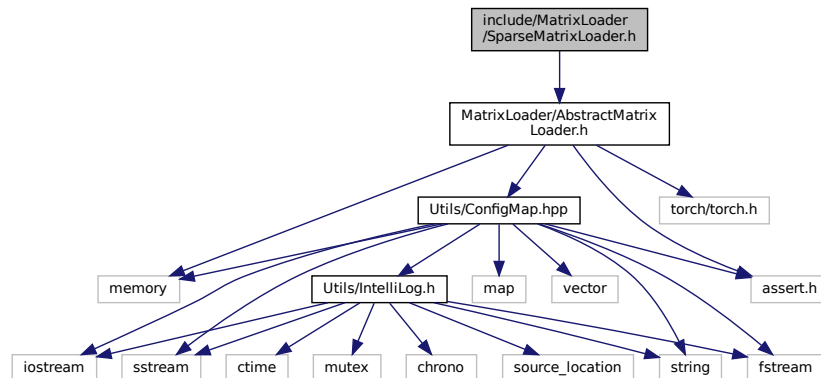
## Classes

- class [LibAMM::RandomMatrixLoader](#)  
The Random class of matrix loader.
- `#define` [newRandomMatrixLoader](#) `std::make_shared<LibAMM::RandomMatrixLoader>`  
(Macro) To creat a new RandomMatrixLoader under shared pointer.
- `typedef` `std::shared_ptr< class` [LibAMM::RandomMatrixLoader](#) `>` [LibAMM::RandomMatrixLoaderPtr](#)  
The class to describe a shared pointer to [RandomMatrixLoader](#).

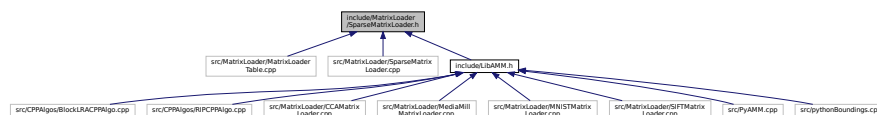
## 9.23 include/MatrixLoader/SparseMatrixLoader.h File Reference

```
#include <MatrixLoader/AbstractMatrixLoader.h>
```

Include dependency graph for SparseMatrixLoader.h:



This graph shows which files directly or indirectly include this file:



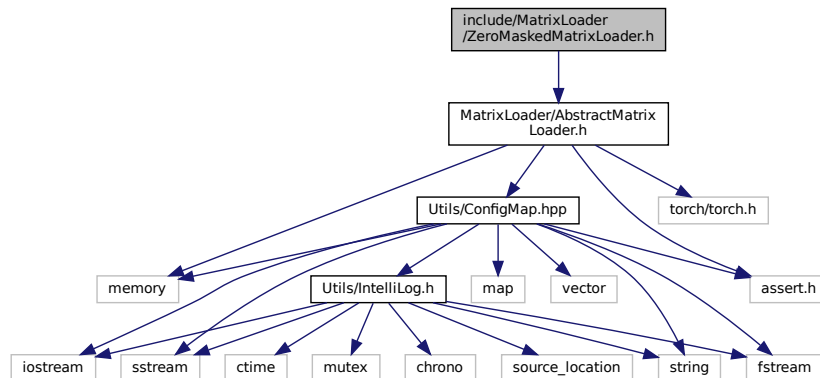
## Classes

- class [LibAMM::SparseMatrixLoader](#)  
The matrix loader to generate adjustable sparse matrix with adjust rank reduction.
- `#define newSparseMatrixLoader std::make_shared<LibAMM::SparseMatrixLoader>`  
(Macro) To creat a new SparseMatrixLoader under shared pointer.
- `typedef std::shared_ptr< class LibAMM::SparseMatrixLoader > LibAMM::SparseMatrixLoaderPtr`  
The class to describe a shared pointer to [SparseMatrixLoader](#).

