

Intelligent Evaluation of Traffic Offender Records

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Abstract: This paper describes an intelligent computer system giving decision support in the area of sentencing of traffic law offenders. The system evaluates the previous record of a traffic offender, and suggests how to consider that record when passing sentence in a new traffic case.

Keywords: intelligent evaluation, intelligent decision support system (DSS), sentencing, traffic law offenders.

1. Introduction

Previous work by us considered the intelligent evaluation of an offender's previous record in the general area of criminal law [1, 2]. The object of that work was to develop an intelligent decision support system (DSS) to help judges (and perhaps other parties in the legal system) to evaluate the previous, general criminal record of an offender, i.e., a person that had been found guilty of some offence. Such an evaluation would be of help to the judge about to pass sentence on the offender. No other work has been carried out on this particular subject.

During that work we considered the possibility of doing similar work on traffic offenders. Intuitively a DSS for this domain might have a different form, as the issues to consider are different than in the general criminal area, but then, perhaps not. Another question that presented itself was to which extent there is a connection between an offender's general criminal record and his traffic offence record. This paper describes the results of our work on the new DSS for evaluating a traffic offender's previous record.

The purpose of the system is *not* to suggest any kind of sentence for the offence at hand, but to evaluate the offender's previous record, and suggest the weight this record should be given in the sentence in the present case.

2. Background

When the judge is about to pass sentence, he can in theory take many factors into account. In practice he will consider only some of these, namely those that have been salient in the case at hand. These factors will then have an aggravating or mitigating

influence on the sentence. One of the factors a judge will often consider is the offender's previous record. It is believed by many that the record is of importance and should carry weight. Thus features like the increase or decrease in the severity of past offences and the time-intervals between consecutive offences ought to bear influence on the sentence in the present case.

What happens in practice in the Israeli courts (and presumably in courts all over the world) is the following scenario: After an accused has been pronounced guilty, the prosecutor hands the judge the "sheet", i.e., the record of previous convictions. This record is a hardcopy printout of the entire record stored in the central Israeli police computer relating to the offender.

There is a practical problem with the previous record: The record is often quite extensive, containing a long list of past offences, which may all be of the same type but often include related types of crimes, or even entirely different types of crimes. The record may also span a considerable number of years. The judge can have great difficulty in acquiring a clear picture of the situation, and he must necessarily devote a lot of time to the interpretation of the record. This time is often not available, and the sentence may therefore not reflect the facts embedded in the past record.

What has been described so far holds for general criminal cases and for traffic offences. There are, however, also some important differences:

1. Traffic offences are usually considered less serious than general criminal offences. The public believes that everybody could be involved and found guilty of a traffic offence, not just professional criminals.
2. The sentences handed out in traffic cases are usually much lighter. Traffic offences only very seldom lead to custodial sentences. The customary sentences are monetary (fines and reparation) and driving disqualification. Often the sentences are deferred (suspended), being applied only in the case of repeated offences within a certain period of time.
3. The public believes that the previous record of traffic offences is of extreme importance. The judges do not all agree, but they are under great pressure from the media. It is a common belief that the previous record ought to have a dominant influence in determining the sentence in the case at hand. The media is happy to publish and point out whenever it is believed that some traffic offender with a large number of previous offences gets off with what is considered too light a punishment.
4. The previous record of a traffic offender submitted in a traffic court exclusively contains traffic offences. Only if the offender has a relevant general criminal record (or perhaps in the case of a professional criminal) will a separate printout of the general criminal record be submitted by the prosecutor.
5. The computer printout of an offender's previous record is very hard to read. It is almost impossible to understand for the uninitiated. This of course is not of great importance, as judges, prosecutors and defense lawyers become familiar with the layout over time.

However, even an experienced judge does not have the time to go through, say 100 previous offence records to see whether how the offender has behaved himself in traffic after receiving previous suspended sentences.

3. Our System: Presentation of Basic Data

From our description of the computer record in the previous section it is clear that the first step in building a DSS must be to present the previous record in a clear manner. This will serve two purposes: (1) It will enable legal practitioners to carry out a speedy overview of the record, (2) It will enable them to proceed to the second step: An intelligent analysis of the record. In order to carry out step (1) we spent a large effort interviewing legal professionals involved in reading such records: Judges, lawyers and police officers.

