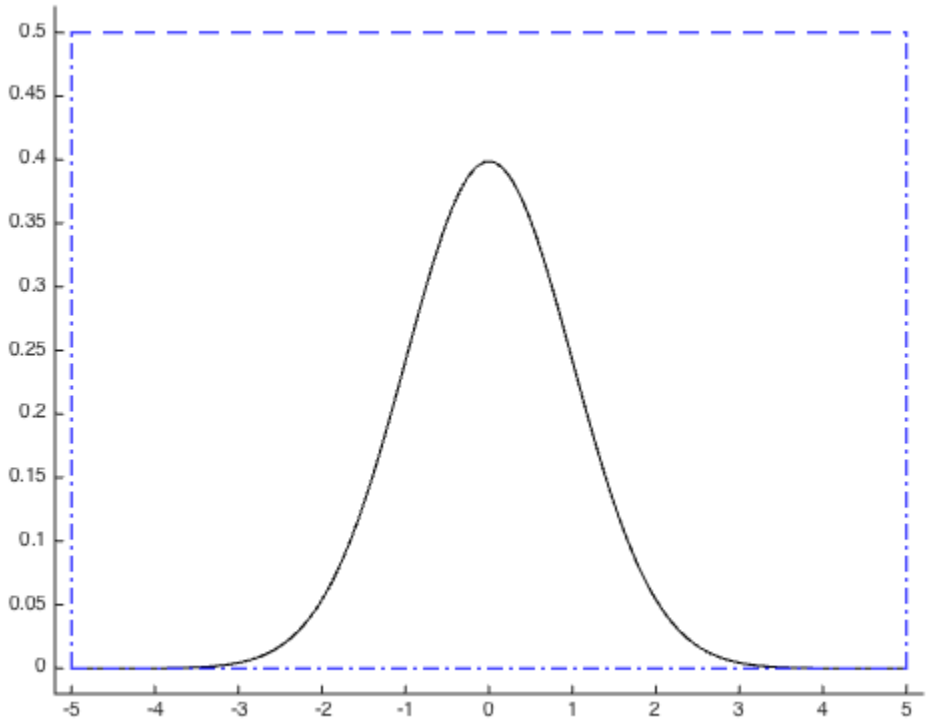
```
function [] = example2_monte_carlo()

    figure;
    % Allow overlapping multiple plots on the same figure.
    hold on;
    % 100 equally spaced samples in [-5, 5].
    x = linspace(-5, 5, 100);
    % Plot function to be integrated.
    plot(x, f(x), 'k');
    % Plot region to be integrated over.
    plot(xlim, [0 0], 'b-.')
    plot(xlim, [0.5 0.5], 'b--')
    plot([-5 -5], ylim, 'b-.')
    plot([5 5], ylim, 'b-.')
    % Adjust axes
    xlim([-5.2 5.2]);
    ylim([-0.02 0.52]);

    % Number of Monte Carlo steps.
    N = 10^5;

    % First compute integral using a for loop. 'toc' will return the
    % elapsed time since a call to 'tic'
    tic;
    hits = 0;
    for i=1:N
        hits = hits + simulate_pt();
    end
    for_estimate = hits/N*(0.5*10)
    toc;

    % Rewritting the operation in a vectorial fashion will significantly
    % speed up its execution.
    tic;
    vectorised_estimate = sum(unifrnd(0, 0.5, N, 1) < f(unifrnd(-5, 5, N, 1)))/N*(
    toc;

    % Create a parallel pool of 4 workers.
    pool = parpool(4);

    % If executed when a pararell pool of workers is available, parfor will
    % distribute the iterations of the loop among the available workers.
    %
    % MATLAB identifies hits as being a reduction variable and gets the
    % correct value at the end of the parfor despite the concurrent
    % execution. Note that this wouldn't work with examples such as
    % computing a Fibonacci sequence.
    tic;
    hits = 0;
    parfor i=1:N
        hits = hits + simulate_pt();
    end
```

```
    parfor_estimate = hits/N*(0.5*10)
    toc;

    % Run the parfor loop a second time and notice the decrease in
    % execution time. There seems to be some startup cost associated with
    % the first execution of parfor after creating a pool.
    tic;
    hits = 0;
    parfor i=1:N
        hits = hits + simulate_pt();
    end
    parfor_estimate_bis = hits/N*(0.5*10)
    toc;

    % Close parallel pool.
    delete(pool);
end

function [ret] = f(u)
    % It is important to use .^ rather than ^ so that the exponentiation is
    % done element-wise if the function is called with a vector as input.
    ret = exp(-u.^2/2)/sqrt(2*pi);
end

function [ret] = simulate_pt()
    % Draw a random location within the search space and return whether it
    % is located under the curve defined by function f(x) or not.
    rand_x = unifrnd(-5, 5);
    rand_y = unifrnd(0, 0.5);
    ret = rand_y < f(rand_x);
end
```

```
for_estimate =

    0.9969

Elapsed time is 7.063251 seconds.

vectorised_estimate =

    0.9949

Elapsed time is 0.005609 seconds.
Starting parallel pool (parpool) using the 'local' profile ... connected to 4 work

parfor_estimate =

    1.0030

Elapsed time is 4.114996 seconds.

parfor_estimate_bis =
```

```
    1.0082

Elapsed time is 2.129472 seconds.
Parallel pool using the 'local' profile is shutting down.
```



Published with MATLAB® R2014b