BNPlib for density estimation:

A nonparametric C++ library

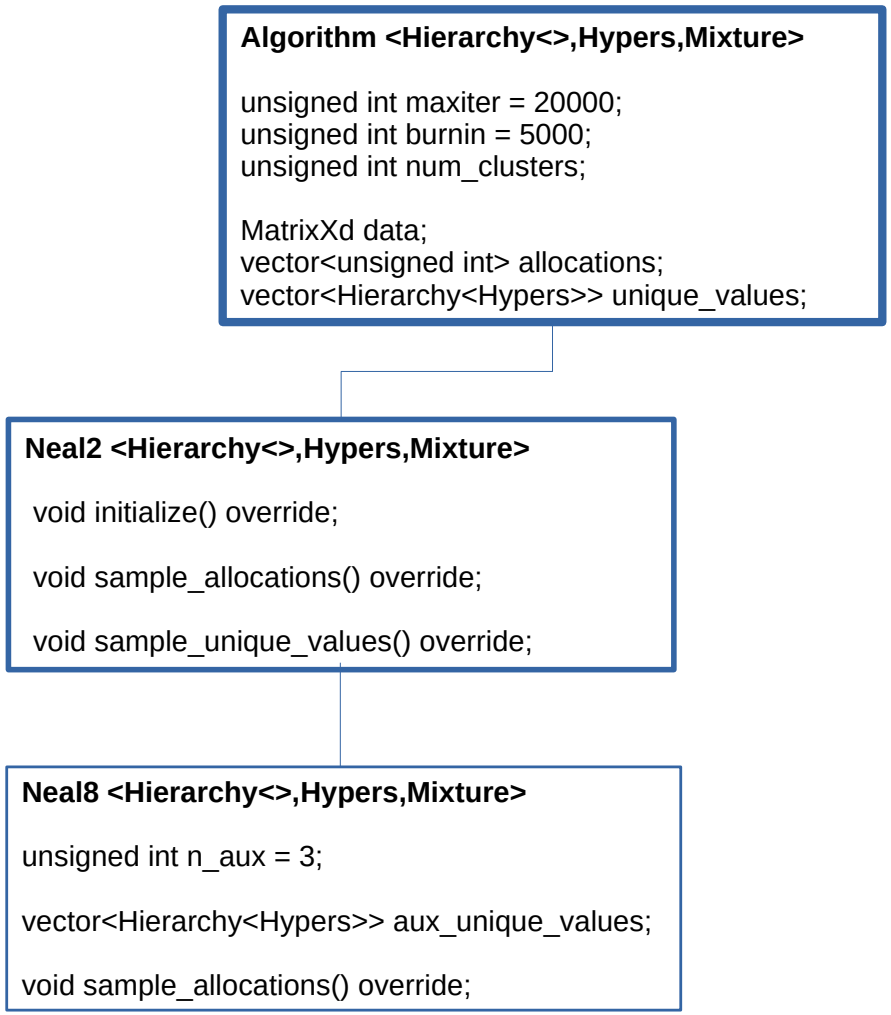
Bruno Guindani
Elena Zazzetti

POLITECNICO
MILANO 1863

https://github.com/poliprojects/BNPlib

Algoritmhs

`Algorithm<Hierarchy<>, Hypers, Mixture>`



Hierarchies

Template parameter for `Algorithm`: common interface needed

HierarchyNNIG <Hypers>

```
vector<MatrixXd> state;
shared_ptr<Hypers> hypers;

VectorXd eval_marg(MatrixXd datum);
VectorXd like(MatrixXd datum);
void sample_given_data(MatrixXd data);
void draw();
vector<double> normal_gamma_update(VectorXd data,
      double mu0, double alpha0, double beta0, double lambda0);
```

state(2, MatrixXd(1,1))

check in Algorithm Constructor
if data is univariate

HierarchyDummy <Hypers>

```
vector<MatrixXd> state;
shared_ptr<Hypers> hypers;

VectorXd eval_marg(MatrixXd datum);
VectorXd like(MatrixXd datum);
void sample_given_data(MatrixXd data);
void draw();
std::vector<Eigen::MatrixXd> dummy_update(MatrixXd data,
      VectorXd mu0, MatrixXd lambda0);
```

Hyperparameters

Template parameter for `Algorithm`: common interface needed

HypersFixedNNIG

double mu0, lambda, alpha0, beta0;

HypersDummy

VectorXd mu0;
MatrixXd lambda0;

Mixtures

Template parameter for `Algorithm`: common interface needed

DirichletMixture

double totalmass;

double const prob_existing_cluster(int card, unsigned int n)
double const prob_new_cluster(unsigned int n, unsigned int n_unique)

PitYorMixture

double strength;
double discount;

double const prob_existing_cluster(int card, unsigned int n)
double const prob_new_cluster(unsigned int n, unsigned int n_unique)

Factory

To choose the Algorithm at runtime:

