SPOTless

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December 8, 2012

SPOTless is a tool for modeling semidefinite programming (SDP) problems, with an emphasis on those associated with sum-of-squares (SOS) programming. There are a number of freely available tools for addressing this and similar problems, but SPOTless is particularly designed to for *building libraries*. If the reader is interested in modeling a single SOS or SDP problem, for most purposes we recommend YALMIP or CVX as alternatives.

SPOTless consists of two basic layers: a simple symbolic algebra library, and a system for describing SDP and SOS problems. This second layer makes calls to several external optimization programs, (in particular GLPK and SeDuMi) to prepare and solve these problems – no solver is included.

1 Quick Start Examples

```
%--- Generate Problem Data:
n = 2; N = 1000;
X = randn(n,N);
Y = exp(-sum(X.^2)) + 0.01*rand(1,N);


%--- Construct a new SOS Program.
pr = spotsosprog;

%--- Define function to fit to data.

% Create a n-by-1 symbolic variable, with name x.
x = msspoly('x',n);
% Create a basis for fitting.
% All terms (x(1)^a(1)*...*x(n)^a(n)), s.t. sum(a) in 0:4.
basis = monomials(x,0:d);

% Create a polynomial, f = coeff'*basis, where
% coeff are new free variables.
[pr,f,coeff] = pr.newFreePoly(basis);
```

```
%-- Provide conditions to ensure f is convex.
% Construct the Jacobian of f w.r.t x.
Df = diff(f,x);
% Construct the Hessian of f w.r.t x
H  = 0.5*diff(Df',x);
% Make another n-by-1 column of indeterminates.
q = msspoly('q',n);
% Require q'H(x)q to be a SOS
pr = pr.withSOSMatrix(H);
```

2 Classes

2.1 msspoly

2.2 spotsqlprog

2.3 spotsosprog