There is no Artificial Intelligence in this part of the system. Applying basic principles of modern interface design [3] and after several iterations with the legal experts, we have reached a way of presenting the previous record in a way that is easily and speedily overseen.

Figure 0 in the appendix shows the original printout from the police computer. One can imagine how difficult it would be even for a legal professional (a judge, a prosecutor, a defence lawyer or a police officer) to survey such a record if it contains, say, 100 items.

Our assumption is that a user should be able to become familiar with even an extensive past record should take three seconds! Surveying details should take another three seconds. Figure 1 gives brief overview of who the offender is, and what he has done in the past (three seconds). Figure 2 shows what Figure 0 would look like in our system¹ (perhaps another three seconds). The colour code enables the user to get an immediate impression of the different types of offences

If the user has more time - one can imagine a lawyer preparing himself for the present case, or a police officer wishing to estimate the dangerousness of somebody he has stopped on the road - more information is available.

Figure 3 is a graph showing the sentences given in the past: Periods of Disqualification and Fines. Sentences are often combined: Disqualification + Fine, etc. It would be nice if one could present such a combined sentence in one graph. This is impossible, one cannot compare apples and oranges, and one cannot say that 3 months disqualification is more serious than, say, a NIS 10,000 (US\$ 3,000) fine. So we decided to show two graphs in the same screen.

The system interface was established by asking the experts a set of pre-formulated questions. For example:

1. What is wrong, impractical and/or not user-friendly in the old police output?
2. What are you looking for and in which order?
3. Are there data you would like to see sorted in various orders (e.g. dates)?

We did *not* ask whether there was additional data the experts would like to see, even though this seems to be an obvious question. As mentioned above, the printout of the previous record today includes what is stored about the offender in the police computer. Obtaining additional information would call for a major overhaul of police procedure and perhaps the information systems of the entire justice organisation. It would also raise questions of legality of what information the

¹ Obviously all records, computer printouts and screens are in Hebrew. We hope to have them translated (at least partially) before the workshop.

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government should be allowed to keep in its computers, and would certainly necessitate new legislation.

The Knesset (Israel's parliament) is aware of such questions and problems. It has formed an external committee (chaired by one of us - R. Kannai) to consider the kind of questions raised above with respect to all kinds of offenders, traffic and otherwise..

In the theory of expert systems it is well-known that different experts come up with different answers [4]. Sometimes experts outright contradict each other. This phenomenon was indeed observed by us with respect to the layout. The solution was simple (but a bit tricky): We chose the answer that was proposed by the majority. What then invariably happened was that at the next iteration the experts found the solution acceptable - also the ones who initially suggested other approaches.

4. Our System: The Intelligent Component

4.1 Preliminaries

In this section we shall deal with two issues: (1) The complexity of the problem, (2) What kind of system to aim for.

4.1.1 The Complexity of the Problem

The intelligent component of the system aims at analysing the previous record in order to determine the presence and extent of certain factors. These are the factors that influence the decision of the judge in passing sentence in the case at hand.

It was clear to us at the beginning of the project, that a sizable amount of specific domain knowledge would be necessary. The problem of how to evaluate an offender's previous record is far from trivial, even for humans. We shall give just a few examples of the complexity of evaluating a previous record:

1. A person is about to be sentenced for speeding in an urban zone. His past record shows a large number of convictions for parking offences. Should judges take such past offences into account? (A case like this would come to court only in extreme cases).

2. A person is about to be sentenced for speeding in an urban zone. He has but one previous conviction, also for speeding in an urban zone. However, that previous offence was ten years ago. How should that fact bear upon the decision by the judge? This offender has possibly spent the previous nine out of ten years out of the country. Is that information available to the judge?

3. A person is about to be sentenced for driving without a valid licence. His past record shows no convictions for that particular offence, but several quite recent convictions for speeding. How should a judge compare the offences (if at all).

4. A person has been found guilty of driving while his licence was suspended. His past record shows no convictions for this offence, but he has several previous convictions for reckless driving, having been involved in several accidents. Is this situation somehow similar to the one in example 3?