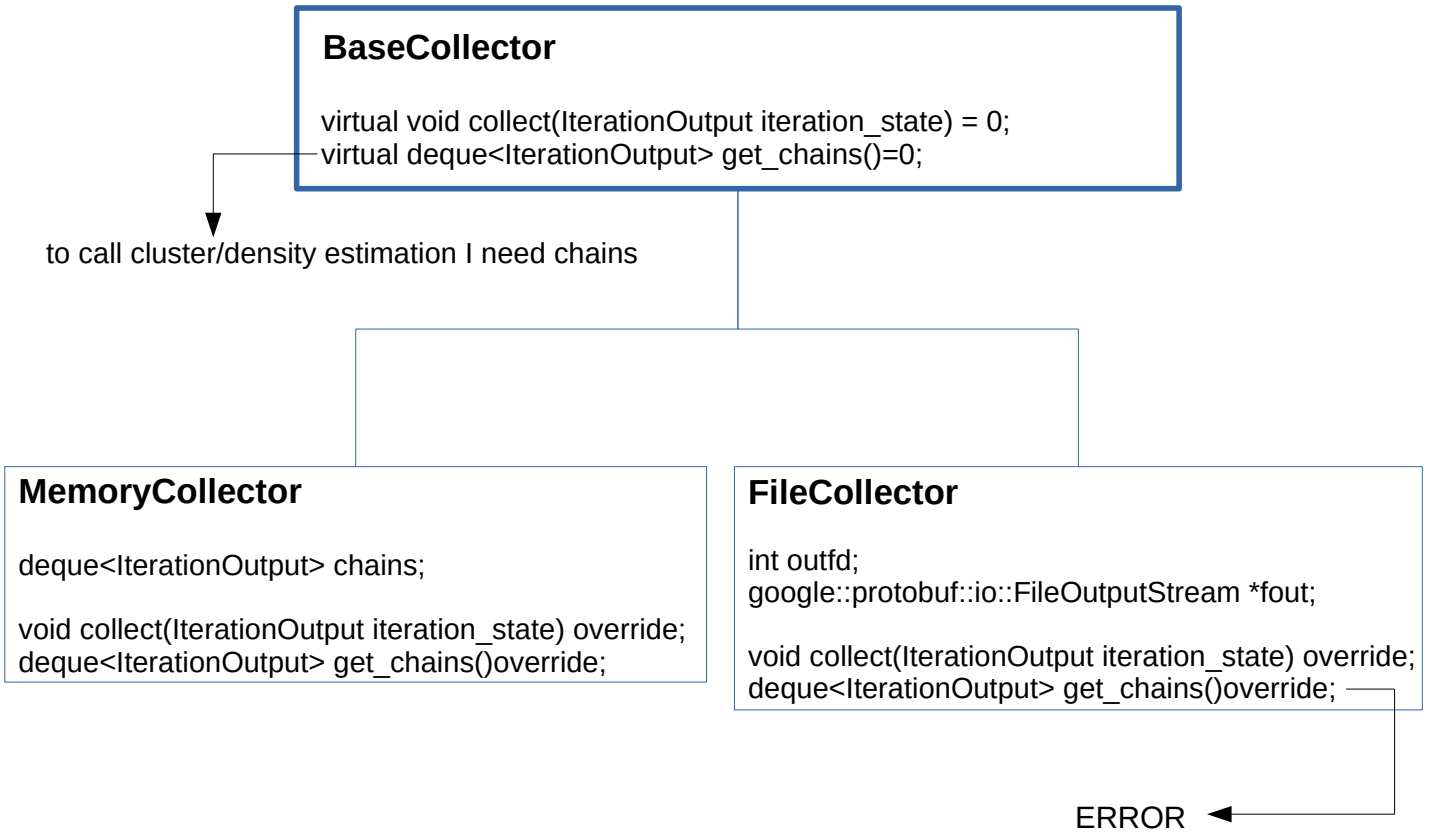
```
template<class AbstractProduct, typename... Args>
class Factory{
private:
    std::map<Identifier, Builder> storage;
    //[...]
public:
    static Factory& Instance();
    std::unique_ptr<AbstractProduct> create_object(
        const Identifier &name, Args... args) const;
    void add_builder(const Identifier &name,
        const Builder &builder);
    //[...]
}
```

Protocol Buffers

For multivariate data storage

```
message Par_Col {
    repeated double elems = 1;
    }
message Param {
    repeated Par_Col par_cols = 1;
    }
message UniqueValues {
    repeated Param params = 1;
    }
message IterationOutput {
    repeated int32 allocations = 1;
    repeated UniqueValues uniquevalues = 2;
}
message ChainOutput {
    repeated IterationOutput chain = 1;
}
```

Collectors


BaseCollector
virtual void collect(IterationOutput iteration_state) = 0;
virtual deque<IterationOutput> get_chains()=0;
to call cluster/density estimation I need chains
MemoryCollector
deque<IterationOutput> chains;
void collect(IterationOutput iteration_state) override;
deque<IterationOutput> get_chains()override;
FileCollector
int outfd;
google::protobuf::io::FileOutputStream *fout;
void collect(IterationOutput iteration_state) override;
deque<IterationOutput> get_chains()override;
ERROR