

# Package ‘IntLik’

February 19, 2015

**Type** Package

**Title** Numerical Integration for Integrated Likelihood

**Version** 1.0

**Date** 2012-01-25

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**Depends** maxLik

**Description** This package calculates the integrated likelihood numerically. Given the Likelihood function and the prior function, this package integrates out the nuisance parameters by Metropolis-Hastings (MCMC) Algorithm.

**License** GPL-2

**LazyLoad** yes

**NeedsCompilation** no

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## Description

This package calculates the integrated likelihood numerically. Given the Likelihood function and the prior function, this package integrates out the nuisance parameters by Metropolis-Hastings (MCMC) Algorithm.

**Details**

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 Type: Package  
 Version: 1.0  
 Date: 2012-01-25  
 License: GPL

### Author(s)

Zhenyu Zhao <zhenyuzhao2014@u.northwestern.edu>

### References

Chib, S. and Jeliazkov, I. (2001) Marginal likelihood from the Metropolis-Hastings Output. *Journal of the American Statistical Association*. 96, 270-281

Severini, T.A. (2007) Integrated likelihood functions for non-Bayesian inference. *Biometrika*. 94 529-542

### Examples

```
##Integrated Likelihood for Ratio of Normal Mean (Example 2 in Severini 2007)
##Generating Data
n=10
u1=4
u2=1/5
x=rnorm(1,u1,sqrt(1/n))
y=rnorm(1,u2,sqrt(1/n))

##Calculate MLE for the start value
psi_hat=x/y
lambda_hat=(x*psi_hat+y)/(psi_hat^2+1)

#Define prior function
prior=function(lambda,psi){
dnorm((psi^2+1)*lambda/(psi*psi_hat+1),mean=0,sd=1)*(psi^2+1)/(psi*psi_hat+1)
}

#Define Likelihood
L=function(psi,lambda){
L=n/2/pi*exp(-n/2*((x-psi*lambda)^2+(y-lambda)^2))
L
}

#Estimate the Integrated Likelihood evaluated at a sequence of psi
ILik(L,prior, start=lambda_hat, seq(psi_hat-10,psi_hat+10,1), 1, "Normal")
```

IntLik

*Numerical Integration for Integrated Likelihood***Description**

This function calculates the integrated likelihood numerically. Given the Likelihood function and the prior function, this function integrates out the nuisance parameters by Metropolis-Hastings (MCMC) Algorithm.

**Usage**

```
ILik(L, prior, start, psiseq, psidim = 1, proposal = "Normal", iternum = 1000)
```

**Arguments**

L	Likelihood function with two arguments, defined in form of $L(\psi, \lambda)$ , where $\psi$ is the parameter interested in and $\lambda$ is the nuisance parameter. $\psi$ and $\lambda$ can be scalar or vector.
prior	Prior function for $\lambda$ , in form of $\text{prior}(\lambda, \psi)$ , which can depend on $\psi$ .
start	Starting value of $\lambda$ to search for the MLE of $\lambda$ given certain $\psi$ .
psiseq	The sequence of $\psi$ for which the integrated likelihood will be evaluated at.
psidim	The dimension of $\psi$ . If default value is 1.
proposal	The proposal distribution used in MCMC procedure, with two options: "Normal" and "Gamma". For $\lambda$ which can take any value, then proposal distribution can be set as "Normal". For $\lambda$ which can only take positive value, e.g. variances, then the proposal distribution should be set as "Gamma". The default value is "Normal".
iternum	The number of iteration in the MCMC procedure.

**Value**

This function return a vector of estimated Integrated Likelihood evaluated at the given  $\psi$  sequence.

**Author(s)**

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