Question 26

You have, as you write, the block Viterbi algorithm (VA). And for some reason, many code specialists are very interested in this result. But VA has been known for more than half a century. And during this time, a huge number of new good decoding methods have appeared. So why is there so much attention to your BVA? After all, it had little effect on anything. How can I explain such a great attention to your new algorithm?

Answer to question 26

And your attention to BVA is also understandable. Note that VA is the optimal decoding method for error probability , so efficient and simple (in the sense that it performs only the simplest additions and comparisons of small integers!), that with formally exponential growth with the length of the code of its complexity, it immediately provided remarkable characteristics for small codes, permanently excluding algebraic theory from almost all competitions in the field of coding. The only scheme where algebraic codes looked good was the concatenated scheme with VA and the Reed-Solomon code. But this version of concatenation was very successful again thanks to VA. Simply because VA is the convenient optimal decoder (OD)

VA is well studied in all aspects and is applicable almost everywhere.

But it is for convolutional codes. Turning it into a block algorithm usually leads to a very inconvenient reduction in the final code rates R compared to the original ones, which allowed supporters of the classical approach to continue to deal with strange algorithms like Chase and so on, explaining all games with such very inconvenient block algorithms to some technical needs.

Attempts by another direction of "theorists" to decode optimally block codes based on convolutional ones allowed us to create such an algorithm without losing the original code rate R , but with a doubled exponent of complexity $N \sim 2^{2K}$. It is clear that all these results of "algebraists" are useless at all! However, due to this "method" and decoding with all sorts of "aggregates" already a huge (!) number of "specialists" managed to defend even doctoral dissertations. But the complexity of decoders based on such "achievements", as we wrote in our recent reviews, sometimes exceeds the complexity of our similar BVA-based decoders by 16'000 or more times, and somewhere for very reasonable parameters of code structures even by 10^{200} times (!), which is by hundreds of orders in magnitude more than the number of atoms in the Universe!!!

So before us, before MTD, VA and BVA, there were no real and optimal algorithms available for implementation, i.e. OD, at all!

And then what are the advantages of our already patented BVA? Yes, it does not change the rate R of the convolutional code on which base it is built, and it has the same complexity N as for the convolutional VA, which is of the same

order: $N \sim 2^K$! Here K is of course the degree of the generating polynomial of the convolutional code. But no one has done this during the 50 years since the discovery of convolutional VA and the agony of not having a good block analogical one.

So now we have an analog! And it is as simple as a convolutional VA. So what's too happy about it? For block codes, ODs have now been created both on the basis of the MTD and on the basis of the BVA. Both are in their class the simplest possible. So, the methods of "algebraists" can be completely forgotten forever! And this is extremely important. They all were extremely non-technological.

But BVA have showed else others of its most valuable qualities. Convolutional VA is almost completely characterized by the length K of the code. As for BVA it has two parameters: K and the length of the block code being created n. This is the mass of advantages of BVA, its unexpected and very useful flexibility. After all, by varying only n, you can very significantly change the probability of BVA error probability per block and per bit at a fixed value of K and, of course, for the same code rate R. And if we go to sufficiently large values of n, the error probabilities per bit for the BVA will become the same as for the convolutional VA, which greatly expands the scope of applications of the BVA and which will slightly affect the application areas of the basic convolutional algorithm. All this has already been tested, modeled and fully confirmed experimentally! Read about all these properties BVA in our articles!

This possibility gives special value to the BVA method in addition to the fact that after 50 years of waiting for its appearance, it is now possible to stop all works with algebraic methods for implementing ODs, which have long been completely useless.

And as for the future, on the basis of BVA it will also be much easier to develop and simple good BVA with the incomplete viewed ways. There are no doubts that in a certain parameters area of the code, algorithm, and channel, such BVAnvw will be as effective as the original BVA, but it will be much simpler if we consider the complexity strictly, which we always do, as the number of simplest addition and comparison operations performed by a fabulously perfect algorithm that a once was found by Viterbi.

YES! But this is the subject of another discussion of the of creating good decoders problems to work near the Shannon’s bound, which is that one our OT school has been doing all these years.

We wish you success!

Scientific school OT