5. A person has been found guilty of reckless driving. He has been found guilty in causing an accident where the other driver was killed. His past record shows that he has several convictions for having neglected to renew his licence and pay the yearly car-tax . How should that fact influence the sentence in the present case? (if at all).

6. Combinations of the above examples occur of course, and complicate matters even further.

4.1.2 The System Architecture

Various system architectures have been used in the past to build DSS in the sentencing domain. In principle we distinguish five kinds of systems: (i) Statistical Systems, (ii) Model-Based Systems, (iii) Case-Based Systems, (iv) Neural Network based system and (v) Rule-Based Systems.

(i) Statistical Sentencing Systems in the general criminal domain have been built in the past [5], [6], [7], but are not in use (except, possibly, for one).

(ii) Model-Based Systems have been proposed, but not implemented.

(iii) A Case-Based Sentencing System like the one described in [8] and [9] is appropriate for a court of appeal. The time span of an appeal case is measured in weeks and months (perhaps even years). A judge at this level has the time to apply a case-based system, convince himself that the retrieved case or cases are indeed relevant, and include the conclusions of the system in his deliberation.

However, our present system is intended for a judge at the lowest level of the judiciary. He often hears several cases a day, he has practically no time for deliberation, and he must hand down his decision the moment counsel and witnesses have had their say. It is therefore clear that a case-based sentencing system would be of no use. The judge simply does not have the time to apply it.

(iv) A neural network based system. Such a system lacks transparency in the sense that the user cannot see clearly how a certain recommendation by the system is derived. Nevertheless, in some legal applications there is a definite place for this kind of system. [10]

(v) A rule-based system is the classical kind of expert system. It uses a knowledge-representation in rule-form and applies logical deduction to the rules. Such a system can be appropriate in our case if:

1. It operates very fast, so the user (judge) receives a qualified answer to a query practically without any waiting time.
2. The output is concentrated and summarised for the user to survey in a moment.

As we shall show below there is no problem in fulfilling both of these conditions. The rule-based paradigm is therefore the appropriate choice for our system. The system is a rule-based system written in Prolog, with the interface (shown in the Appendix) in Visual Basic.

4.2 Deriving and Compiling the Domain (Expert) Knowledge

4.2.1 The Relevant Factors

Having decided on the architecture of the system, we approached the step of compiling the domain knowledge. By this we mean the factors judges use to evaluate an offender's previous record. This is of course where the intelligence is found. Two questions came to mind before beginning interviews with the experts. The first question was to which extent experts would agree among themselves about the factors. The second question was to which extent the relevant factors were different for traffic offences than for general criminal offences.

It appears that experts did not differ in their opinion of what these factors are (or should be). This is both surprising and also a bit disappointing. As developers we would have liked to cope with conflicting opinions.

The factors that judges considered relevant in the general criminal DSS were as follows [1]:

1. Number of Previous Offences (Number of Adult Offences, Juvenile Offences)
2. Seriousness of Previous Sentences
3. Seriousness of Previous Offences
4. Similarity of Offences (Same type of offence, same law paragraph)
5. Frequency of Offences
6. New Offence Committed during Service of Previous Sentence
7. New Offence Committed during Cooling-off Period

The factors that traffic judges found relevant for traffic offences are as follows:

1. Seriousness of previous offences
The offences are categorised as
 - (i) Serious offences:
 - Driving causing death, driving under influence of alcohol and/or drugs
 - Driving during period of disqualification (i.e. while licence is suspended)
 - (ii) Less serious offences (red light, speeding, etc.)
2. Similarity of previous offences
3. Seriousness of previous sentences:
Custodial, licence disqualification, deferred licence disqualification, fine, deferred fine.
4. Driving causing accidents in the past:
Bodily damage, damage to property
5. Present offence committed during period of disqualification arising from a previous traffic offence.
6. Present offence committed during period of deferred disqualification arising from a previous traffic offence.
7. Frequency of offences

4.2.2 The Analysis

The four classical approaches to punishment, Retribution, Deterrence, Prevention and Rehabilitation form a classification of punishment commonly used by the judiciary and by criminologists:

“We have thought it necessary not only to analyse the facts, but to apply to those facts the classical principles of sentencing. Those classical principles are summed up in four words: retribution, deterrence, prevention and rehabilitation. Any Judge who comes to sentence ought always to have those four classical principles in mind and to apply them to the facts of the case to see which of them has the greatest importance in the case with which he is dealing” [Lawton L.J., in: Sargeant (1974) 60 Cr. App. Rep. 74 C.A. at pp.77-84].

