

Programming Languages Literature Review

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Chapter 1

Functional Programming

1.1 Data Structures

An Introduction to the Theory of Lists [1].

Formal definitions for lists and list operations. Discusses common list operations (map, filter, reduce, etc.) and offers best use cases. Provides examples of multiple interacting operations and operation equivalences.

What are infinite lists?

Chapter 2

Object Orientated Programming

2.1 Java

The Expression Problem [3].

Proposes a solution to the expression problem - "goal is to define a datatype by cases, where one can add new cases to the datatype and new functions over the datatype, without recompiling existing code and while retaining static type safety." Solution in GJ creates a series of types that are dependent on one another, and relies on Interfaces for expression evaluation. Type variables can be indexed by any inner class defined in the variable's bound.

I'm not sure I know what "indexing a type variable" is ?

Chapter 3

Machine Learning

3.1 Type Safety

Typesafe Abstractions for Tensor Operations (Short Paper) [2].

Typesafe tensors for tensor operations and machine learning. Tensors created with two types, the type (primitives) of the elements, and the phantom types used to label dimensions. This allows operations to be checked at compile time to ensure that all tensor operations are valid. Typesafe tensors are differentiable and can be type-checked. Computation graphs are also typed, and inputs/ outputs are also type-checked. Examples given for tensor operations - matrix multiplication, tensor contraction. Examples given for NN layers - FC, conv, recurrent (recursive).

Bibliography

- [1] Richard S Bird. An introduction to the theory of lists. In *Logic of programming and calculi of discrete design*, pages 5–42. Springer, 1987.
- [2] Tongfei Chen. Typesafe abstractions for tensor operations (short paper). In *Proceedings of the 8th ACM SIGPLAN International Symposium on Scala, SCALA 2017*, pages 45–50, 2017.
- [3] Philip Wadler. The expression problem. *Java-genericity mailing list*, 1998.