Rationale for design of Pharsight Modeling Language (PML)

Michael R. Dunlavey, Robert H. Leary
Certara/Pharsight Corp.

Introduction

PML uses similar semantics to other languages for nonlinear mixed-effect modeling, with fixed effects, random effects, and observational error, combined with ordinary differential equations and arbitrary dosing and time-varying covariates. PML differs in that it tries to follow the philosophy of declarative languages, in which the language describes the problem, not the solution to the problem. To this end:

1. It simplifies the writing of unusual models, such as enterohepatic reflux, time-to-event, count, ordinal, binomial, etc.

2. It is not necessary to rewrite the model to select a different ODE solver or a different modeling engine. It makes heavy use of symbolic differentiation to accomplish this.

3. It can be embedded in an existing statistics-oriented language (R), facilitating orchestration of model development from within scripts.

4. It can be embedded in an existing statistics-oriented language (R), facilitating orchestration of model development from within scripts.

1. Simplify the writing of unusual models

# TIME TO EVENT

event(occur, hazard)

# COUNT

count(n, hazard)

# ORIGINAL

original(obs, linkFunc, x, slope, intercept, intercept2, ...)

# DLC

obs(cObs = c * (1 + eps), bql)

# ENTEROHEPATIC REFUX

sequence {

# BQL

doReflux = 0

while(1){

sleep( offTime )

reflux = 0

sleep( initialOffTime )

}

}

2. Symbolic differentiation allows ODE model to be used with Matrix-exponent, and stiff ODE solvers, obviates explicit Mu-modeling, etc.

3. Embed models in R to facilitate scripted development

4. Facilitate Trial Designer models by incorporating several fitted models, without error-prone transcription

References

Certara Corp.
Phoenix 1.4 Modeling Language Reference Guide.pdf