We note that the traffic-factors from the previous section are quite similar to the ones found for general criminal offences. This leads to the conclusion (confirmed by our experts) that traffic judges apply the same approaches to traffic offenders.

However, we were somewhat surprised to find that one factor found relevant for the general criminal DSS is not considered important: The total number of offences. The reason could be that even a person with a great number of traffic offences is not considered a professional criminal, neither by the public nor by the judiciary.

In the first version of our prototype we simply gave ad hoc definitions of the weight of the factors described above. However this is too simplistic a view of the weighing of the factors against each other by a human.

There seems no particular reason to postulate complex interrelationships among the factors resulting in a non-linear expression for the final result. However, the computation of the individual weights had to be done in a more detailed and intelligent manner, reflecting the views of the experts (judges). Thus, e.g., frequency of offences is measured as a function of the type of offence.

The system analyses the record it obtains as input, determines the various factors, and assigns them a weight according to the built-in rules derived from interviewing the experts. Based on that computation the system issues a recommendation to the judge of how to consider the previous record within the framework of passing sentence in the case at hand. Figure 4 shows the intelligent output of the system.

We have not been bothered by the fact that different experts assigned slightly different weights to the factors. The contribution of the past record to the sentence in the case at hand is never as great as the contribution of the offence at hand, so there cannot be a great sensitivity in the choice of constants.

5. Conclusion

In the introduction we raised the question about the correlation between general criminal offenders and traffic offenders. We have examined records of offenders who committed both kinds of offences, and also searched the literature. A large number of papers in the field of Criminology address this question, without reaching any definite conclusions. It is therefore not surprising that we have not found any correlation.

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At this stage the system is undergoing testing by the experts under laboratory conditions, not in the courtrooms. It is not clear to what extent the traffic judges in Israel will actually use this system. We have in the past been involved in building DSS for sentencing of various kinds. All were favourably received by the judiciary, legal practitioners and the police. None of these systems are in actual use. This phenomenon has also been observed by others [11]. This question will be the subject of our future work.

6. Acknowledgements

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8. Figures

3 - קצ"ר 103-5 אבירות

תאריך הדפסה: 30/12/2007

** דף מס. : 1 **

הרשעות תעבורה קודמות

זהות: רשיון: 1998 שם: ת. לידה: 10/8/80
 ת. משפט: תיק: 000 יחידה: תעבורה מענייא 08שאילתא

מספר הרשעה: 1

א: פרטי עבירה תאריך עבירה 19/06/1998	סוג תיק דוח בי"מ	תיק משטרה 12374159677	יחידה מרחב דן	מקור ההרשעה בעקבות תשלום	קנס 1000
ב: תאור עבירה 1: (6528) תקנה	א 022	לתיית-1961.	נהיגה כשברמזור אור אדום (בצומת)		

מספר הרשעה: 2

א: פרטי עבירה תאריך עבירה 15/09/1998	סוג תיק דוח בי"מ	תיק משטרה 12373442561	יחידה מרחב דן	מקור ההרשעה בעקבות תשלום	קנס 130
ב: תאור עבירה 1: (5480) תקנה	א 022	לתיית-1961.	אי ציות לתמרור ב-6 (פניית פרטה)		

מספר הרשעה: 3

א: פרטי עבירה תאריך עבירה 15/10/1998	סוג תיק דוח בי"מ	תיק משטרה 15373135564	יחידה מרחב נתביג	מקור ההרשעה בעקבות תשלום	קנס 130
ב: תאור עבירה 1: (5913) תקנה	א 022	לתיית-1961.	אי ציות לתמרור ב-29		

Fig. 0: Computer printout from Israeli Police computer of an offender's previous record of traffic offences.