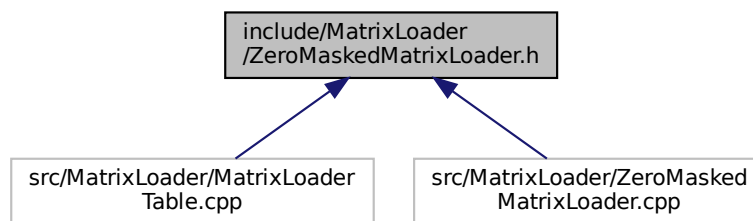
## 9.24 include/MatrixLoader/ZeroMaskedMatrixLoader.h File Reference

```
#include <MatrixLoader/AbstractMatrixLoader.h>
```

Include dependency graph for ZeroMaskedMatrixLoader.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [LibAMM::ZeroMaskedMatrixLoader](#)

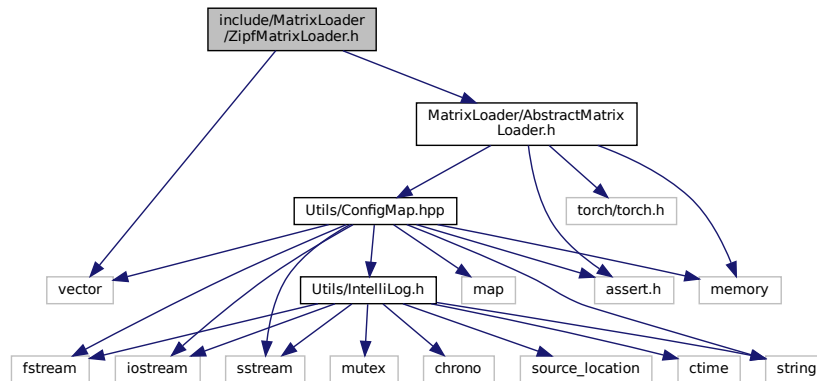
*The zero masked class of matrix loader, given generate a  $n \times m$  matrix, where only the left-top  $n1 \times m2$  contents are not zero.*

- `#define newZeroMaskedMatrixLoader std::make_shared<LibAMM::ZeroMaskedMatrixLoader>`  
*(Macro) To creat a new ZeroMaskedMatrixLoader under shared pointer.*
- `typedef std::shared_ptr< class LibAMM::ZeroMaskedMatrixLoader > LibAMM::ZeroMaskedMatrixLoaderPtr`  
*The class to describe a shared pointer to ZeroMaskedMatrixLoader.*

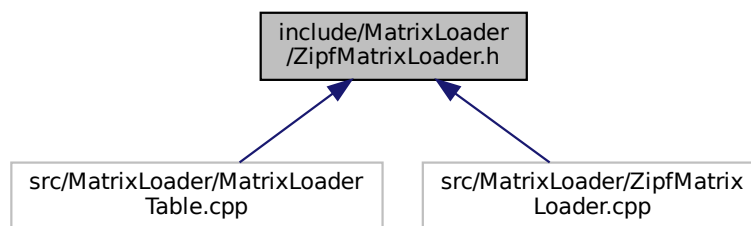
## 9.25 include/MatrixLoader/ZipfMatrixLoader.h File Reference

```
#include <MatrixLoader/AbstractMatrixLoader.h>
#include <vector>
```

Include dependency graph for ZipfMatrixLoader.h:



This graph shows which files directly or indirectly include this file:



## Classes

- class [LibAMM::ZipfMatrixLoader](#)  
The Zipf class of matrix loader.
- #define [newZipfMatrixLoader](#) std::make\_shared<LibAMM::ZipfMatrixLoader>  
(Macro) To creat a new ZipfMatrixLoader under shared pointer.
- typedef std::shared\_ptr< class [LibAMM::ZipfMatrixLoader](#) > [LibAMM::ZipfMatrixLoaderPtr](#)  
The class to describe a shared pointer to [ZipfMatrixLoader](#).

