# LTCC Advanced Course

**Title:** High-Dimensional Statistics

**Basic Details:**
Core Audience: 2nd/3rd year, Statistics
Course Format: Extended, 5 x 2hr lectures

**Course Description:**
A brief introduction to high-dimensional statistics, focusing on sparse linear regression, covariance estimation, and principal component analysis. This course will also introduce some concentration inequalities and basic random matrix theory, which are commonly used in theoretical statistics and probability outside of high-dimensional statistics.

**Key words:** High-dimensional statistics; concentration inequalities; regression; sparsity

**Syllabus:**
1. Problem introduction and motivation. Discussion of sparsity and penalization. Introduction to concentration inequalities.
2. Concentration inequalities continued. Isoperimetric inequalities (time permitting).
3. Random matrices and covariance estimation
4. Sparse linear models in high-dimensions
5. PCA and sparse PCA (principal component analyses)

**Recommended reading:**
Chapters 1, 2, 6, 7 and 8 of High-Dimensional Statistics: A Non-Asympotic Viewpoint by Martin J, Wainwright, Cambridge University Press.

**Additional or optional reading:**
Chapters 3, 4, 5 of High-Dimensional Statistics: A Non-Asympotic Viewpoint by Martin J, Wainwright, Cambridge University Press.

**Prerequisites:** Fundamentals of probability and statistical inference.

**Format:**
- Number of discussion/problem sheets: 2
- Electronic lecture notes: Yes
- Necessary support facilities: Projector and black/whiteboard
- Proposed timing: Preference for winter session
- Lecture/computer session/tutorial/discussion split (hours of each): All lecture based, no tutorials. Discussions are embedded in lectures.

**Lecturer Details:**
- Lecturer: Yanbo Tang
- Lecturer home institution: Imperial College London
- Lecturer e-mail: yanbo.tang@imperial.ac.uk