מערכת לניתוח עבר תעבורתי - [מידע נוסף]

קובץ כלים עזרה

פרטי הנאשם

שם מלא: ישראלי ישראלי | מין: זכר | תאריך לידה: 24/03/1967 | שנת הוצאת רישיון: 1996

תעודת זהות: 1

קטגוריית עבירה: []

גורם עבר תעבורתי: [] | גורם עבר תעבורתי: [] | גורם עבר תעבורתי: [] | גורם עבר תעבורתי: [] | גורם עבר תעבורתי: []

מספר עבירות ועונשים

עבירה 34 | עבירות תעבורתיות ומתוכן 21 ב"מ

קיבלה 0 | מאסרים בפועל 0 | מאסרים על תנאי

קיבלה 4 | פסילות 5 | פסילות על תנאי

עבירות שעבר יותר מ-3 פעמים

פקודה התעבורה 2

תשנת התעבורה 22

פרטים אישיים

הנאשמת/בן/בת 42 ונוה/ת 13 שנים

פירוט לפי קטגוריות עיקריות

0	אורות ופנסים	14	רשיונות ותעודות
1	הולכי רגל	4	כביש
1	חגורות בטיחות	6	תמורים
2	חנייה	1	רמזור
0	מטענים	3	מהירות
0	שונות	1	עקיפות ופניות
		1	תאונות דרכים / חבלה

תוספת ראשונה/ שניה

סה"כ עבירות תוספת ראשונה: 5

סה"כ עבירות תוספת שניה: 7

האם קיים תנאי פעיל

קיים תנאי פעיל 27 חודשים מתאריך 30/11/2005

Fig. 1: Short summary of previous record. Same colour-scheme as in Figure 2.

Intelligent Evaluation of Traffic Offender Records

מערכת לניתוח עבר תעבורתי - [טבלת עבר תעבורתי]

קטגוריית עבירה:

פרטי הנאשם

תעודת זהות	שם מלא	מין	תאריך לידה	שנת הוצאת רשיון
3	אבנר	זכר	11/11/1956	1998

טבלת עבר תעבורתי
 מידע נוסף
 גרף משולב
 ניתוח עבר תעבורתי
 גרף עבר תעבורתי
 גרף עבר פלילי

