

fn make_odomter_to_filter

Michael Shoemate

This proof resides in “**contrib**” because it has not completed the vetting process.

Proves soundness of fn make_odomter_to_filter.

1 Hoare Triple

Precondition

Compiler-verified

- Argument odometer of type Odometer<DI, MI, MO, Q, A>.
- Argument d_in of type MI_Distance, the associated distance type of MI.
- Argument d_out of type MO_Distance, the associated distance type of MO.
- Generic DI implements **Domain**.
- Generic MI implements **Metric**.
- Generic MO implements **Measure**.
- MI_Distance implements **ProductOrd**.
- MO_Distance implements **ProductOrd**.
- (DI, MI) implements **MetricSpace**.

User-verified

Pseudocode

```
1 def make_odometer_to_filter(  
2     odometer: Odometer[DI, MI, MO, Q, A],  
3     d_in: MI_Distance,  
4     d_out: MO_Distance,  
5 ) -> Measurement[DI, OdometerQueryable[MI, MO, Q, A], MI, MO]:  
6     function = odometer.function  
7  
8     def function(  
9         arg: DI_Carrier, query_wrapper: Wrapper | None #  
10    ) -> OdometerQueryable[MI, MO, Q, A]:  
11        continuation_rule = new_continuation_rule(d_in, d_out, MI, MO) #  
12  
13        wrapper = compose_wrappers(continuation_rule, query_wrapper) #  
14        return function.eval_wrap(arg, wrapper) #  
15  
16    def privacy_map(d_in_p: MI_Distance) -> MO_Distance:
```

```

17         if d_in_p.total_gt(d_in):
18             raise "input distance must not be greater than d_in"
19
20         return d_out
21
22     return Measurement.new(
23         odometer.input_domain,
24         Function.new_interactive(function),
25         odometer.input_metric,
26         odometer.output_measure,
27         PrivacyMap.new_fallible(privacy_map),
28     )

```

Postcondition

For every setting of the input parameters (`odometer`, `d_in`, `d_out`, `DI`, `MI`, `MO`, `Q`, `A`) to `make_odometer_to_filter` such that the given preconditions hold, `make_odometer_to_filter` raises an exception (at compile time or run time) or returns a valid odometer. A valid odometer has the following properties:

1. (Data-independent exceptions). For every pair of elements x, x' in `input_domain`, `function(x)` and `function(x')` either both raise an exception, or neither raise an exception.
2. (Wrapping guarantee). Interactive measurement queryables spawned while evaluating external queries are wrapped by the wrapper function accompanying the external query.
3. (Valid odometer queryable). For every element x in `input_domain`, where `function(x)` does not raise an exception, `function(x)` returns a valid odometer queryable.

Proof. Data-independent exceptions `Function.eval_wrap` on line 14 has data-independent exceptions, because the function is from `odometer`, which is a valid odometer. Since this is the only location where an exception can be raised, the data-independent exceptions guarantee holds. \square

Proof. Wrapping Guarantee The query wrapper is labeled `query_wrapper` on line 9. `wrapper` on line 13 includes `query_wrapper` by the postcondition on `compose_wrappers`.

`Function.eval_wrap` on line ?? guarantees to wrap all spawned IM queryables with the provided wrapper, satisfying the wrapping guarantee. Since this is the only location where interactive mechanism queryables can be spawned, the wrapping guarantee holds. \square

Proof. (Privacy Guarantee). By the postcondition of ??fm Under the assumption that the input data is a member of the input domain, the precondition of `make_odometer_to_filter` is met, so by its postcondition the return value is a valid odometer queryable. \square