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Can Infopipes Facilitate Reuse in a Traffic Application?

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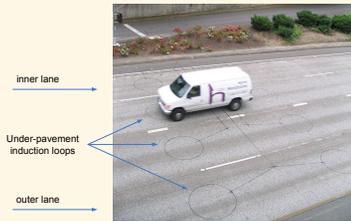


traffic

the problem

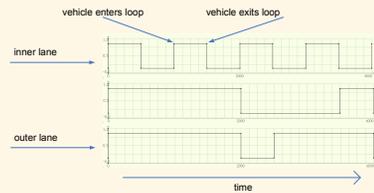
Calculating truck volume on roadways is important in planning, design, and policy decisions. While modern highway instruments can very accurately measure truck volume, many US highways are equipped with antiquated equipment that is designed to detect only total volume.

the hardware



On many US highways, data is collected from single induction loops that lie under the pavement.

Collected data is sent to a station every second for aggregation and analysis.



Aggregated data from each lane can be visualized as a series of pulses. Each pulse represents a vehicle passing over a loop.

a traffic application

We implemented an algorithm described by Kwon and colleagues*. This algorithm allows truck volume to be accurately estimated on a segment of highway using single induction loops. Our implementation of this algorithm is representative of a current, real-world traffic analysis application.

The algorithm rests on two basic assumptions about highway traffic:
The innermost lane contains no trucks.
Velocity in adjacent lanes is closely correlated.

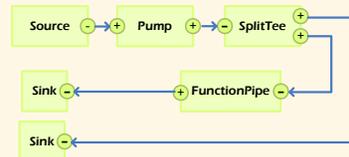
Infopipes are presented as reusable building blocks for streaming applications. To evaluate this claim, we have built a significant traffic application in Smalltalk using Infopipes. This poster presents a traffic problem and solution, a short introduction to Infopipes, and the types of reuse Infopipes facilitate in our implementation.

infopipes

what infopipes are

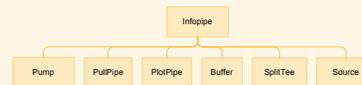
An Infopipe is a software component for processing a continuous data stream. A streaming application is built by reusing old Infopipes or creating new Infopipes and connecting them together.

example infopipeline



general purpose infopipes

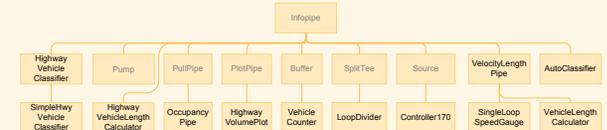
General-purpose Infopipes should be reusable in any application. Below is a class hierarchy of some well known Infopipes.



reuse

inheritance

Infopipes can be subclassed to specialize behavior. In this application, eight Infopipes reused behavior from their superclass. For instance, a VehicleCounter has the same control, data flow, and connection semantics as a Buffer, so a VehicleCounter is a natural subclass of Buffer.

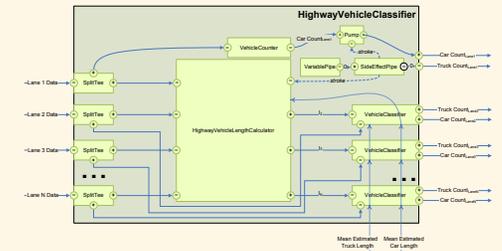


parameterization

Some Infopipes can be specialized by giving them parameters. For instance, the FunctionPipe was specialized in our application to apply a lane-to-lane velocity function.

instance

Infopipes can be reused by instantiating the same Infopipe class in different contexts. For instance, one VehicleClassifier was used for each lane in the HighwayVehicleClassifier.



conclusion

The Infopipe abstraction is useful for facilitating reuse in a real-world streaming application.

* First published in: "Estimation of truck traffic volume from single loop detector outputs using lane-to-lane speed correlation" by J. Kwon, P. Varaiya, A. Skabardonis.