מיונים

לפי תאריך עבירה
 לפי תאריך גז"ד
 לפי קטגוריית
 לפי העונש שניתן
 לפי מקור הרשעה

אפשרויות נוספות

עבר פלילי
 עבר תעבורתי

תאריך עבירה	מקור הרשעה	תאריך גז"ד	העונש	סוג חקיקה	סעיף	תיאור	העבירה
19/06/1998	תשלום		קנס	תקנות התעבורה	22 א	עובר דרך חייב לקיים את המוראות הניתנות	נהיגה כשברכב מנוע או אדם
15/09/1998	תשלום		קנס	תקנות התעבורה	22 א	עובר דרך חייב לקיים את המוראות הניתנות	אי ציות לתמרוד ב-6
15/10/1998	תשלום		קנס	תקנות התעבורה	22 א	עובר דרך חייב לקיים את המוראות הניתנות	אי ציות לתמרוד ב-29 (האזן)
31/10/1998	תשלום		קנס	תקנות התעבורה	28 א	נוהג רכב חייב להחזיק בידיו את ההגה או הכידון	תצוגה תראית לנהג
25/01/1999	תשלום		קנס	תקנות התעבורה	22 א	עובר דרך חייב לקיים את המוראות הניתנות	אי ציות לתמרוד ב-3
07/02/1999	תשלום		קנס	תקנות התעבורה	28 א	נוהג רכב חייב להחזיק בידיו את ההגה או הכידון	תצוגה תראית לנהג
03/04/1999	תשלום		קנס	תקנות התעבורה	35 א	נוהג רכב ישתמש בכל האפשר בצדו הימני הקיצוני של כב	
17/06/1999	תשלום		קנס	תקנות התעבורה	22 א	עובר דרך חייב לקיים את המוראות הניתנות	אי ציות לתמרוד ב-4
16/10/1999	תשלום		קנס	תקנות התעבורה	97 א	לא ינהג אדם רכב מנועי בזמן תאורה אלא כשפנ	הפנסים האחוריים אינם מאיר
10/05/2000	תשלום		קנס	תקנות התעבורה	37 א	לא ינהג אדם רכב בכל קטע של כביש חד-סטרי	נהיגה בכיוון ההפוך בכביש חד-
18/05/2000	תשלום		קנס	תקנות התעבורה	83 ב	לא ינהג אדם ברכב להסעת תלמידים, אלא אם כ	נהג ללא תגורות בטיחות
01/06/2000	תשלום		קנס	תקנות התעבורה	22 א	עובר דרך חייב לקיים את המוראות הניתנות	אי ציות לתמרוד ב-37 עמוד
04/06/2000	תשלום		קנס	תקנות התעבורה	71 ב	לא יעצור אדם רכב, לא יעמידנו, לא יתנהו ולא י	הבעצירה (כולל העמדה ותניהו)
05/06/2000	תשלום		קנס	תקנות התעבורה	83 ב	לא ינהג אדם ברכב להסעת תלמידים, אלא אם כ	נהג ללא תגורות בטיחות
10/05/2000	פס"ד	21/06/00	קנס	פקודת התעבורה	10 א	לא ינהג אדם רכב מנועי אלא אם הוא בעל	נהיגה ברכב מנועי או במכוון
06/08/2000	תשלום		קנס	תקנות התעבורה	28 ב	האמור בתקנת מסנה (א) לא יחול על תצוגה החיי	שימוש בעלפון בעת שהרכב נע
27/08/2000	תשלום		קנס	תקנות התעבורה	28 א	נוהג רכב חייב להחזיק בידיו את ההגה או הכידון	אי החזקת הגה של רכב מנועי בע
	תשלום		קנס	תקנות התעבורה	83 ב	לא ינהג אדם ברכב להסעת תלמידים, אלא אם כ	נהג ללא תגורות בטיחות

Fig. 2: An offender's previous traffic record as it appears in our system (not on scale - in actual system it appears as a full screen). The fields are coloured according to different kind of traffic offences (red light, speeding, invalid licence, etc.).

