The evaluation of clinical magnetic resonance (*MR)* images is influenced by errors (subjective evaluation, noise, etc.). It is possible to eliminate these errors by using certain mathematical and statistical methods. One of these methods is texture analysis (*TA*), which can describe images quantitatively by computed texture parameters.
The aim of this thesis was to analyze *MR* images of various subjects (phantoms, apples, calf muscles, livers) by *TA* and to evaluate its possible use in clinical practice. The main tasks of the thesis were:
1) to develop a new phantom suitable for *TA* and *MR* imaging that is biochemically and mechanically stable
2) to optimize an algorithm for *TA* parameter selection and classification
3) to apply *TA* in evaluating *MR* images.
The first methodical part of the thesis deals with the optimization of texture parameter selection and texture classification. For this purpose a new type of phantom was developed. This *PSAG* phantom, with a nodular structure from polystyrene spheres (PS) placed into agar (AG), is suitable for *MR* imaging and for *TA* because it produces a strong *MR* signal and because its *T1* and *T2* relaxation times are in the range of biological tissue and can be easily modified by employing various densities of *PS* spheres or by the addition of a contrast agent. Measurements of *PSAG* phantoms using an experimental Bruker Biospec 4.7 T *MR* spectrometer confirmed their stability for at least 12 months.
MR images were analyzed by the program MaZda, which computes about 300 texture parameters [5]. Automatic techniques (Fisher coefficient *Fkoef*, the combined probability of classification error and average correlation coefficients between features *POE*) [6, 7] and a manual algorithm based on invariant texture parameters selected *TA* parameters for image classification, which was done by Raw analysis (*RAW*) and Linear discriminant analysis (*LDA*). *TA* was able to successfully separate phantoms with different diameters of *PS* spheres. The results were verified by data obtained with an experimental SMIS 7 T *MR* machine.
The possible separation of different structures at the limits of resolution using *TA*, measured by a standard sequence with the standard parameters used in clinical examinations, was investigated using five clinical *MR* scanners. These multicenter studies should prove whether *MR* experiments are comparable among various *MR* centers equipped with different *MR* hardware and software. The classification differed (0-60%). The reason was insufficient resolution, as shown by tests conducted at various resolutions with a 1.5 T Siemens Vision clinical *MR* scanner at the Institute for Clinical and Experimental Medicine (IKEM).
The study of phantoms showed that the automatic selection of texture parameters and subsequent classification is overly sensitive to very small differences in pixel intensities (the influence of noise, local inhomogeneity etc), and therefore it is possible to separate even identical textures. These techniques are suitable for the classification of different textures. The algorithm of invariant parameters was developed as a potential method for classifying both the same and different textures.
In the second part of thesis, we apply the results of the phantom study to clinical studies (cirrhotic liver, diseased calf muscle) and food

analysis (comparison of apple varieties).
The *TA* of the liver was divided into two parts. The first part dealt with the analysis of liver tissue measured *in vitro*. We tried to find a correlation between the *TA* parameters obtained from optical and *MR* images. *MR* measurements of liver tissue *in vitro* were performed using the experimental Bruker Biospec 4.7 T *MR* spectrometer, while optical images were obtained by a Camedia C-4040 Z Olympus digital camera. *TA* was able to successfully separate healthy and cirrhotic liver. The best results (100% correct classification) were achieved using data measured by an *MR* gradient echo sequence because this type of sequence is sensitive to any inhomogeneities present in cirrhotic tissue. No statistically significant correlation among *TA* parameters obtained from optical and *MR* images was found.