

# In conclusion... Linnea: Automatic Generation of Efficient Linear Algebra Programs

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## Input

`n = 1000`

`m = 2000`

Matrix `S(n, n)` <SPD>

Matrix `A(m, n)` <FullRank>

ColumnVector `v(m)` <>

ColumnVector `x(n)` <>

`x = inv(S)*trans(A)*v`

## Output (Julia)

```
potrf!('L', S)
```

```
x = ArrayFloat64(undef, 1000)
```

```
gemv!('T', 1.0, A, v, 0.0, x)
```

```
trsv!('L', 'N', 'N', S, x)
```

```
trsv!('L', 'T', 'N', S, x)
```

- Translates linear algebra expressions to optimized sequences of kernel calls.
- Uses knowledge about linear algebra.
- Code generation time between seconds and minutes.
- Speedups over Matlab, Julia, Eigen, and Armadillo up to and exceeding 10×.