fn make_row_by_row

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This proof resides in "contrib" because it has not completed the vetting process.

Proves soundness of make_row_by_row in mod.rs at commit f5bb719 (outdated¹). This constructor is a special case of make_row_by_row_fallible. The proof for this constructor appeals to the proof for make_row_by_row_fallible.

make_row_by_row returns a Transformation that applies a user-specified function to each record in the input dataset.

Vetting History

• Pull Request #562

1 Hoare Triple

Precondition

- DI (input domain) is a type with trait RowByRowDomain<DO>. This trait provides a way to apply a map function to each record in the input dataset to retrieve a dataset that is a member of the output domain, of type DO. The trait further implies that DatasetDomain is also implemented for DI.
- DO (output domain) is a type with trait DatasetDomain. DatasetDomain is used to define the type of the row domain.
- M (metric) is a type with trait <code>DatasetMetric</code>. <code>DatasetMetric</code> is used to restrict the set of valid metrics to those which measure distances between datasets.
- MetricSpace is implemented for (DI, M). Therefore M is a valid metric on DI.
- MetricSpace is implemented for (DO, M).
- row_function has no side-effects.
- If the input to row_function is a member of input_domain's row domain, then the output is a member of output_row_domain.

Pseudocode

```
def make_row_by_row_fallible(
   input_domain: DI,
   input_metric: M,
   output_row_domain: DO,
   # a function from input domain's row type to output domain's row type
```

 $^{^1\}mathrm{See}$ new changes with git diff f5bb719..9da571d3 rust/src/transformations/manipulation/mod.rs

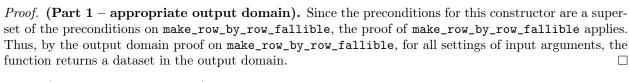
```
row_function: Callable([[DI::RowDomain::Carrier], DO::RowDomain::Carrier])
7 ) -> Transformation:
8 make_row_by_row_fallible(input_domain, input_metric, output_row_domain, row_function)
```

Postcondition

For every setting of the input parameters (input_domain, input_metric, output_domain, row_function, DI, DO, M) to make_row_by_row such that the given preconditions hold, make_row_by_row raises an exception (at compile time or run time) or returns a valid transformation. A valid transformation has the following properties:

- 1. (Appropriate output domain). For every element v in input_domain, function(v) is in output_domain or raises a data-independent runtime exception.
- 2. (Stability guarantee). For every pair of elements u, v in input_domain and for every pair (d_in, d_out), where d_in has the associated type for input_metric and d_out has the associated type for output_metric, if u, v are d_in-close under input_metric and stability_map(d_in) \leq d_out, then function(u), function(v) are d_out-close under output_metric.

2 Proofs



Proof. (Part 2 – stability map). The proof of make_row_by_row_fallible similarly applies. Thus, by the stability map proof on make_row_by_row_fallible, for all settings of input arguments, where u, v are d_in-close under input_metric, function(u), function(v) are d_out-close under output_metric.