SI2-SSI: NIMBLE: Programmable Statistical Modeling for Hierarchical/ Graphical Models

Award: ACI-1550488

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What do we want to do with hierarchical models?

1. More and better MCMC
   - Many different samplers
   - Better adaptive algorithms
2. Numerical integration
   - Laplace approximation
   - Adaptive Gaussian quadrature
   - Hidden Markov models
3. Maximum likelihood estimation
   - Monte Carlo EM / Newton-Raphson
   - Data cloning
4. Sequential Monte Carlo
   - Auxiliary Particle Filter
   - Ensemble Kalman Filter
   - Iterated Particle Filter
5. Normalizing constants
   - Importance sampling
   - Bridge sampling
   - Others
6. Model assessment
   - Bootstrapping
   - Calibrated posterior predictive checks
   - Cross-validation
   - Posterior re-weighting
7. Idea cominbations
   - PF + MCMC
   - MCMC + Laplace/quadrature

NIMBLE Components

1. **Domain-specific language (DSL) for statistical models**
   - We adopt and extend the widely-used BUGS language
2. **Domain-specific language embedded within R for model-generic algorithms**
3. **Code-generator (compiler) that generates C++ from the model and algorithms DSLs.**
   - C++ objects are managed from R by dynamically-generated interface classes
4. **Algorithm library (MCMC, SMC, etc.)**

Core Team

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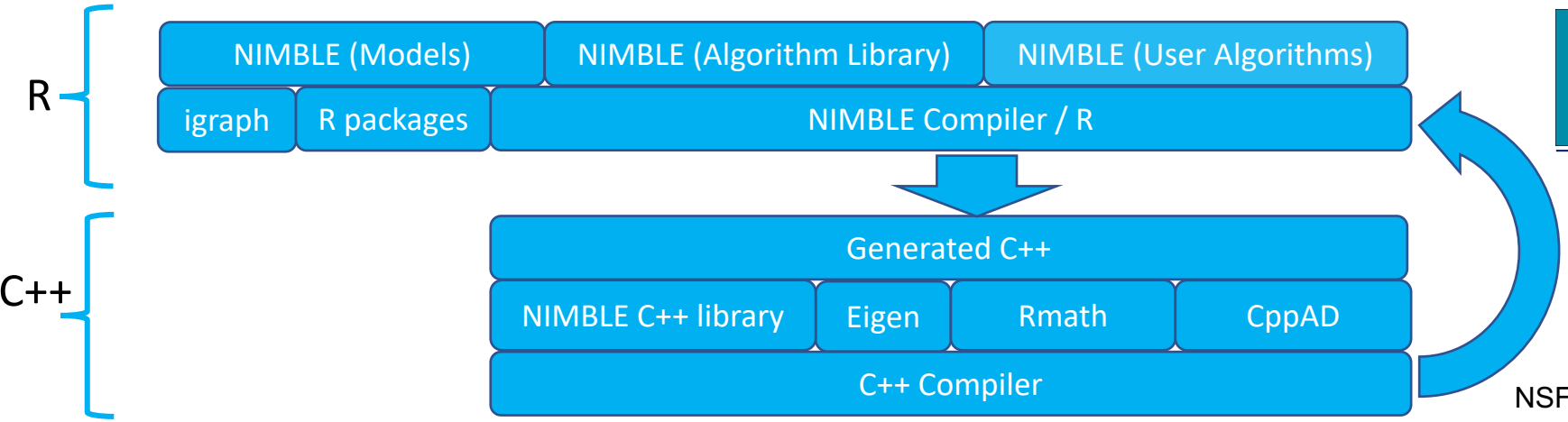

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Programming With Models: Writing Statistical Algorithms for General Model Structures With NIMBLE

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https://r-nimble.org

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