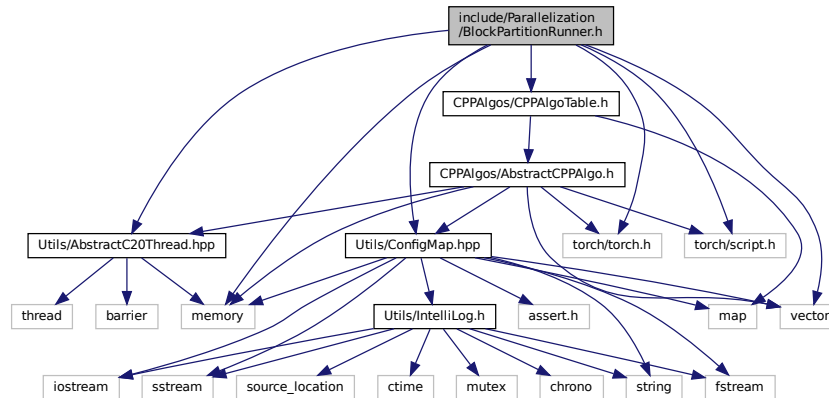
## 9.26 include/Parallelization/BlockPartitionRunner.h File Reference

```

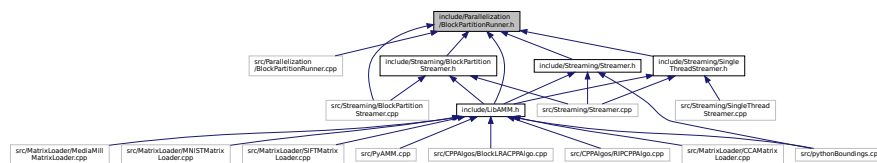
#include <Utils/AbstractC20Thread.hpp>
#include <Utils/ConfigMap.hpp>
#include <torch/torch.h>
#include <torch/script.h>

```

```
#include <memory>
#include <vector>
#include <CPPAlgos/CPPAlgoTable.h>
Include dependency graph for BlockPartitionRunner.h:
```



This graph shows which files directly or indirectly include this file:



## Classes

- class [LibAMM::BlockPartitionWorker](#)  
*The basic partition worker.*
- class [LibAMM::BlockPartitionRunner](#)  
*The top entity to control all workers, see also [BlockPartitionWorker](#). This one works under a simple row partition parallelization.*

## Macros

- `#define newTensor make_shared<torch::Tensor>`

## Typedefs

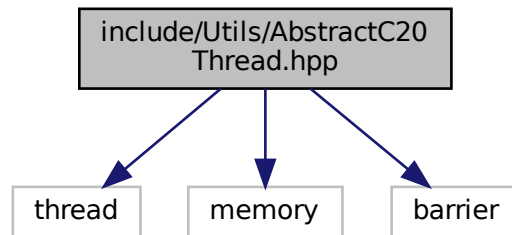
- `typedef std::shared_ptr< torch::Tensor > LibAMM::TensorPtr`
- `#define newBlockPartitionWorker std::make_shared<LibAMM::BlockPartitionWorker>`  
*(Macro) To creat a new BlockPartitionWorker under shared pointer.*
- `typedef std::shared_ptr< LibAMM::BlockPartitionWorker > LibAMM::BlockPartitionWorkerPtr`



## 9.27 include/Utils/AbstractC20Thread.hpp File Reference

```
#include <thread>
#include <memory>
#include <barrier>
```

Include dependency graph for AbstractC20Thread.hpp:



This graph shows which files directly or indirectly include this file:



### Classes

- class [INTELLI::AbstractC20Thread](#)  
*The base class and abstraction of C++20 thread, and it can be derived into other threads.*

### Macros

- #define [newAbstractC20Thread](#) std::make\_shared<[INTELLI::AbstractC20Thread](#)>  
*(Macro) To creat a new [newAbstractC20Thread](#) under shared pointer.*

### Typedefs

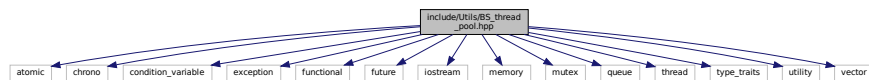
- typedef std::shared\_ptr< AbstractC20Thread > [INTELLI::AbstractC20ThreadPtr](#)  
*The class to describe a shared pointer to [AbstractC20Thread](#).*
- typedef std::shared\_ptr< std::barrier<> > [INTELLI::BarrierPtr](#)

