String theory is born with the aim of explaining strongly interacting fields and has then shifted its interest to the research of a quantum theory of gravity. A big achievement is that of gauge/gravity correspondence, where quantum field theories are dualized in classical gravitational theories. This is very useful to compute some quantum effects by switching to a gravitational theory. The most prominent example of such dualities is the AdS-CFT correspondence that relates a conformal field theory in d dimension to a classical gravitational theory in $d+1$ dimensions whose geometry is asimptotically that of Anti de Sitter spacetime. This is quite extraordinary since this is a duality between a theory with gravity and a theory without gravity. The idea came across with the study of thermodynamical properties of black holes. The entropy of a black hole should give a measure of its degrees of freedom and it should thus be proportional to the volume of the black hole. However, the entropy is directly proportional to the area of the horizon (so with one less dimension). This analogy to that of an hologram led to the name holographic principle for this stunning idea. With the success of this principle in the application to AdS-CFT, its importance is now aknowledged by many physicist. Even if the correspondence is born to study relativistically invariant theories (such as AdS) mapped to scale invariant theories (conformal field theories), it can be generalized to many other cases. It is quite interesting to consider condensed matter systems, that are somehow governed by strongly coupled physics. Such systems present anisotropic or dynamical scaling, where space and time have different scaling properties, i.e. $t \to \lambda^z t$, $x \to \lambda x$. This of course breaks relativistic invariance and, thus, the dual theory cannot be conformally invariant. However, such theories are interesting and arise in condensed matter problems. A typical example is that of a Lifshitz field theory, that is a scalar field theory whose action is given by:

$$\mathscr{L} = \int d^2x dt ((\partial_t \phi)^2 - k(\nabla^2 \phi)^2)$$

Holographic duals to this theories are quite difficult to find and are usually ad hoc construction of gravity theories with Lifshitz geometry. This duals have metrics parametrized by z:

$$ds^2 = R^2 \left(r^{2z} dt^2 - \frac{dr^2}{r^2} - r^2 dx^2 - r^2 dy^2 \right)$$

and this metric is a classical solution of gravity with cosmological constant and a massive gauge field. However, string theories solutions that provide an holographic dual to Lifshitz theories are much more difficult to find.

On the other hand, AdS solutions are quite known and well understood. The idea of my work is then to look for a new way of understanding Lifshitz theories by associating them to an AdS theory. More precisely, I have worked in the context of four-dimensional $N = 2$ gauged supergravity where supersymmetric solutions with Ads or Lifshitz symmetry are known. With the field content and the gaugings fixed, I have looked for a theory that has vacua presenting the two symmetries. If two such solutions are found, this means that our theory admits solutions with spacetimes with one region asymptotically AdS and one of Lifshitz type. Using a radial coordinate, we can perturbate one of the two vacua and roll on to the other one. We can then consider the holographic correspondence with the field theory and, more precisely, it is natural in such correspondences to identify the distance from the horizon with an energy scale on the dual field theory side. We can then interpret this solution as a renormalization group flow from a conformal field theory to a Lifshitz-like field theory. At field theory level, the flow is given by the running of the energy scale identified with the radial coordinate in the gravitational theory. We would then have a field theory that at an energy scale is conformally invariant and at another scale flows to a theory with dynamical scaling. Since we know the dual of many AdS vacua, we can identify this field theory with a deformation of a gauge theory. So, we have a gauge theory that, after deformation, flows either to a conformal field theory or to a Lifshitz-like theory.

After having studied $N = 2$ gauged supegravity, I choose a model with only one hypermultiplet and an abelian gauging of two of its isometries. I have considered models with two and three vector multiplets and gaugings that can be both electric and magnetic. Throughout the work I have found several solutions with either AdS or Lifshitz symmetry, but none of them is inside the same theory. I have also shown that, within the particular hypermultiplet manifold chosen, an AdS solution with purely electric gaugings cannot exist, even with an arbitrary number of vector multiplets. When the gaugings are a mixture of electric and magnetic, I find some solutions both in AdS spacetime and in Lifshitz. However, Lifshitz-like solutions impose restricting conditions on the charges that are incompatible with AdS solutions.