

# Pattern Recognition in SS 2012

## Programming of Machine Learning Algorithms for Smartphone Sensors

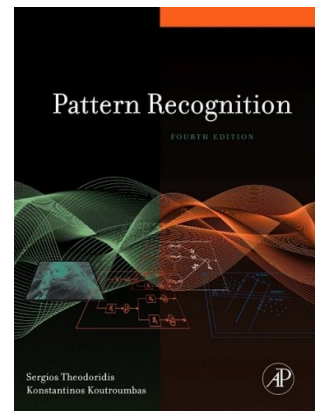
Lectures: Prof. Dr. Marcin Grzegorzek\*  
Exercises: Dr. Tomasz Staś, Dipl.-Inform. Matthias Mielke  
Studiengang: Master Bildinformatik; Wahlpflichtblock: Vertiefung Bildinformatik

<http://www.pr.informatik.uni-siegen.de/Courses/Summer12>

In broad sense, pattern recognition has been around since our earliest ancestors learned which animals they could approach to hunt and which they should flee from. They were doing classification based on features like size, length of teeth, temperament, etc. Nowadays, robots can do the same. If you want to learn how machines recognise dangerous animals, you should attend the lecture pattern recognition.

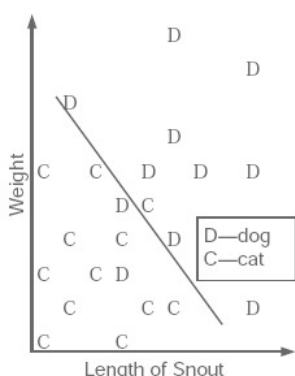
## 1 General about the Course

**Lecture** We are going to take you on a trip through the state-of-the-art pattern recognition algorithms and methods. The course will follow the structure proposed in the book depicted on the right-hand side which is available in our library. It is obvious that the scope of the book is much too wide to be taught in detail within a single course. Therefore, every single lecture will start with a general overview of all approaches from a certain “big” topic (slides) followed by a detailed explanation of only one of them (blackboard) accompanied by many calculation examples and demos, if available. In this way, you will be able to gather knowledge about a general classification of the pattern recognition techniques on the one hand. But on the other hand, you will learn in detail about selected algorithms from this area.



**Exercises** In the exercises we will realise programming projects on smartphones with Android, iOS, and Microsoft-based OS in small groups. Today’s smartphones are equipped with a number of sensors providing data that can be used for learning of the user behaviour and condition models as a function of the sensor values (profiling). Using appropriate pattern recognition techniques these models can be then used for automatic detection of abnormal situations with regard to users’ behaviour or condition. For example, we will develop prototypical apps for driver condition analysis, depression detection and prediction, etc.

## 2 What is Pattern Recognition?



What is actually a pattern? The patterns associated with pattern recognition are not single instances of patterns in a signal not an area of stripes in an image or an interval of sinusoids in a sound clip. Instead, they are patterns of features that repeat across different samples. For instance, an image of a plowed field may have a stripe pattern whose feature can be found by Fourier analysis. Pattern recognition pertains not to the single stripe pattern, but to the pattern of a number of different image areas having that same stripe pattern, by which they are classified together (and distinguished from areas of other features).

Now lets focus on the word recognition. In a broad sense, recognition implies the act of associating classification with a label. Using the figure on the left-hand side, that would say that those samples falling into the upper right region are

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recognised as dogs and those in the lower left are recognised as cats. Strictly speaking, pattern recognition doesn't go so far. Pattern recognition says only that the upper right samples are classified as having higher weight and longer snouts. Determining that this category is that of dogs is one step above pattern recognition.

Concluding, pattern recognition is a field whose objective is to assign an object or event to one of a number of categories, based on features derived to emphasise commonalities. In practice, features are often extracted from sensory signals, such as images or audio.

### 3 Contents

#### I. Supervised Algorithms

- Classifiers Based on Bayes Decision Theory
- Linear Classifiers
- Nonlinear Classifiers
- Feature Selection
- Feature Generation
- Template Matching

#### II. Unsupervised Algorithms

- Context-Dependent Classification
- Clustering: Basic Concepts
- Clustering: Sequential Algorithms
- Clustering: Hierarchical Algorithms
- Clustering: Schemes Based on Function Optimisation

### 4 Organisational

Course No. in LSF	1122431211
Semester	SS 2012
Who	Studiengang: Master Bildinformatik Wahlpflichtblock: Vertiefung Bildinformatik
Dates and Times	Lectures: Tuesdays 12:15 - 13:45 Exercises: Wednesdays 12:15 - 13:45
Begin	Wednesday, 4 April 2012
End	Wednesday, 11 July 2012
Where	H-E 216
Language	English
Questions?	Marcin Grzegorzec Office: H-E 216 Phone: 0271 740 3972 Email: marcin.grzegorzec@uni-siegen.de <a href="http://www.pr.informatik.uni-siegen.de">http://www.pr.informatik.uni-siegen.de</a>

### 5 Registration for Participation

There is no registration via LSF. If you want to participate, just come to the first lecture on April, 4, 2012, 12:15 in H-E 216.