## 9.28 include/Uutils/BS\_thread\_pool.hpp File Reference

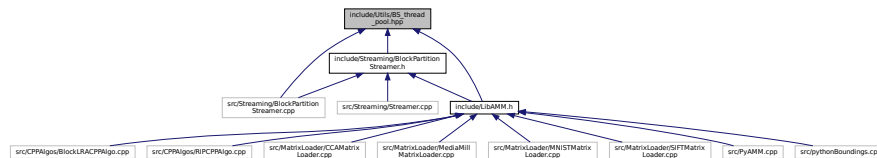
**BS::thread\_pool**: a fast, lightweight, and easy-to-use C++17 thread pool library. This header file contains the entire library, including the main **BS::thread\_pool** class and the helper classes **BS::multi\_future**, **BS::blocks**, **BS::synced\_stream**, and **BS::timer**.

```
#include <atomic>
#include <chrono>
#include <condition_variable>
#include <exception>
#include <functional>
#include <future>
#include <iostream>
#include <memory>
#include <mutex>
#include <queue>
#include <thread>
#include <type_traits>
#include <utility>
#include <vector>
```

Include dependency graph for BS\_thread\_pool.hpp:



This graph shows which files directly or indirectly include this file:



## Classes

- class **BS::multi\_future**< T >  
A helper class to facilitate waiting for and/or getting the results of multiple futures at once.
- class **BS::blocks**< T1, T2, T >  
A helper class to divide a range into blocks. Used by `parallelize_loop()` and `push_loop()`.
- class **BS::thread\_pool**  
A fast, lightweight, and easy-to-use C++17 thread pool class.
- class **BS::synced\_stream**  
A helper class to synchronize printing to an output stream by different threads.
- class **BS::timer**  
A helper class to measure execution time for benchmarking purposes.

## Macros

- `#define BS_THREAD_POOL_VERSION "v3.3.0 (2022-08-03)"`

## Typedefs

- using `BS::concurrency_t` = `std::invoke_result_t< decltype(std::thread::hardware_concurrency)>`  
*A convenient shorthand for the type of `std::thread::hardware_concurrency()`. Should evaluate to unsigned int.*
- `typedef std::shared_ptr< thread_pool > BS::thread_pool_ptr`

### 9.28.1 Detailed Description

`BS::thread_pool`: a fast, lightweight, and easy-to-use C++17 thread pool library. This header file contains the entire library, including the main `BS::thread_pool` class and the helper classes `BS::multi_future`, `BS::blocks`, `BS::syncd_stream`, and `BS::timer`.

#### Author

Barak Shoshany ( [baraksh@gmail.com](mailto:baraksh@gmail.com)) ( <http://baraksh.com>)

#### Version

3.3.0

#### Date

2022-08-03

#### Copyright

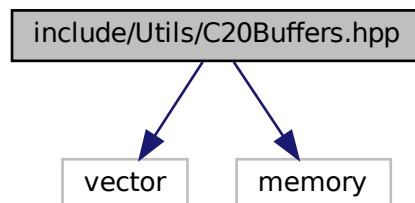
Copyright (c) 2022 Barak Shoshany. Licensed under the MIT license. If you found this project useful, please consider starring it on GitHub! If you use this library in software of any kind, please provide a link to the GitHub repository <https://github.com/bshoshany/thread-pool> in the source code and documentation. If you use this library in published research, please cite it as follows: Barak Shoshany, "A C++17 Thread Pool for High-Performance Scientific Computing", doi:10.5281/zenodo.4742687, arXiv:2105.00613 (May 2021)

## 9.29 include/Utils/C20Buffers.hpp File Reference

```
#include <vector>
```

```
#include <memory>
```

Include dependency graph for C20Buffers.hpp:



This graph shows which files directly or indirectly include this file:



## Classes

- class `INTELLI::C20Buffer< dataType >`

## Macros

- `#define _UTILS_C20BUFFERS_HPP_`
- `#define ADB_memcpy(dst, src, size) memcpy(dst, src, size)`

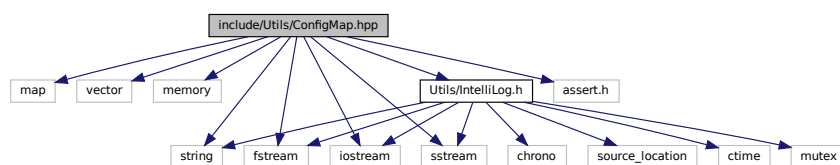
## 9.30 include/Utils/ConfigMap.hpp File Reference

```

#include <map>
#include <vector>
#include <memory>
#include <string>
#include <fstream>
#include <iostream>
#include <sstream>
#include <assert.h>
#include <Utils/IntelliLog.h>

