<table>
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<th>Course 11</th>
<th>SVMs and Regularized Learning</th>
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| 1. **Introduction:** | - Modelling, Optimization and Regularization.  
|          | - Classical Unconstrained Optimization.  
|          | - Examples in Constrained Optimization.  
|          | - Linear classifiers, margins and generalization.  
|          | - Linear Support Vector Machines; primal problem.  
|          | - Lagrangian formulation and dual problem.  
|          | - KKT conditions and optimal solution.  
|          | - Linear classifiers revisited: Cover's theorem.  
| 2. **SVM models:** | - Kernelization and non-linear SVMs:  
|          |   - Non-linear classification in feature spaces.  
|          |   - Common kernel choices.  
|          |   - Parameter tuning.  
|          | - Support Vector Regression:  
|          |   - Regression problems.  
|          |   - Epsilon-insensitive loss.  
|          |   - Primal and dual formulations, kernelization.  
|          | - One-class Support Vector Machine:  
|          |   - Density estimation problems.  
|          |   - Primal and dual formulations, kernelization.  
|          |   - Kernels for non-vector data.  
|          | - Other SVM-related models.  
| 3. **SVM learning algorithms:** | - Brief introduction to convex optimization.  
|          | - Non-linear SVM learning algorithms:  
|          |   - Chunking and decomposition methods. SVMlight.  
|          |   - Sequential Minimal Optimization. LIBSVM.  
|          | - Linear SVM learning algorithms:  
|          |   - Primal solver: Pegasos.  
|          |   - Dual solver: LIBLINEAR.  
|          | - Practical work with SVMs.  
| 4. **Convex non differentiable optimization:** | - Convex optimization problems.  
|          | - Subgradients and subdifferential calculus.  
|          | - Proximal optimization.  
|          | - Proximal methods: Forward-backward Splitting, Douglas-Rachford, Dykstra, etc.  
|          | - The ISTA and FISTA algorithms.  
|          | - Application to regularized learning: lasso, elastic nets, group variants, fused lasso.  
|          | - Application to image processing.  
|          | - Application to projection problems.  
<p>|          | - Practical work with proximal methods.  |</p>
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