Successful candidates of the MSc "Statistics in Smart Data" degree will have a solid background in the following statistical, mathematical and IT subjects:

Analysis

- **Sets:** Sets, subset and inclusion. Union and intersection of sets, difference of two sets, complement of a subset. Countable sets. Mapping between two sets. Direct and inverse image of a set by a mapping. Inverse mapping. Injective, surjective and bijective mappings. Composition of two mappings.
- **Sequences and series of real numbers:** Limit of real valued sequences, convergence and divergence. Equivalent sequences. Monotone sequences. Partial sums and convergence of series. Absolute convergence of a series. Geometric and exponential series.
- **Functions defined on the real line**: Definition of a function, graph of a function. Limit of a function at a given point and continuity. Derivative of a function, tangent equation and usual properties of derivatives (derivation of a product, a quotient or a composition of functions, derivative of the inverse). Odd, even and periodic functions. Derivative and variations of a function. Usual functions: exponential, logarithm, power, sine and cosine. Convex functions. Primitive of a function. Riemann sums, Riemann integral and area under a curve. Basic properties of the Riemann integral. Integration by parts and change of variables formula.
- **Functions of several variables:** Partial derivatives. Gradient. Hessian matrix. Taylor expansions. Optimization without constraints: first-order and second-order conditions. The case of convex functions. Integration of functions of several variables. Fubini theorem.
- **Norm, scalar product and Euclidean space:** Definition of a norm, of a distance. Scalar product and associated norm. Cauchy-Schwarz inequality. Orthogonal vectors. Euclidean spaces. Orthonormal basis. Gram-Schmidt process. Distance between a point and a vector subspace, orthogonal projection and expression in an orthonormal basis. Orthogonal complement of a vector subspace. Affine hyperplanes in Euclidean spaces.