Tool: Printing the intermediate representation

Translate our compiler's intermediate representation (EIN) into a readable latex or unicode format.

In Action

Derivations by hand can be tedious and error-prone. To address that issue we support a higher-order notation. For instance, consider the following Diderot code

```
image(2)[] a;            image(2)[] b;
field#4(2)[]A = a⊛u;     field#4(2)[]B = b⊛v;
field#4(2)[]G = (A*V)/B;
output tensor[3] out =  ∇⊗(G)(pos);
```

> *Note* that that the image type is defined separately. These are the variable names that will be used when printing out the IR.

The differentiation operations ∇⊗∇ are distributed across the tensor operations defined in filed type G. Internally, Diderot's rewriting system applies tensor calculus based rewrites that will distribute the differentiation operation. The user can print out the intermediate representation after the rewriting stage with command line arguments:

> Diderot-Dev/bin/diderotc --readEin3 T.diderot

$$\rightarrow_{refactor} \Big(\frac{((a * \nabla \otimes v) + ((v \otimes \nabla a)))}{b} - \frac{(a * (v \otimes \nabla b))}{((b)^2)} \Big)$$

To see multiple rewriting options we can use command --readEinRewrite:

> Diderot-Dev/bin/diderotc --readEinRewrite T.diderot

$$\rightarrow_{flat} \Big(\frac{-((a * (v \otimes \nabla b)))}{((b)^2)} + \frac{(a * \nabla \otimes v)}{b} + \frac{((v \otimes \nabla a))}{b} \Big)$$

$$\rightarrow_{match} \left(\frac{-((a * (v \otimes \nabla b)))}{((b)^2)} + \frac{(a * \nabla \otimes v)}{b} + \frac{((v \otimes \nabla a))}{b} \right)$$

$$\rightarrow_{refactor} \left(\frac{((a * \nabla \otimes v) + ((v \otimes \nabla a)))}{b} - \frac{(a * (v \otimes \nabla b))}{((b)^2)} \right)$$

$$\rightarrow_{pull-division} \left(((a * \nabla \otimes v) + ((v \otimes \nabla a))) * \frac{1}{b} - (a * (v \otimes \nabla b)) * \frac{1}{((b)^2)} \right)$$

> *Note* There are four rewriting options listed above. The best output can vary by computation. The user can compile the program again and specify a particular rewrite with the command "–readEin" followed by the rewrite number. Thus the command "–readEin3" printed the third rewrite.

By default we print out the latex format. However you can use unicode as well.

> Diderot-Dev/bin/diderotc --readEinUni --readEinRewrite T.diderot

Details

- Branch: Diderot-Dev
- Run: runs with command line flags
    - Format
        - -readEinLatex : latex output (default)
        - -readEinUni : unicode output
    - Rewrite call
        - -readEinRewrite : print four steps of rewriting
        - -readEin1, -readEin2, -readEin3, -readEin4: specify a single step of rewriting
- Issues/Future Work
    - pull out of strands
    - image types needs to be defined separately so we have a unique variable to refer to

Directory Organization

- PVO Example in X1