```

Include dependency graph for ConfigMap.hpp:



This graph shows which files directly or indirectly include this file:



## Classes

- class `INTELLI::ConfigMap`

*The unified map structure to store configurations in a key-value style.*



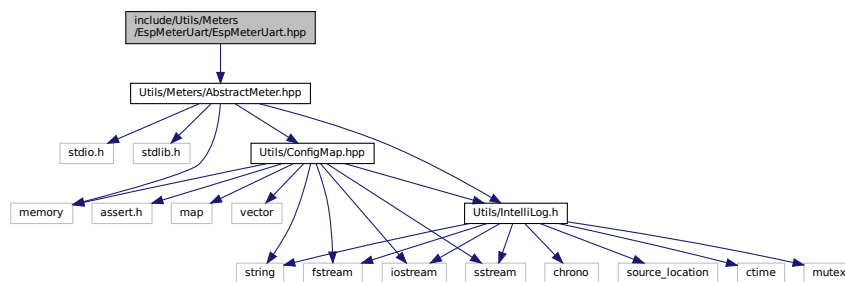
## Typedefs

- typedef std::shared\_ptr< [DIVERSE\\_METER::AbstractMeter](#) > [DIVERSE\\_METER::AbstractMeterPtr](#)

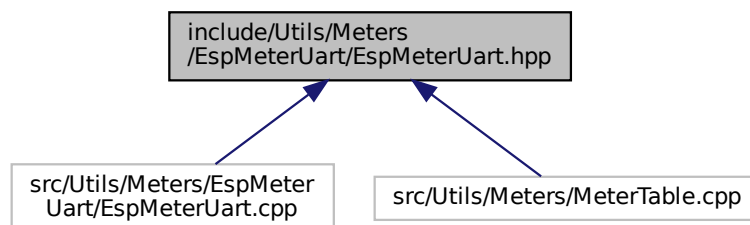
## 9.32 include/Utils/Meters/EspMeterUart/EspMeterUart.hpp File Reference

```
#include <Utils/Meters/AbstractMeter.hpp>
```

Include dependency graph for EspMeterUart.hpp:



This graph shows which files directly or indirectly include this file:



## Classes

- class [DIVERSE\\_METER::EspMeterUart](#)  
*the entity of an esp32s2-based power meter, connected by uart 115200*

## Macros

- #define [ADB\\_INCLUDE\\_UTILS\\_EspMeterUartUART\\_HPP\\_](#)
- #define [newEspMeterUart\(\)](#) std::make\_shared<EspMeterUart>();

- `typedef std::shared_ptr< DIVERSE_METER::EspMeterUart > DIVERSE_METER::EspMeterUartPtr`

```
#include <string>
#include <sys/time.h>
#include <assert.h>
#include <fcntl.h>
#include <inttypes.h>
#include <math.h>
#include <stdint.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <sys/syscall.h>
#include <sys/types.h>
#include <sys/ioctl.h>
#include <sys/stat.h>
#include <time.h>
#include <unistd.h>
#include <linux/perf_event.h>
#include <signal.h>
#include <memory.h>
#include <memory>
#include <vector>
#include <Utils/ConfigMap.hpp>
```

**Include dependency graph for ThreadPerf.hpp:**



This graph shows which files directly or indirectly include this file:



- class [INTELLI::ThreadPerf](#)  
*The top entity to provide perf traces, please use this class only UNLESS you know what you are doing.*
- class [INTELLI::ThreadPerf::PerfPair](#)  
*a record pair of perf events*
- class [INTELLI::ThreadPerf::PerfTool](#)





## Macros

- #define **ERROR\_RETURN**(retval) { fprintf(stderr, "Error %d %s:line %d: \n", retval, \_\_FILE\_\_, \_\_LINE\_\_); }
- #define **newThreadPerfPAPI** std::make\_shared<INTELLI::ThreadPerfPAPI>  
*(Macro) To creat a new ThreadPerfPAPI under shared pointer.*

## Typedefs

- typedef std::shared\_ptr< INTELLI::ThreadPerfPAPI > INTELLI::ThreadPerfPAPIPtr  
*The class to describe a shared pointer to [ThreadPerfPAPI](#).*



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