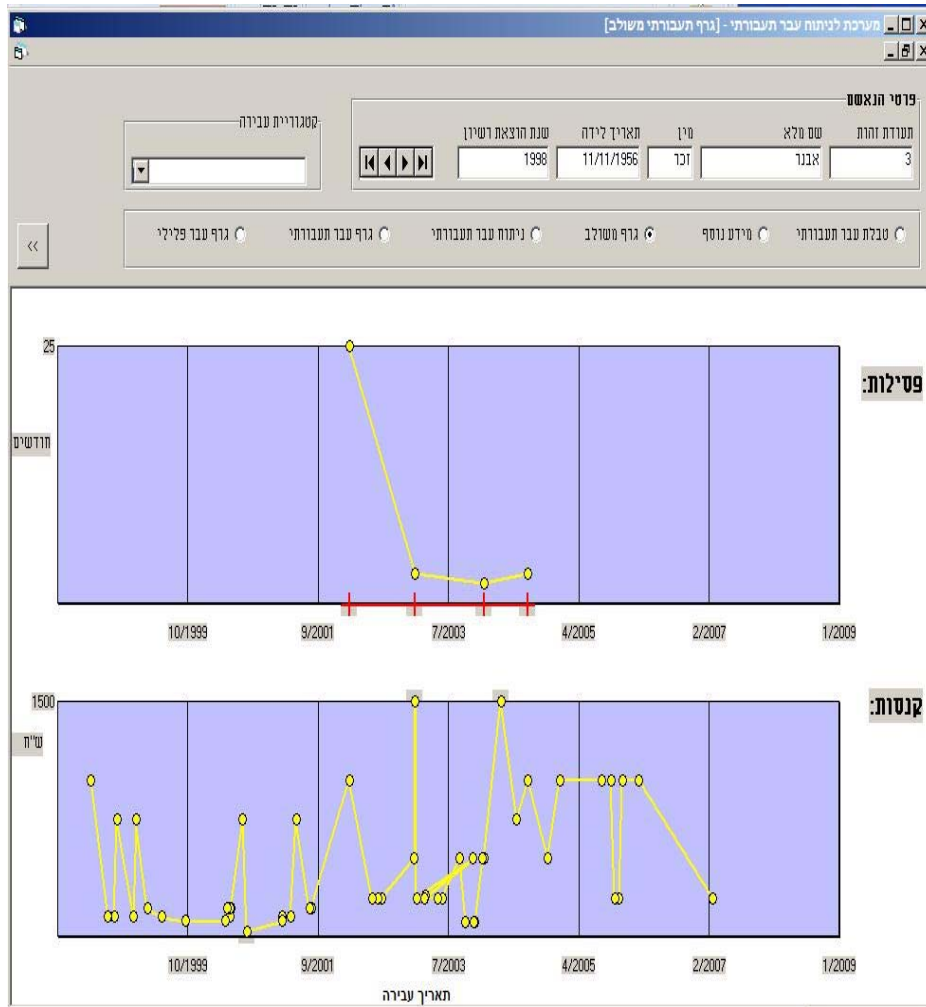


Fig. 3: Graph showing sentences over time. The upper graph shows sentences of driving disqualification, and the lower graph shows fines (not on scale - in actual system it appears as a full screen). The y-axis indicates months (for disqualification) and sums in NIS (for fines).

Intelligent Evaluation of Traffic Offender Records

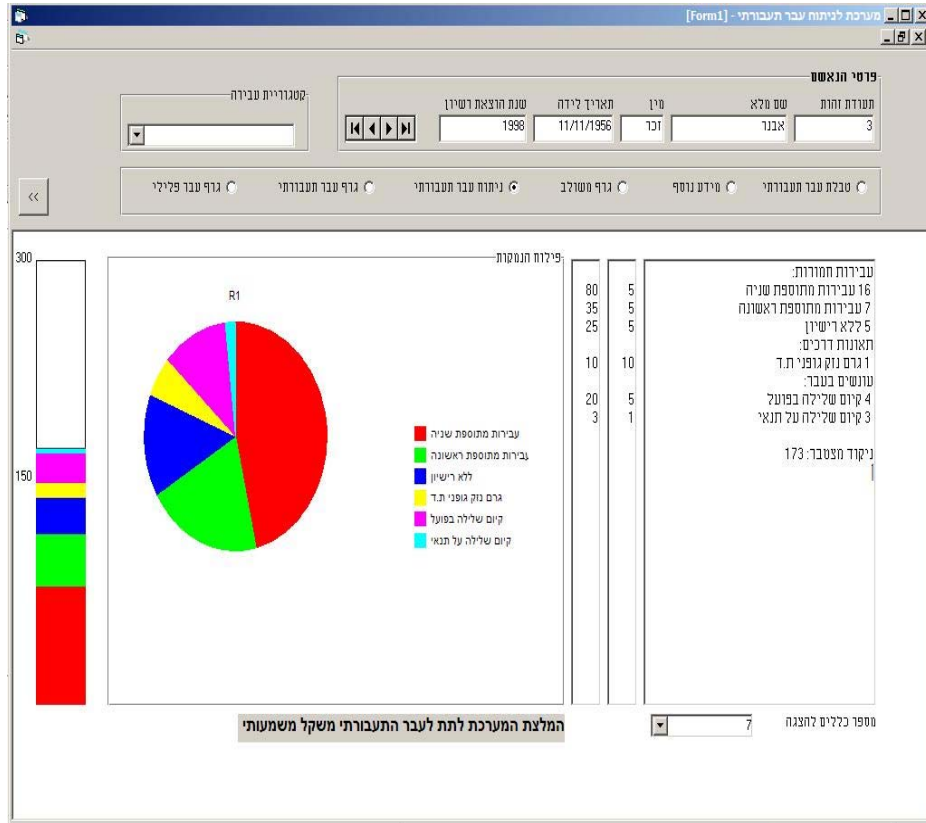


Fig. 4: List and pie-chart showing the relevant factors for weighing traffic offences, summarizing the past record and computing a recommendation. Same color scheme as in Figure 1 (not on scale - in actual system it appears as a full screen).